BUILDING SMART CITIES TOGETHER

SHARINGCITIES

Deliverable 7.1

Measures Exploitation Potential

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Summary

Sharing Cities – by its very name – is committed to delivering common solutions for shared challenges. The various measures being implemented by the cities offer different forms of replication and scale-up potential. They have different characteristics and risks. They are more, or less, attractive to the investment community. And they will be implemented in different city contexts with different operating and business models. That there is opportunity for synergies is not debatable. The question this report explores is what form and scale of potential do these measures represent; and how best can these benefits be accessed?

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CONTENTS

1 INTRODUCTION

This section provides an overview of the Sharing Cities programme; the Work Package on Business Models, Financing & Funding; and on this specific deliverable.

1.1 INTENDED READERSHIP & PURPOSE

This report is intended for the Sharing Cities consortium members and INEA in order to assess the nature and scale of opportunities that can emerge from taking a collaborative approach to implementing the various measures in the lead and fellow cities involved in Sharing Cities; *and* what potential might exist from broader collaboration with the identified Sharing Cities National Scale-Up, EU Scale-Up, and International 'Link' Cities.

In addition, it is also intended for those interested SCC01 programmes to support the increasing collaboration between SCC01 programmes, again to assess replication and scale-up potential. In doing so, this would have the added benefits of a more consistent set of messages to the market (cities, industry, research communities, and investors); and likely additional and longer-term market influencing benefits.

1.2 THE SHARING CITIES PROGRAMME

This Section 1.2 contains standard text that appears consistently throughout ShC deliverables.

Our vision is of a more agile and more collaborative smart cities market that dramatically increases the speed and scale at which we implement smart solutions across European cities, engaging society in new ways to cause them to play an active role in the transformation of their communities – delivering more vibrant, liveable, economically active, and resource efficient cities.

Underpinning this are shared solutions that apply a 'digital first' approach; are more common, integrated, open; and provide the 'building blocks' incorporating European and worldwide leading practices that can be deployed at scale, yet tailored to cities of different size and stage of development.

A vision where Sharing Cities – in collaboration with other like-minded parties – is instrumental in 'creating the movement' that makes a profound and sustained difference.

Figure 1 Sharing Cities Vision

The Sharing Cities vision is captured in figure 1. It drives what we do. Specific terms in the supporting text provide a clear direction regarding what we do to convert this to practical action, specifically:

"*Underpinning this are shared solutions that apply a 'digital first' approach; are more common, integrated, open; and provide the 'building blocks' incorporating European and worldwide leading practices that can be deployed at scale, yet tailored to cities of different size and stage of development*".

Sharing Cities is an EU Horizon 2020 Smart Cities and Communities Programme. The programme brings together 70 people, from 35 partner organisations and 6 countries to work across 8 highly connected work packages; which broadly focus on the themes of People, Place and Platform. Its vision is for a more agile and more collaborative smart cities market that dramatically increases the speed and scale at which we implement smart solutions across European cities, engaging society in new ways to cause them to play an active role in the transformation of their communities – delivering more vibrant, livable, economically active, and resource efficient cities.

Underpinning this are shared solutions that apply a 'digital first' approach; are more common, integrated, open; and provide the 'building blocks' incorporating European and worldwide leading practices that can be deployed at scale, yet tailored to cities of different size and stage of development.

There is one demonstrator are in each of the three lead cities of London, Lisbon, and Milan. The demonstrator areas will test the replicability of these physical, digital and human systems to deliver sustainable place and resource management opportunities.

1.3 BUSINESS MODELS & FINANCING WORK PACKAGE 7

This Section 1.3 contains standard text on WP7 that appears consistently throughout ShC deliverables.

1.3.1 WP7 Objectives

The objectives the 'Business Models & Financing' WP7 are to:

1. **Develop a series of fundable business models** to ensure that the measures delivered across the demonstrators can become sustainable, financially viable and scalable propositions across the full range of European cities.
2. **Trigger €500M European Smart Cities Investment** to accelerate exploitation of common integrated smart city solutions.
3. **Establish Smart City Investment Funds** in 3 of the principal cities
4. **Boost scale-up businesses** to support the 'jobs and growth' agenda (locally)

WP7 addresses two principal themes:

Theme 1: Matching Measures to Cities

This seeks to understand cities and measures in order to maximise the speed and scale of adoption, and the value generated. To do so we:

- Profile cities to better understand their context & needs
- Characterise Measures and assess measure-specific needs
- Develop business models that enable adoption
- Perform city-to-measures matching (for the 3 lead; 3 fellow; & relevant scale-up cities)

Theme 2: Establish Funds

This seeks to: **A)**. unblock investments of all forms, understand investor motives, de-risk investment, and deliver investable (bundles of) measures in the cities, and **B)**. support SMEs and scale-up businesses in the principal cities by packaging and disseminating the Funding London model

- **A**: Design & tailor implementations in other SHARLLM cities
- …and move to Design & implement an EU-level fund
- **B**: Package "Funding London" (SME enablement) model, that will…
- …provide City-level SME focused support

1.3.2 Relationship of WP7 to the Sharing Cities Vision and Goals

The Sharing Cities vision highlights a number of underpinning features (text shown in red in figure 2). WP7 seeks to support the vision by resolving a key market scale-up barrier – release of **money**!

Five of the '10 Audacious Goals' are relevant to WP7:

1. Aggregate Demand and achieve wide Scale Deployment of smart city solutions
   - *e.g. Engage 100 cities (2016), & 50% exploit our products*
2. Deliver Highly Relevant Common and Replicable Innovative Solutions
   - *e.g. deliver >10 repeatable solutions, & ~10 tools/frameworks*
3. Attract Quantum External Investment
   - *e.g. Trigger € 500 million external exploitation investment*
4. Make Acceleration in Uptake of Smart City Solutions Real
   - *e.g. Speed uptake and reduce implementation cycle times*
10. Strengthen Local Scale-Up Businesses in (at least) the 3 cities
   - *e.g. Create >100 new jobs in 3 districts in related sectors*

Sharing Cities: '10 Audacious Goals'

1. **Aggregate Demand and achieve wide Scale Deployment of smart city solutions**
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   - *e.g. Speed uptake and reduce implementation cycle times*
5. **Deliver 3 Role-Model Low Energy Efficient Districts**
   - *e.g. Reducing bills by €600,000 pa*
6. **Shift the thinking irreversibly to Decarbonised / Local Renewables**
   - *e.g. Retrofit 10,000 homes, save 5.9kWhr/yr of energy*
7. **Shift the thinking irreversibly to new models of eMobility in the Districts**
   - *e.g. Demonstrate clear shift in citizen thinking as regards choice of mobility, with 10% moving to eVehicles*
8. **Make Real the Notion of Citizen Participation**
   - *e.g. Prove the active participation of 50% of the 15,000 affected residents (citizens) of the buildings under renovation*
9. **Exploit 'City Data' to Genuinely Prove its Value**
   - *e.g. Demonstrate real user value from city data stores in support of decision making, automated operations, SMEs*
10. **Strengthen Local Scale-Up Businesses in (at least) the 3 cities**
   - *e.g. Create >100 new jobs in 3 districts in related sectors*

Figure 2 Sharing Cities "10 Audacious Goals"

1.4 THIS DELIVERABLE: D7.1 – MEASURES EXPLOITATION POTENTIAL

Figure 3 gives context. It shows the logic for the first theme of WP7 Business Models & Financing. It shows the feed from, and interdependence with, WP3 & 4 in terms of capturing the essence of each measure as the discussion moves from technical to financial…and again (bottom right) as measures move to procurement, implementation, and evaluation in the cities. Thus 'closing the loop'. It also highlights the specific task and deliverable. The text from the GA for D7.1 is included for ease of reference.
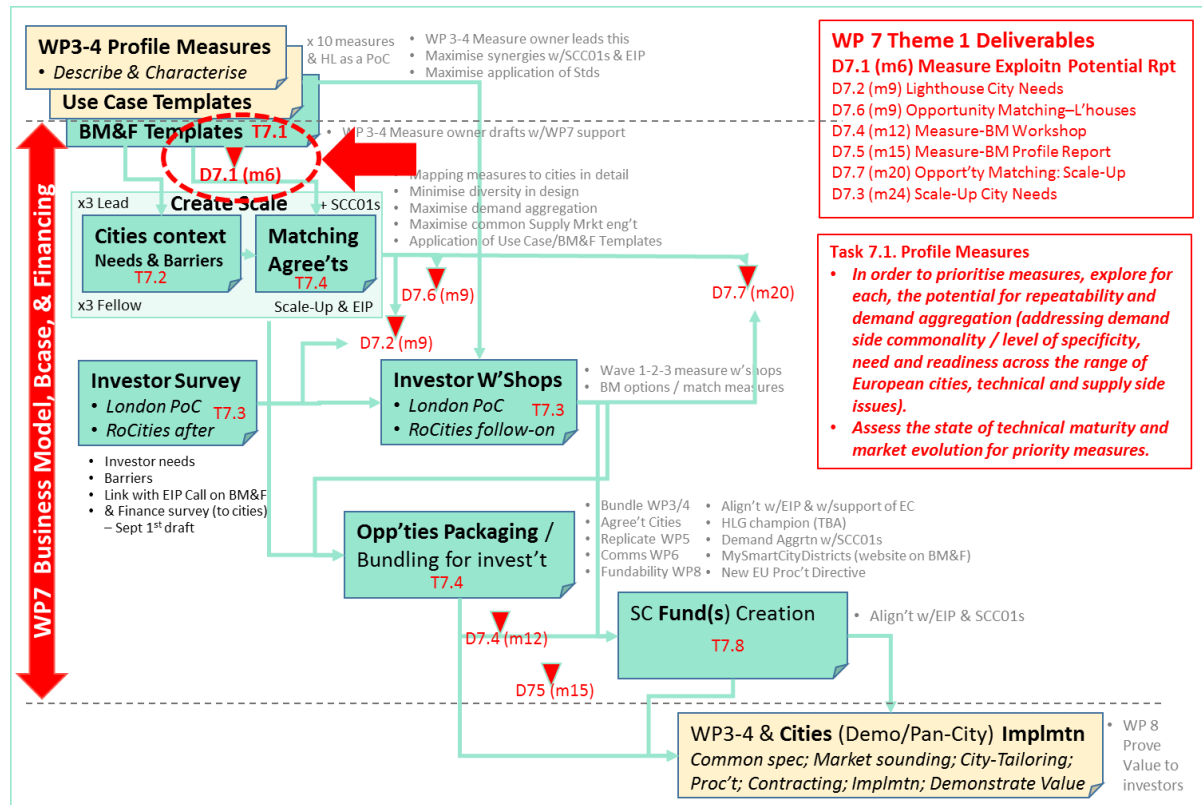

Figure 3 Contextual positioning of Task / Deliverable 7.1 within WP7

As such, Deliverable 7.1 'Measures Exploitation Potential' poses a few questions:

1. *What is the optimal scope and scale of deployment for each measure* by which we balance the benefits of scale against the hurdles of achieving that scale?
2. *What is the best configuration by which the various measures should get deployed?* Are they best treated individually – for cities, industry, society, investor – or is there a more logical relationship between the measures that suggests they should be dealt with as a 'bundle'?
3. *What factors should be considered in implementing the measures to maximize scale advantage (e.g. who is the buyer – city, industry, other), and what barriers exist to their implementation (i.e. demand side, technical, market readiness)?*
4. *What is the potential value?*
5. *As a result, what priorities (value, timing) should be placed on testing and addressing exploitation within and across the various cities?*
6. *What recommendations result from this analysis* that Sharing Cities will address in subsequent work, and that can inform actions in a broader market context?

This report addresses the 10 measures of Sharing Cities based on their present level of development. Some are more mature and understood than others, so the report provides analysis and findings consistent with these levels of development.

A subsequent deliverable, **D7.2 "Lighthouse City Needs"** is intended that will capture, per measure, the scope and financing / funding needs for the principal cities; including options where appropriate". To an extent D7.1 already covers some of these points.

1.5 DEPENDENCIES

The Business Model and Financing work package is significantly dependent on developments in other areas of the Sharing Cities programme; and on initiatives outside of Sharing Cities. Specifically, in the context of this deliverable, as shown in figure 4 below:

- WP3 and 4 supply the content for each of the 10 measures and thus the insights of this report are dependent on the development of this work
- WP8 (D8.6: "Development and application of up-scaling and replication toolbox")
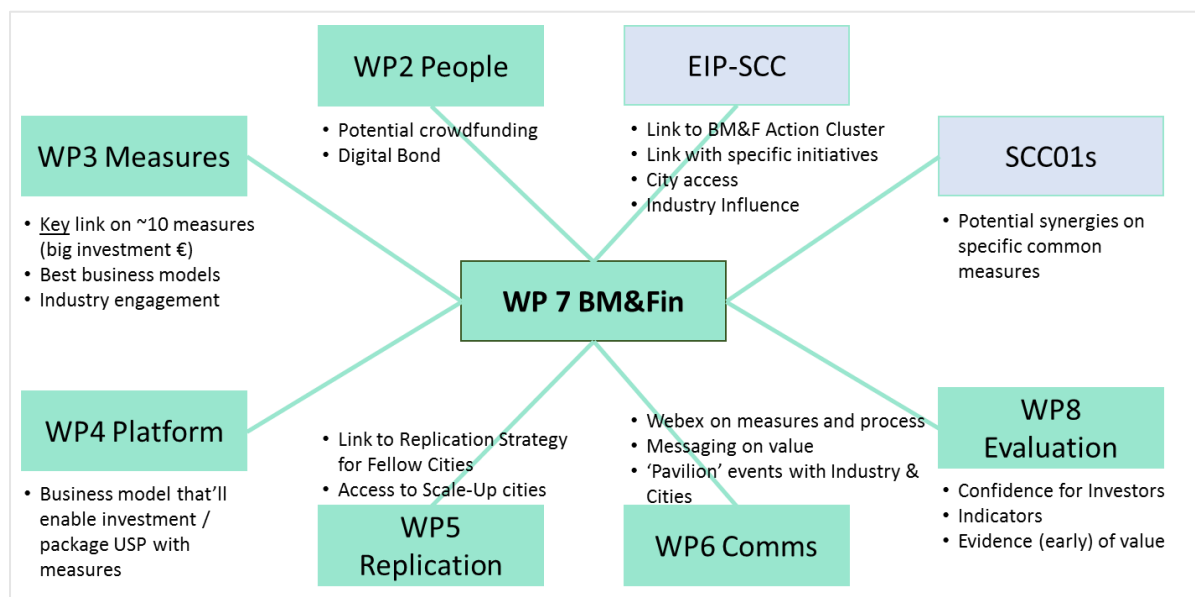- Exploitation potential is dependent on alignment and collaboration with the other SCC01s and the EIP-SCC, and the activities of WP5 and 6

Figure 4 WP7 Interdependencies

2 CONTEXT

This section provides an overview of all measures; the context within which they are implemented; the stakeholders that affect their success, and the inter-disciplinary nature of them.

2.1 THE 10 MEASURES – THE CORE BASIS OF EXPLOITATION

Table 1 provides a summary description for each of the 10 measures of Sharing Cities. The 'Building Retrofit' measure (2) has been subdivided in recognition of the different characteristics (e.g. ownership) that influence the choice of business models, financing, and funding mechanisms. These are the 10 measures that are consistently used throughout Sharing Cities. They relate also to the '10 tools' that we seek to develop, test and exploit.

Table 1 Sharing Cities Measures

Measure		Description *(NB These descriptions are used consistently throughout Sharing Cities materials*
1	**Citizen-Focus, Sharing Services Layer (Apps)**	The provision of applications that can support goals of the programme (e.g. building / personal energy usage; mobility options etc) that can be exploited collectively
2	**Building Retrofit**	Apply deep-retrofit measures to public and private residential properties affecting 15,000 citizens across the six cities and integrating the properties with low carbon energy sources (solar PV, water source heat pump) and electric vehicle charging, all wrapped together by a digital first digitally driven sustainable energy management systems wrapping it all together.
2a	Social housing Energy Retrofit	Social housing Energy retrofit: Transforming maintenance in energy efficiency (EE) retrofit in publicly owned social housing
2b	Multi-Owner EE deep renovation	Energy efficiency (EE) deep renovation of multi-owner residential buildings
2c	Real Estate EE Retrofit	Real estate development based in energy efficiency (EE) retrofit
3	**SEMS (Smart Energy Mgmt System)**	Design and implement a 'Sustainable Energy Management System' (SEMS) to integrate and optimise energy from all sources in districts (and interface with city-wide system); including demand response measures.
eMobility Solutions		Provide the framework and technological conditions for the implementation of shared e-Mobility solutions, allowing the delivery of new and efficient services to citizens and to cities. Solutions include:
4	**eCar Share**	EV car sharing – building on and learning from Milan's 10yrs and London's 20yrs of car sharing experience applying different business models (public/private) and shift to EV car clubs in recent years;
5	**eBikes**	eBikes as part of the sustainable and integrate mobility-as-a-service offer in the cities, building on and integrating (Milan will be the first city in Italy to do this) with very substantial conventional bike share schemes (i.e. 11,500 public hire bikes in London);
6	**eVeh Charge**	EV charging stations maintained by an interoperable network (i.e., mobi.me already successfully implemented across Portugal, including significantly in Lisbon), with 100 new smart charge points as part of this project
7	**Smart Parking**	smart parking to incentivize use of eMobility and eMobility services, reduce search time, optimise limited parking space, reduce road km and emissions;

8	eLogistics	eLogistics to streamline the growing volume of light freight caused by increasing on-line- delivered customer/business purchasers;
9	**3.4 Humble Lamppost**	Smart lamppost presents a very visible "quick win" for smart cities; and the well-proven lighting and maintenance savings offer an attractive bankable initiative. The smart approach is to consider how to develop business models and funding mechanisms that incentivise implementation of 'smart' measures (WiFi; air quality, parking, eV charging, etc) alongside lighting exploiting what is typically a considerable network of existing assets – in other words to multi-purpose the 'humble' lamppost.
10	**4 USP (Urban Sharing Platform)**	An Urban Sharing Platform (USP) is a logical collection of technical components, capabilities and processes which provides functions and services that enable a Smart City. Its purpose is to aggregate data and control functions from a wide variety of devices and sensors, store, process, correlate the data and present information to the city and citizens which enables better use of the city resources and may provide support for innovative service verticals.

2.2 THE CITY LANDSCAPE WITHIN WHICH MEASURES CAN BE EXPLOITED

2.2.1 The Principal Cities

London, Lisbon and Milan will implement all 10 measures.

Warsaw, Bordeaux, and Burgas will implement some measures; be involved in the co-design of others; and only validate the designs of yet others. All as shown in figure 5 below.

Figure 5 Measure implementation in the 3+3 Principal Cities

Volumes of each as promised in the bid, and as currently planned may differ. Typically, this is the result of adjacent plans to implement the measures at <u>greater</u> scale beyond the demonstration area. Of itself this affords greater efficiencies in the design, procure, implement and operate value chain. The discussion of volumes is addressed for each measure.

2.2.2 Additional Adopting Cities

We also hope that through packaging up the measures in a readily consumable fashion, and by attracting investors to a de-risked design, other cities will be incentivised to also adopt these solutions; and potentially do so in parallel (demand aggregation; and joint potentially cross-border procurement).

We have identified different groups of cities (see also figure 6):

- **Metro Area Neighbours** – what has become evident in all cities is that there are substantial untapped opportunities for scale within the principal cities' metro areas / Functional Urban Areas (FUA). Collaboration amongst neighbouring municipalities is typically not a tradition, however lack of capacity and shortage of funds may well prove useful motives to revisit such arrangements.

- **National Scale-Up cities** – these exist typically in similar enabling conditions (legal, cultural, language, supply market, etc), and so in theory a solution packaged by Sharing Cities should be tried and tested and seen to be legitimately replicable within that country. In addition, collaboration should in theory be relatively easy (same language, lower travel costs, existing relationships), so these cities should more rapidly see addition value.

- **EU Scale-Up cities** – these will have less similar conditions, however if solutions are designed to common EU standards and norms, though there will be more challenges in cross-border collaboration, they should benefit from the security and market factors if they collaborate with Sharing Cities, and / or apply Sharing Cities specifications.

- **International 'Link' cities** – these are typically fairly advanced cities in terms of development, and operate in different markets. That however in no way excludes learning either way, and application of common materials. IN addition, there are potential economic benefits (for industry partners).

- **SCC01 Consortia cities** – there are now in excess of 50 cities that are involved in SCC01 activities (as lead or follower); and more to come. They are all addressing similar thematic scope. As such there is likely substantive opportunity to adopt common solutions[1].

- **EIP-SCC Participant cities** – the EIP marketplace presents an opportunity to engage an already conditioned audience of cities, many of whom may well not be involved in the SCC01 activities and many of which may not be of a size or have the capacity to address 'smart' opportunities most efficiently and effectively. The Marketplace presents a more trusted community in which to engage and find opportunities for value.

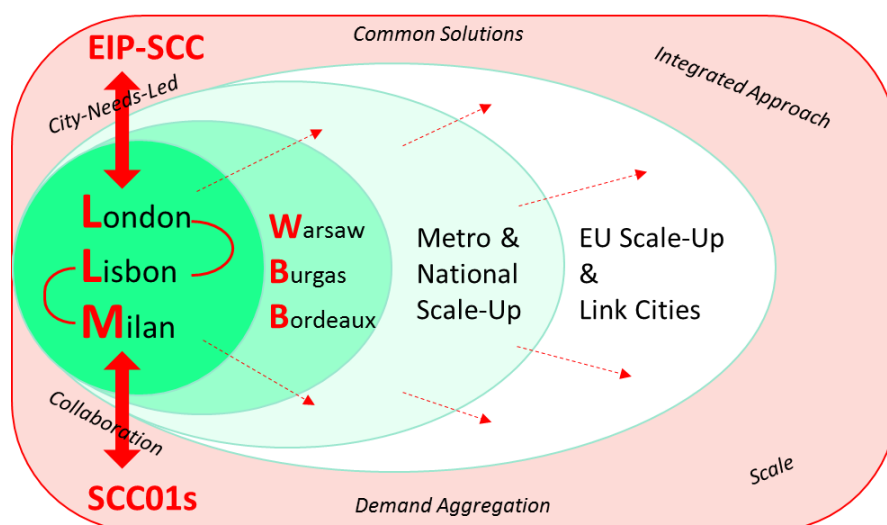*Figure 6 Target City Categories*

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[1] "Common Solutions" in this context refers to measures where there is generally a common need; a high degree of logical similarity, or indeed physical standard; where demand aggregation opportunities occur.

2.2.3 Geographical & Development Variance

Europe is heterogeneous in many ways. Yet common in many others. The culture, social environment, economic conditions, infrastructural maturity, and more general development path of a city can all have a bearing on a city's propensity to adopt any particular measure. The 6 principal cities performed a development assessment applying a similar (BSI) assessment model in 2015, which at a top-line level indicates diversity of development. These different contexts will have a bearing on which measures are more or less relevant to each city. So, as we consider packaging the measures we must also consider the applicability of the measures (or internal levels of sophistication of the measures) in these different contexts.

2.3 THE STAKEHOLDER ENVIRONMENT

At a more specific level there are multiple stakeholders that can be involved in the exploitation process. Their involvement may be as directly involved actors (e.g. cities or industry), as users, as context setters (e.g. Gov't), or as influencers (press). For each measure, it is important to be cognizant of these groups as neglecting any important one can have a significant influence on the success of the exploitation process. The impact may also not be immediate, so recognizing *when* and *how* these parties influence matters is also important. Table 2 illustrates the diversity of stakeholders, and the influence they can have.

Table 2 Stakeholders & Influence

Stakeholder	Role	Potential Influence	Key timing
Governments & Supra-National bodies	Set regulation Establish market conditions (e.g. public/private ownership & action) Fund initiatives; run competitions	Significant influence on overall market development. Can stimulate action. Important role for smaller communities	Pre-procurement
Investors	Finance projects Develop innovative business models	Significant: speed or slow implementation; Stimulate or impede demand aggregation	Pre-procurement (often involved too late)
SDOs / NSOs (international & national standards development organisations)	Publish guidance; capture best practice; set standards Accreditation and validation	Speed market understanding and acceptance. Stimulate innovation. Balance diversity & standards. Build market confidence.	Throughout product / service life-cycle
Cities	Set policy Finance & fund initiatives	Paramount	Needs evaluation & specification on
Academics	Research / advise	Lend credibility & confidence	Pre-procurement Improvement cycle
Industry Associations	Represent industry position Share practices and learning	Modest	
Big Industry (both 'smart' & 'traditional')	Production scale solutions RD&I Buyer (e.g.	Significant – positive/resistive; e.g. open/proprietary; design of solutions; stimulate market with pilots / block progress	Needs analysis
City Service Providers	Operate services	Significant: service efficiency, effectiveness & innovation	Post acquisition
SMEs	Agile flexible innovative solutions	Modest: local innovations	Procurement
Society (citizen, resident, visitor)	Use; Co-create	Growing: in design, test and improvement processes	Post implementation

2.4 Inter-Disciplinary Integration and Product Life-Cycle Considerations
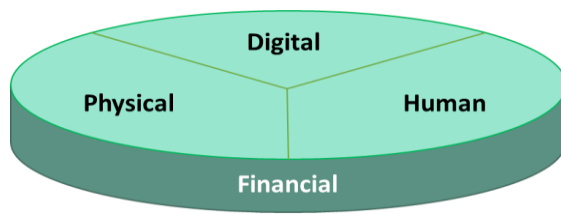
Figure 7 Integration Challenge

'Smart' products and services often involve the integration of (existing) **physical** with (new) **digital** and **human** solutions (figure 7). Some of the physical may well be already well developed (e.g. a lamppost), and the challenges and barriers to integrating new digital solutions within / alongside / instead of existing physical solutions can be significant; particularly from traditional industry players that seek to protect their existing markets.

The exploitation of multiple assets (and/or multi-purposing of existing assets) at different lifecycle (TRL) stages may also warrant consideration – for instance, packages of mobility solutions involving various components of different development stages.

Things do not stop there. Underpinning the physical, digital, human integration is the need to ensure enabling **financial** conditions – notably how measures may be implemented (financed) and paid for (funding). This is very contemporary. Data from the three noted areas (physical, digital, human) may be directly connected to the financing and funding model in new ways and with greater accuracy to positively disrupt and create new possibilities. For instance: real time energy flows; sentiment analysis; transport infrastructure state – all can be built into algorithms that 'nudge' behaviours through financial dis/incentives.

Consideration of product life-cycles and product maturities will also very likely be appropriate. Technology Readiness Levels (TRLs) are a generally known concept. The generic product life-cycle stages are shown in figure 8.
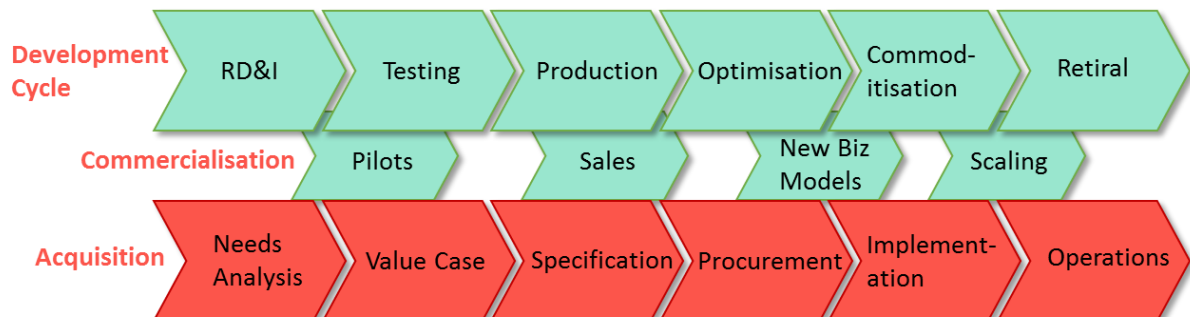
Figure 8 Product Life-Cycle (Supplier & Buyer Perspectives)

To bring this to life, the humble lamppost is in fact a combination of a very mature component – the pole; with a relatively new (in comparison) luminaire – the LED; with a variety of still quite fast evolving technologies – the sensors. And indeed, the latter are starting to be built back into the luminaire fixture itself. So, unpacking the measure into its various component parts may at times be necessary to best evaluate exploitation potential.

3 EXPLOITATION POTENTIAL

This section discusses the benefits and challenges of exploitation; explores economies of scale; evaluates attractiveness of the measures for exploitation; & considers how to develop scale in ShC.

3.1 POTENTIAL BENEFITS – WHAT MOTIVE FOR CITIES TO EXPLOIT COMMON SOLUTIONS?

The metaphor of the Human is used on an increasing number of occasions to pose the question of how cities could or should adopt common solutions. Humans are all very different, yet their DNA is extraordinarily similar. Different circumstances warrant different interventions. Take for instance in the medical field. We expect different types of interaction and treatment in different circumstances (see figure 10). We have a headache; we take an aspirin (or not – it is our choice). An off-the-shelf aspirin is trusted, cheap and functional.

That metaphor can be transposed to cities. The lamppost is the aspirin for cities: very much more standard; with limited 'client contact'.

	STANDARDIZED PROCESS EMPHASIS ON EXECUTION	CUSTOMIZED PROCESS EMPHASIS ON DIAGNOSIS
HIGH DEGREE OF CLIENT CONTACT VALUE IS RENDERED IN THE FRONT ROOM, I.E., DURING INTERACTIONS WITH THE CLIENT	NURSE	PSYCHOTHERAPIST
LOW DEGREE OF CLIENT CONTACT VALUE IS RENDERED IN THE PROFESSIONAL'S BACK ROOM. CLIENT FOCUS IS ON RESULT ONLY	PHARMACIST	BRAIN SURGEON

Figure 9 Metaphor of commonality & personalisation in a human sense

As individual humans; as markets; we seek to find the 'sweet spot' between 'one-size-fits-all' solutions (typically resisted; though often very affordable), and bespoke (and expensive). And the point is that this differs by solution, and is significantly influenced by other factors (e.g. culture). However exploring and evaluating options – particularly in new disruptive conditions – is important to do.

With this as a backdrop, the question then can be posed as to the types of benefit a city can expect to glean from exploiting more common solutions where scale advantages occur. There are many. And they will be measure specific. However, the long-list includes the following:

Potential Benefits of Collaborative Action on Smart City Solutions

- *Financial*
  - Lower price, by using a standard market-recognised specification, and/or demand aggregation
  - Lower internal costs of acquisition through using pre-configured
  - Access to better loan terms through using trusted standard product/service
  - Lower cost of ownership (e.g. replacement parts are standard, not bespoke)
- *Quality*
  - Ability to tailor in a designed sense (ie use a product that has specifically been designed / pre-configured to be tailored locally)
  - More efficient solutions, beyond 'business as usual'
  - Better functionality (tried, tested, and improved by others)
  - More confidence in solution – lower risk (important for decision makers and investors)
  - Ongoing shared learning (& benchmarking / comparison)
- *Speed*
  - Swifter pre-procurement process
  - Shorter implementation times
  - Swifter scale-up potential
- *Strategic*
  - Political (quick) wins (e.g. collaboration)

- o Ability to deliver greater societal outcomes (e.g. buy more product/service cheaper per unit, with more confidence, to serve society better)
- o Ability to demonstrate agility and build in flexibility for change
- o Efficient and effective deployment of scares resource to things that really deserve it
- o Attracting private sector investment
- o Mobilizing internal city market (eg SMEs)

The scale of benefits is particular to the circumstances. However generally, price reductions of significant double digit percentage should be expected. Just that motive, in straightened times, warrants taking seriously.

3.2 TYPICAL CHALLENGES AND BLOCKERS

Though the benefits are often undisputed, the blockers to collaborative action on smart city solutions (be it demand aggregation or replication) are many. Challenges and blockers are addressed in table 3:

Table 3 Challenges to Smart City Collaborative Action

Challenges	Suggestions to mitigate or overcome
Contextual / Strategic	
• Individualistic / city specific behaviours of cities • Personal priorities and motives of decision makers • Political and other decision making cycles	• Communication of common city needs and opportunities • Increased focus on role of city networks • Ensure focus is retained on long-term vision and priorities • Leadership workshops to support 'big picture' alignment • Documented, objective, principle-based decision criteria • Clear participatory policy that withstands political change • Appropriate preparations in advance of elections
Financial / Value	
• Uncertainty in the (additive) value case • Ownership of assets	• Better capture and sharing of evidenced value by cities • Independent ex-post evaluation of benefits, addressing value to different stakeholder / owner groups • Business cases that rationalize value for different ownership structures
Organisational	
• Lack of capability (skills) and capacity (effort) • Lack of bravery; lack of leadership; complex decision making • 'Bad timing'…inertia; change resistance; expert preferences	• Organisational development actions to foster cross-functional understanding, processes, and behaviours • Cross-functional exercises and workshops to explore specific challenges • Collaborative cross-city and cross-sector workshops / exercises on the same
Technical	
• Perceived (and real) mismatch with existing technologies • Perceived (and real) risks	• Independent technical option evaluation, in advance of any actions that would preclude collaboration • Risk management processes
Market & Customer/Buyer	
• Industry defense of existing invested solutions/business models • Resistance from cities to free market model	• Early market analysis; potential introduction of disruptive market players by buyers to cause innovation / change • Liberal use of examples of change (over decades) that demonstrate value and issues of market model changes

Regulatory	
• Procurement constraints • (Perceived & real) regulatory constraints • Intellectual Property Rights	• Innovation workshops, involving procurement, well in advance of acquisition processes to explore innovations • Regulation challenge process to identify real blockers and potential work-arounds (& to inform regulators) • 'Regulation free zones' (e.g. recent FR smart city actions) • Greater openness on IP

The maxim that "a problem shared is a problem halved" is however an important consideration in a city context. Because cities should be seeking to deliver 'for the greater public good', and thus all aim (unlike private sector driven by shareholder profit) towards a common goal there is a strong (theoretical) motive to collaborate, notably regarding challenges where the gains from collaboration outweigh any losses from the lack of competitiveness (where cities may compete on specific points). And where cities collaborate they can reduce their exposure through shared learning and joint resolution of challenges, and can generate the scale that can positively influence the market.

A (perhaps '*the*') key ingredient is to get the top-of-the-office to position 'smart' as essential, exciting and 'sexy' to motivate and support the cross-cutting functions (e.g. digital / CIO) to work best with collaborating 'silos'. Top-line support is often important for city-specific solutions; however it is much more so when demand aggregation or replication opportunities come into play. That way the principles are established, which often help steer away from an over-focus on detail.

3.3   ACHIEVING ECONOMIES OF SCALE

There is no precise science to achieving economies of scale, and there are several factors that make this the case. However, there is a strong logic to explore the potential; and it is important for cities to go about the process of evaluation of options.

The generic logic of economies of scale is illustrated in figure 11. This shows the perspectives that may well be in play for the supply and demand communities.
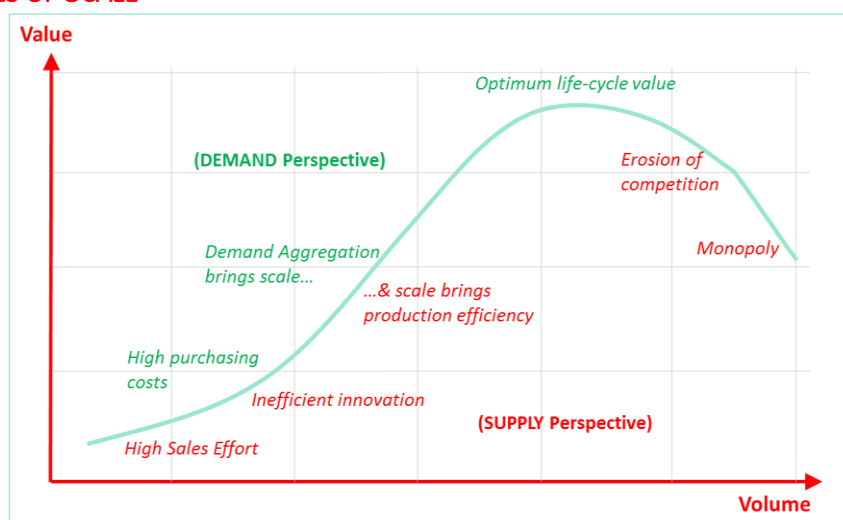
Figure 10 Logic of 'Economies of Scale'

To achieve economies of scale requires:

- Market research to ascertain what the optimal deal volumes might be for any particular category. Procurement data sources can provide a valuable input to this where available, however it is important that the evaluation is made for each measure; or combination of measures (e.g. through pre-procurement market soundings) to understand the nature and shape of the curve
- An understanding of all sides of the market: supply, demand, investor
- Political and decision maker sponsorship
- Procurement mechanisms that are supportive
- Business models that incentivise demand aggregation

- A catchment of buyers that can develop a sensible alignment and emerging strategy
- Supportive standards
- Time to explore options – and this *must* be built in to plans

3.4   THE CANDIDATE MEASURES PORTFOLIO

An assessment of the potential for each of the 10 Sharing Cities measures in terms of the opportunities for economies of scale is presented in figure 12 below. This shows an experience based assessment of the scale advantage in value terms against the potential for standardisation. We have segmented the measures into A, B, and C potential.
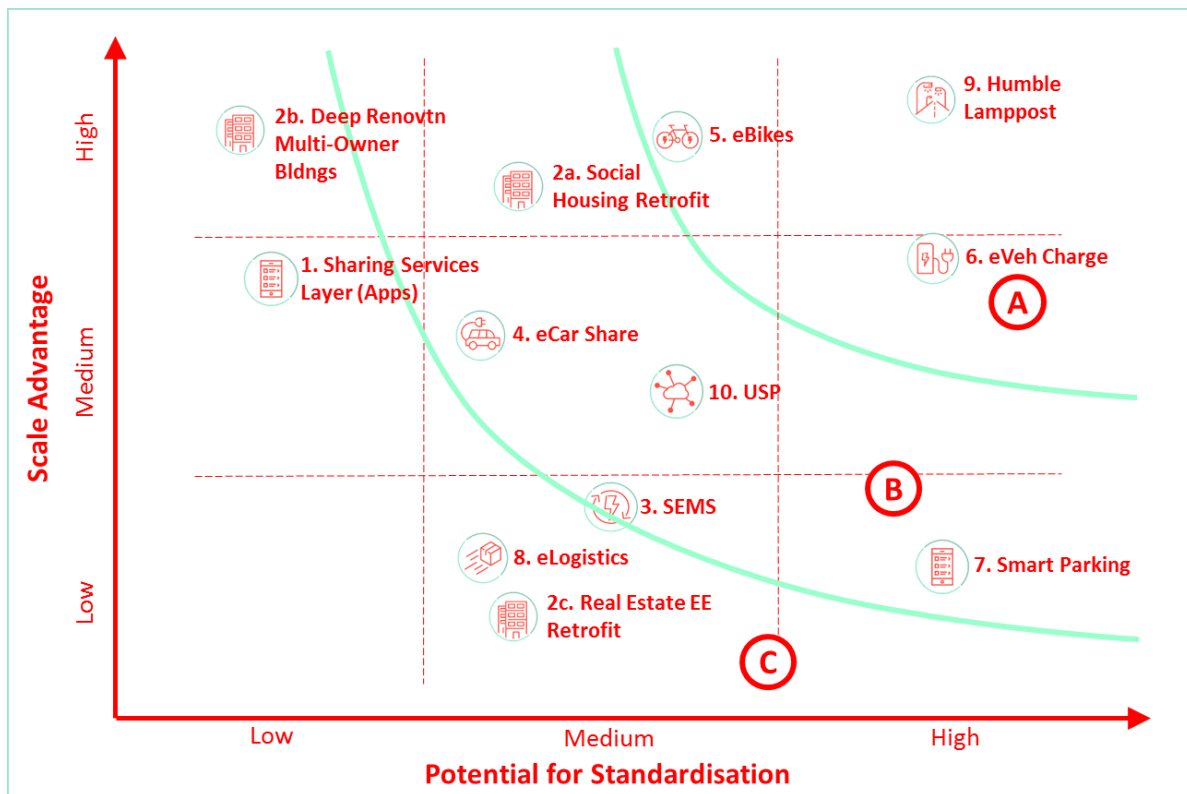
Figure 11 Economies of Scale for Sharing Cities Measures

3.5   THE PROCESS OF EXPLOITATION

Exploitation comes through collaboration. That is key: between demand (cities); and with supply and investors (at least). This is core to the activities of Sharing Cities.

Figure 13 shows the process by which the work package (WP7) approaches exploitation of the measures. This highlights:

1. The dependencies between WP3 Place / WP4 Platform and WP7 in terms of their feed into the exploitation WP7 work through use cases and technical profiling of measures
2. Activities to match city needs to measures…
3. …addressing all potential demand-side groups (lead, fellow, scale-up, EIP-SCC; SCC01 cities)
4. The early engagement of the investor community to understand for each type of investor their propensity to invest in particular types of measure

What this figure does not address is the Industry dimension, which is also a vital component.
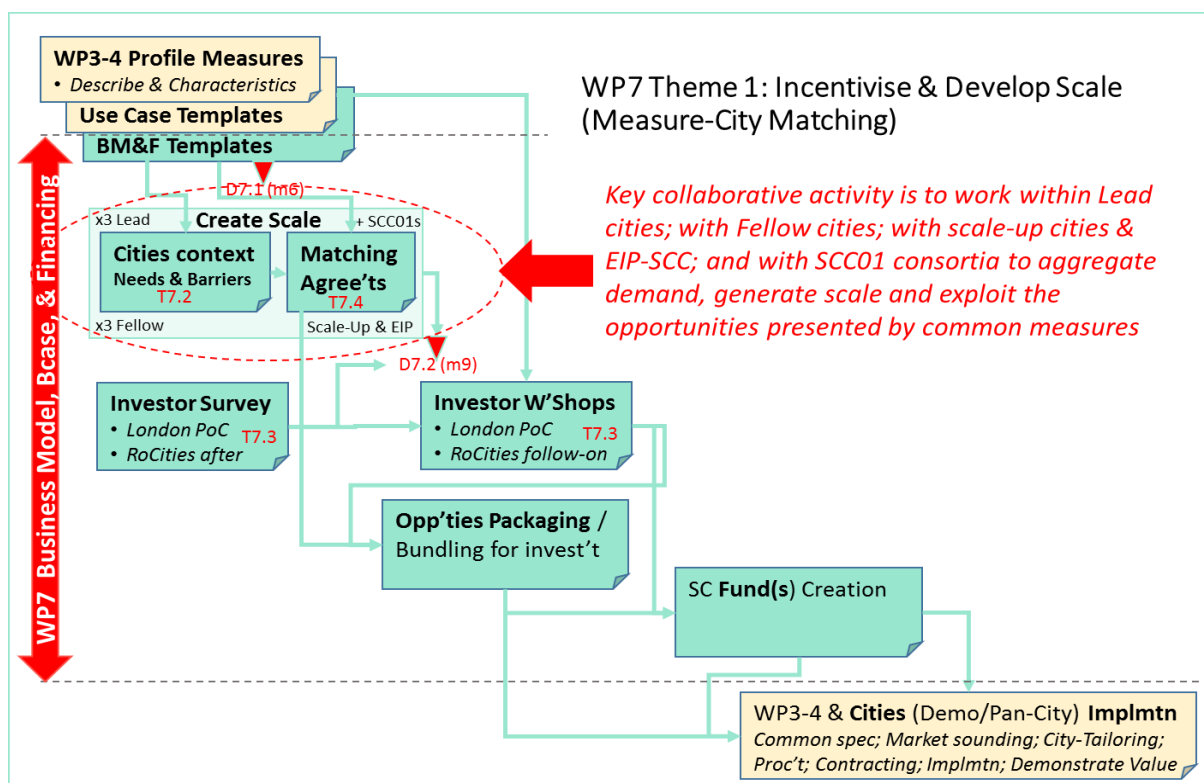
Figure 12 WP7 Approach to Scale Up & Exploitation

A pivotal point in the process of exploitation is procurement and contracting. Perceived and real constraints can and do have a profound effect on the ability of a city to aggregate demand. Existing procurement policies may differ within city departments or agencies, let alone between cities. If the opportunities of exploitation are not seen to be sufficiently compelling the challenge of change in procurement may well preclude it being addressed. Likewise closed (long-term) contracts that do not allow for innovation (e.g. for service delivery) can also preclude aggregation. Framework contracts that allow for ongoing aggregation; outcome-based specification and procurement that allows for innovation; and innovation and change in procurement practices (and at times legislation) all may be required to stimulate demand aggregation and exploitation of common measures. The perception of the procurement challenge all too often detracts from action.

3.6 EVALUATING MEASURES ROLL-OUT POTENTIAL

We have developed a rating scheme to evaluate the roll-out potential for each of the measures. This is based on the EIP-SCC Case Study Roll-out potential report (PWC: cite – once published) with slight augmentation (as shown in red in table 3 below). This evaluates measures against four criteria:

- Economic / Business;
- Political / Administrative;
- Socio-Cultural;
- Technical.

We have additionally added a 1-to-5 measurement to this (included in table 4) to provide an expert assessment process.

Table 4 Criteria for Roll-Out Potential

Dimension	Roll-Out Potential: Evaluation Criteria (1 bad; 5 good) * inverse measure
Economic / Business	• Is there a convincing value case? • Is the project able to achieve economies of scale if its size is increased? • Can the project benefit economically from international implementation (eg standardisation of technology / equipment / solutions, etc)

	• Is the business model flexible to changes?
Political / Policy / Institutional	• Is the project requiring strong political commitment to be developed (general perspective)? * • Would the administration need to be directly involved? * • Does the solution require complex procurement practices?
Societal	• How relevant is the involvement of society for the solution to work? * • Is the solution responding to a pressing need? • Would the solution require a radical change to users habits? *
Technological	• Is the technology well established? • Is the technology standardized & / or interoperable with different IT systems? • How big and complex is the support required to sustain the project from a technological perspective? *

The initial results of the evaluation are shown in figure 14, and the scoring detail is shown in the subsequent table 5.
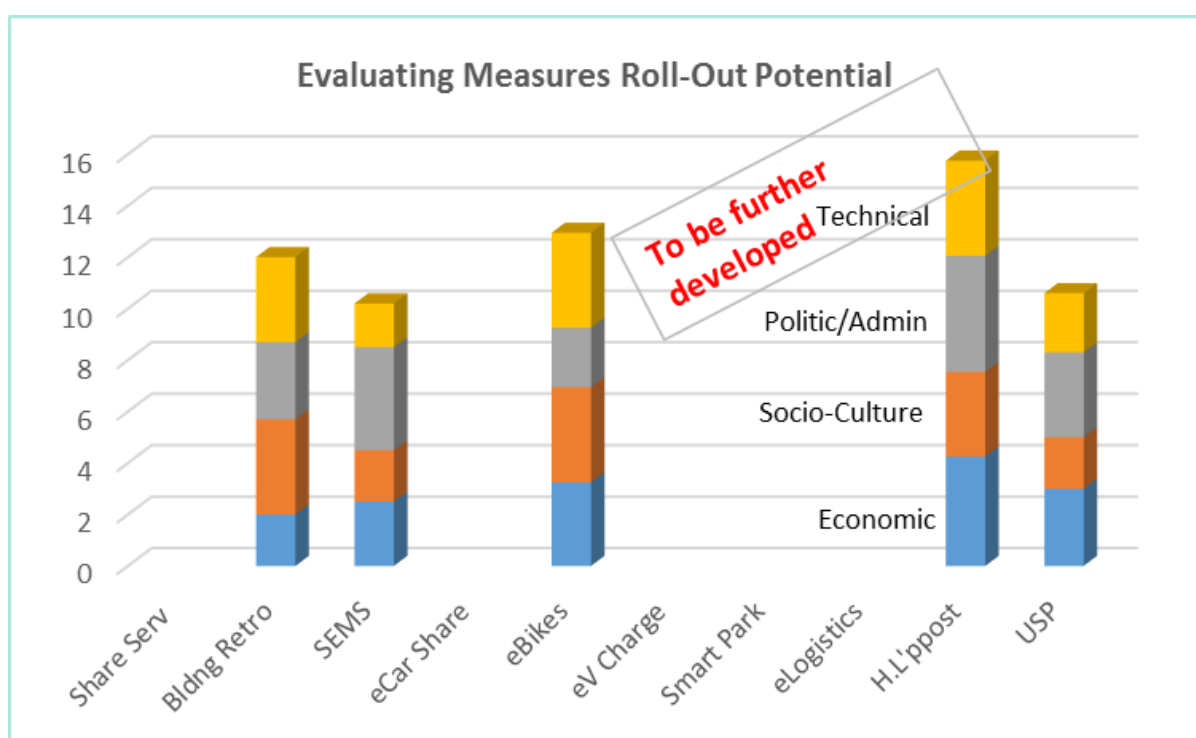
Figure 13 Measures Roll-Out Potential

The table below also indicates the scale of capital investment for each measure. Clearly such assessments can only be indicative, and these figures can be enriched over time and with more data. They have been estimated as investment per 100,000 population, and shown as:

- o € = investment of the order of €100,000
- o €€ = of the order of €1 mln
- o €€€ = ditto €10 mln
- o €€€€ = ditto €100 mln

Table 5 Measure Roll-Out Potential

Sharing Cities 10 Measures: Roll-Out Potential Evaluation

Measure	Economic				Politic/Admin			Socio-Cultural			Technical			TOTAL (max 20)	Investment per 100,000 popltn
	BCase	Econ of Scale	Cross-Border	Flex B/Model	Commitment	Admin involved	Procurement	Society involved	Pressing Need	Big user change	Hi TRL	Std/Inter-op	Complex		
1. Sharing Services			TBD			TBD			TBD			TBD			€
2. Building Retrofit	2	2	1	3	4	4	3	1	4	4	4	3	3		
		2.0				**3.7**			**3.0**			**3.3**		12.0	€€€€
3. SEMS	2	2	3	3	2	2	2	4	4	4	1	2	2		
		2.5				**2.0**			**4.0**			**1.7**			€€
4. eCar Share			TBD			TBD			TBD			TBD			
5. eBikes	3	4	3	3	4	3	4	2	3	2	4	3	4		
		3.25				**3.7**			**2.3**			**3.7**		13.0	€€
6. eV Charge			TBD			TBD			TBD			TBD			
7. Smart Park			TBD			TBD			TBD			TBD			
8. eLogistics			TBD			TBD			TBD			TBD			
9. H.L'ppost	5	5	4	3	3	3	4	4.5	4	5	4	3	4		
		4.25				**3.3**			**4.5**			**3.7**		15.8	€€€
10. USP	1	3	4	4	2	2	2	3	5	2	3	2	2		
		3.0				**2.0**			**3.3**			**2.3**		10.6	€
	BCase	Econ of Scale	Cross-Border	Flex B/Model	Commitment	Admin involved	Procurement	Society involved	Pressing Need	Big user change	Hi TRL	Std/Inter-op	Complex	TOTAL (max 20)	Investment per 100,000 popltn
	Economic				Politic/Admin			Socio-Cultural			Technical				

NOTES: Indicative Measure Investment Estimates:

- <u>Humble Lamppost</u>: for 100,000 people = 10,000 lampposts @ €1,000 per post = €10mln
- <u>eBike</u>: approx. 1,000 bikes / 1 mln popltn (based on London's 11,500 bikes for 8mln) x €500/bike = €0.7pp or €70,000/100k
- <u>Urban Sharing Platform</u>: cost estimates for cities range enormously from €100,000 for data analytics 'platform' to €5-10mln for more operational platforms. City population does not seem to be such a determinant.
- <u>SEMS</u>: anticipated cost per 100,000 popltn of €1-10 million

3.7 OPTIMUM SCALE FOR MEASURES

Whilst recognising that there are many factors that influence the optimum number to acquire of any particular measure in order to achieve optimum value, this is undoubtedly a worthwhile question to pose.

Our thesis is that cities are not achieving best value through many of their acquisitions as they are procuring at modest scale (and often with bespoke specifications), and that demand aggregation (more than perhaps replication – ie sequential purchase) can offer far greater value.

Scale offers value for cities, and for industry on many occasions.

For example, considering two examples:

- **Humble Lamppost**: at present many cities are upgrading their lighting stock in modest volumes based on operational budgets. This involves luminaire replacements with some lamppost replacements. Such volumes will be in the range of 100s or 1,000s per annum. Occasionally a large city will do a 2-3 year scale replacement exercise – e.g. of 100,000s of luminaires (examples being Milan, Madrid, Paris of 150-250,000 each). Scale replacements are rare and in the overall scheme of things still represent a very small fraction of the total stock. Where volumes are aggregated, prices will be lower, and industry can extract efficiencies: good for both parties. Medium and small cities cannot individually generate the scale of volumes that will result in optimal value. Figure 13 suggests an optimum economy of scale at the 100,000s level, not at the typical level that many (smaller) cities purchase. As such the market in most cases is operated at a rather inefficient level. The loss of value is at double digit percentage levels (validated also through informal discussions with Industry).

- **Urban Platform**: this is a far harder measure to assess, indeed also just to define (as has been experienced by the EIP-SCC Urban Platform work). City needs will invariably be different, however much of the design in theory could be similar at a logical architectural level. Each city acquiring a platform individually (i.e. needs analysis, specification, procurement etc) is unlikely to be optimal. Indeed, in many ways this precludes smaller cities being able to enter the market (as is typically experienced in the market to date), or being driven towards entering the market later once solutions are stable and more standard. So collaboration between cities, or demand aggregation at a regional / city-cluster level is more likely to deliver better value – notably, and particularly for the end customer in terms of consistency of experience. This has not been well tested in the market, however is a likely hypothesis. The nature of scale advantage – unlike the lamppost – is likely to be in the order of single digits in terms of physical platforms (see figure 15). An alternative perspective is to consider smart phone platforms which are market driven models delivering digital services to heterogeneous individuals that tailor their platform and applications to suit their desired experiences. The future of the city platform market is not known, however each city acquiring them individually is very unlikely to be the optimum model.
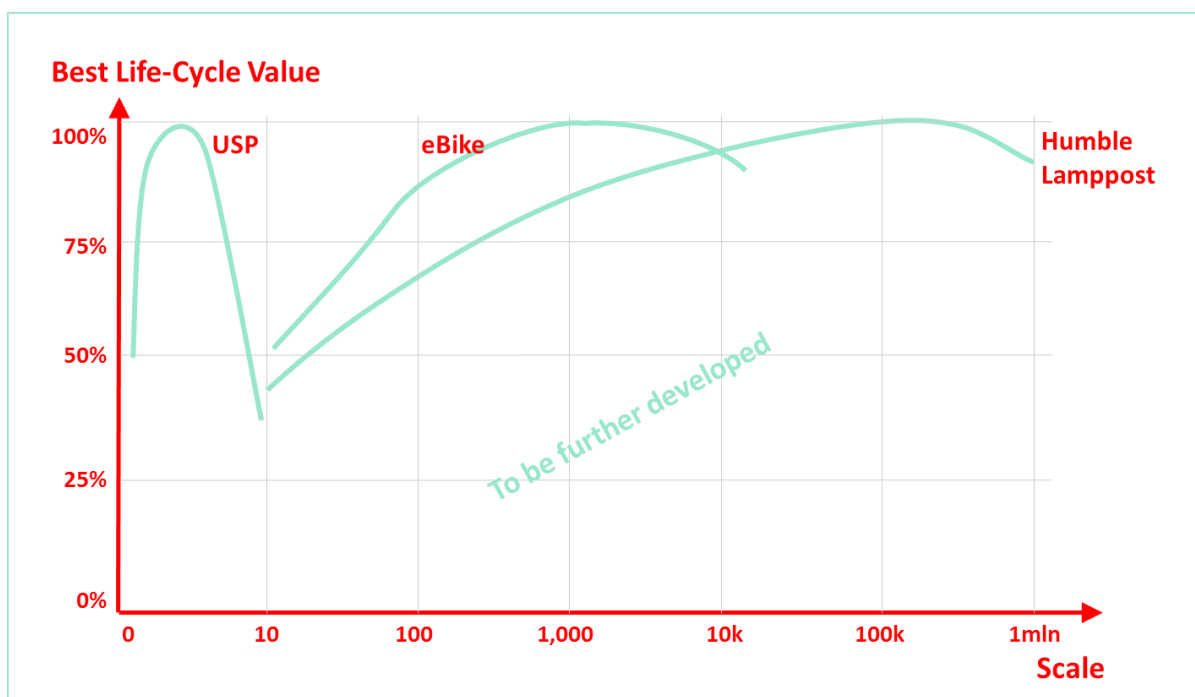
Figure 14 Indicative Optimum Economies of Scale for different Measures

What figure 15 suggests is that cities can get considerably greater value by seeking to bring optimal volumes to the market, and if they cannot do so individually, then there is advantage in seeking to aggregate demand with other cities.

Data points from cross-border EU pilots[2] suggest 'double digit' percentage savings (20%+ is feasible) potential on purchase price; plus savings on procurement process costs (and time); and it is not unreasonable to posit that operational costs will also be lower.

3.8 DEVELOPING SCALE FOR REAL IN THE SHARING CITIES CITIES

Figure 6 indicates the starting point for exploitation: the lead Sharing Cities cities. What is evident from the above analysis is that the volume of measures for those intended for purchase as part of the Sharing Cities programme is (well) below that which would be considered close to optimal for economies of scale.

In some cities the purchase of similar measures is planned outside of the Sharing Cities programme – for instance Lisbon will purchase many more eBikes that are included in the general agreement.

The table below shows the volumes of measures captured in the general agreement (reference is made also to the "Measures Tables", 3.5 of GA); the volumes actually intended through activities within the lead (and fellow) cities; and the estimated optimal economies of scale.

Table 6 Measure Volumes (GA/Planned/Economy of Scale)

Sharing Cities Measure Volumes				
Measure	**GA Volumes**	**Planned Volumes**	**Optimal Ec.of Scale**	**Commentary**
1. Sharing Services Apps		TBD	TBD	Common district bond scheme; and common apps planned for exploitation
	No # of apps in portfolio specified			
2. Building Retrofit	Total 75,000 m²	Ldn: 25k m²; Lis 36k m²; M:52k m²	TBD	
2a Social	50.124 m²	No reported change	3% building stock per year	Holds potential

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[2] EU DG GROW pilot study on cross-border procurement, presented at Nov BM&F EIP-SCC AC meeting; report awaited in early 2017

2b Multi-Owner	21.000 m²	No reported change	3% building stock per year	Holds potential
2c Real Estate Retrofit	3.000 m²	No reported change	NA	TBD
3. SEMS	'3'	'1'	TBD	Common designs. Some city/use case specific algorithms with considerable exploitation potential
	Initial plans for separate solutions	Align't of logical designs in process across cities		
4. eCar Share	150	No reported change	TBD	Exploitation depends considerably on ownership and business model
	L: 20eV/8AV; Li: 62 eV; Mi: 60eV		Ownership & Business Model dependent	
5. eBikes	220	++	X00 – X,000	Holds potential. Cities already procuring adjacent larger volumes.
	L:40; Li: 30; Mi: 150	Increased (outside of SHARLLM scope)		
6. eV Charge	183	No reported change	TBD	Holds potential
	L: 20; Li: 68+29+6; Mi60			
7. Smart Park	455	No reported change	TBD	Holds potential, once technical/operational model & business case tested
	L: 300; Li: 30; Mi: 125	Mi: 125 sensors		
8. eLogistics	63 eL Veh/Bike	No reported change	TBD	Early stage business model, so scale advantage viewed as a later opportunity
	L: AV only; Li: 52 eLVs; Mi: 9eLV/2 eLBike			
9. H.L'ppost	~1,000	56,000	100,000s	Actions in place to scale up within London; with EIP-SCC, & across-SCC01s
	3 cities	3 + 3 cities (aggregatn with LED upgrade plans)		
10. USP	1	1	TBD (however >1)	SaaS has changed the connection between scale and price/performance.
	Similar design in each of the 3 cities intended			

3.9 DEVELOPING 'BASKETS' OF MEASURES

Having suggested that greater volumes lead to greater value; there is clearly scope to develop 'baskets' of measures between collaborating cities. There is also scope to consider logical combinations of interdependent measures. This latter approach can help to deliver more sustained value for cities.

For example, table 4 suggests that the business case for an urban platform is hard to define (as proven by EIP-SCC and cfros-SCC01 analysis), yet few would argue that a platform is a vital enabler for delivering and sustaining value. And more so, a platform delivers best value when the design enables interoperability and (appropriate) sharing of data between service 'silos'. So an approach that combined say a larger purchase of smart lampposts (that have a clear business case) and perhaps some eMobility measures, together with an urban platform would deliver greater collective value.

What the most logical combination of measures might be for any given city is as yet to be further explored. However, the notion of combinations will be explored certainly with the fellow cities, who have time to consider and perform more rigorous market testing to maximise benefits. And where possible within the lead cities.

This work should consider:

i. Whether there are supply market synergies, either because suppliers may be able to provide multiple measures; or (better) through causing industry to create consortia / ecosystems that can deliver logical combinations of measures

ii. Whether there are internal cross-city buyer / departmental synergies, where for instance reduced operating costs and/or greater value can result from combining measures

iii.   Whether there are business model and financing synergies, whereby risk and uncertainty can be spread across more than one type of measure to deliver ultimately greater value – the example of bundling of urban platform with smart lampposts &/or eV charging. And where funding streams enabled through bundling measures can strengthen the case / reduce the investor risk, and thus ease investment decision making.

4 SCALE-UP OF INDIVIDUAL MEASURES

This section discusses the consistent capture of basic information on each measure that can then support evaluation and decision making for Sharing Cities partners about how best to implement at appropriate scale; and provides individual measure summaries addressing also inter-dependencies.

4.1 MEASURE PROFILING

As a basic step, for each of the (10) Measures we have captured in annex a consistent set of data – with particular emphasis on what will help strengthen the adoption of the measure within the ShCities cities, and scale-up / exploitation amongst a wider pool of (EU) cities. For each we have explored half a dozen topics (in red below) with respective bullet points, all in a consistent template.

Overview of Measure

- Headline summary of measure
- Perceived value case
- Market maturity
  - Clarity of proposition
  - Status: within cities: experimental / pilot / in-city roll-out / market scale
  - Status: supply market: TRL; competitiveness; regional factors;
- Investor interest: who and level of

Business Case

- Existence and scale of case studies and previous policies that demonstrate value
- What forms of ('hard'/soft') value, for whom, that provide criteria for decision
- Unintended effects and risks; competition issues and risks
- Interest & level of priority for cities (demand); industry (supply); investor (money)
- Return on Investment / Payback – marketed / real
- What is the case for demand aggregation?
- Critical unknowns, concerns, blockers

Business Model

- What is / are the prevailing business model(s) currently adopted in the market?
- What failings do the current market and/or business model have that inhibit scale adoption?
- Ownership of Assets: which sector; what level of clarity; change of ownership over time
- Operation of asset / service(s), and any change(s) in sight
- Potential for performance contracting

Financing

- Level of financing typically required at a city-specific level
- Source(s) of funding typically used, and new forms that could be accessed
- Upfront vs life-long financing considerations
- Barriers to funding experienced or perceived

Regulatory, Policy & Procurement

- What existing or needed (inter-)national) regulatory and (local) policy actions will support?
- Procurement process(es) applied
- Issues, concerns, blockers

Critical Change

- What critical issues must be resolved to strengthen case for scale adoption of the measure?

4.2 MEASURE INTERDEPENDENCIES AND SYNERGIES

There are several interdependencies between the measures which influence the extent to which they may be implemented within any city. These are covered below (focus more on the 'A' listed measures)

4.2.1 Sharing Services Applications

The (common) user applications intended to support building manager and individual (family) energy efficiency and mobility behaviours and experience have deep interdependencies with WP3 measures.

The district bond scheme will be linked more heavily with city-specific actions.

There is also a very heavy interdependence with the USP which collects (also from users) and processes the data and what is then fed back to the users in both the applications for advice and choices, and via the digital bond scheme to community and individuals as regards incentives. And on energy specific measures interdependence with SEMS.

4.2.2 Building Retrofit

Energy Efficiency retrofits have different interdependencies, according to the different building types, with the following measures:

- **SEMS**: environmental sensors ad smart meters installed on buildings records data that are visualized and managed through the SEMs
- **E-vehicle charging**: in some buildings there will be pv installation connected to e-charging
- **e-Car sharing**: in some private buildings will be implemented car sharing of condominiums
- **USP**: environmental sensors ad smart meters installed on buildings will feed the USP
- **Citizen engagement tools**: in 2.b measure building owners will use citizen engagement tools in the co design process.

National regulations, markets and working practices may make interdependencies stronger between the SCC01 cities within the same Member State perhaps more than between the cities within a particular consortium.

4.2.3 SEMS

The strongest link exists between SEMS and USP as regards the location and treatment of energy data; and how potentially that then links to operational (user reported – e.g. apps) and financial (district bond) energy choices. The type of consuming and producing devices (associated with WP3.1-3.4, eg the type of energy source, building controls, e-mobility etc) requiring integration and optimisation within a district, will impact the way SEMS is designed and configured (including the control strategy deployed).

4.2.4 eCar Sharing

Given different car ownership schemes (public / private) the responsibility for who takes action may differ by city, however the link to WP2 citizen / user focus is strong. A common thread with clear

synergies across all eV measures is the charging and mobility hub concept, which draws many of these measures together.

4.2.5   eBikes

These can operate independent of other eV systems, though common eMobility hubs will draw measures together. Strong links exist with WP2 on user advice

4.2.6   eVehicle Charging

Notably interdependence with the Mobility Hub; Lamppost (where charge facilities are integrated) particularly where a common mobility hub is non practical (e.g. in more dispersed residential areas)

4.2.7   Smart Parking

Strong links exist with WP2 on user advice. And with USP on data collection via sensors. The loop between sensor (WP3), USP (WP4), and user (WP2) is clear.

4.2.8   eLogistics

Ownership (public / private) influences the interdependence between ShC programme activities and potential external partners. Much of the eLogistics work in the programme is public sector influenced (partially also to ensure a city-hall-led shift to this model) so interdependence between these specific eLogistics measures and the other eMobility measures is likely to be higher.

4.2.9   Humble Lamppost

Reference is made to deliverable 3.11 "Smart Lamppost Multi-Sensor Demonstrators" (interim report, Dec 2016) which covers exploitation at some depth.

The lamppost provides light and can also serve as an infrastructure for multiple sensors and services. As such it is interdependent with several other measures, as shown in figure 16.

The business case for energy savings is attractive and so this is a good candidate for potential bundling with other measures where there are shared data opportunities and other synergies.
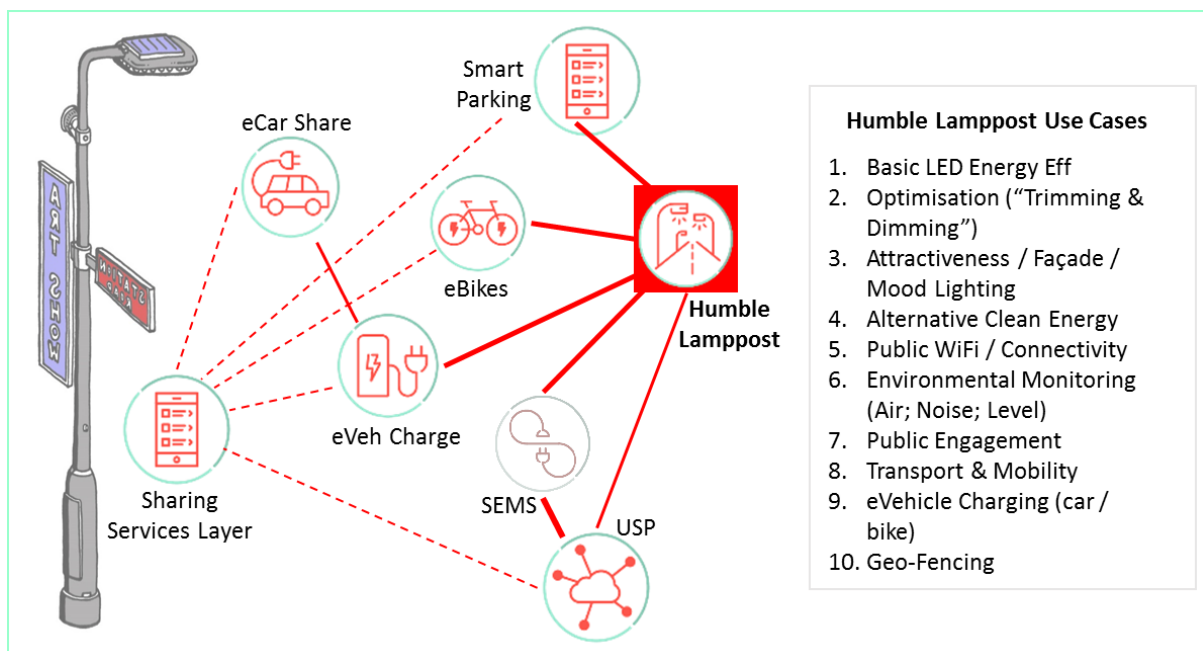
Figure 15 Humble Lamppost Interdependencies

4.2.10 Urban Sharing Platform

The USP (urban sharing platform) is integral to a 'digital first' integrated systemic set of measures within a smart city. As such, interdependencies exist at all levels, addressing things like:

- how we measure and communicate physical flows in ICT-enabled ways (e.g. real time bus locations with sensors);
- how we liberate and improve data and information flows in more general terms; or
- how we manage and link these with financial flows within and across cities.

So the interdependence covers various dimensions.

Interdependencies also exist at strategic levels (e.g. informing long-term planning through visualization; the 'mayor's dashboard'), through tactical levels (service planning and resource deployment), to operational levels (user experience optimization through sensors / IoT).

As such the USP is highly inter-dependent across all of the 10 measures.

To that end this interdependence is managed through such tools as use cases, and data mapping exercises.

More specific detail on each of the measures is included in the completed BM&F templates in Annex.

5 RECOMMENDATIONS

This section suggests specific actionable steps that should be taken in general and measure-specific to maximize value.

5.1 GENERAL RECOMMENDATIONS

Five principal general recommendations are made:

1. ***Apply the concepts in this report within Sharing Cities***
   Sharing Cities is one year in the making, so significant development work has yet to be done. The notions of demand aggregation, scale advantage, cross-city collaboration, supply market shaping that are discussed should be applied where feasible within Sharing Cities such that value is maximized and a body of knowledge is developed for sharing with other cities.
   - i. Workshops with and between the various measures work packages (2/3/4) will help flush out opportunities.
   - ii. Workshops with the 3 lead and 3 fellow cities (WP5 Replication) will help secure acceptance of these opportunities.
   - iii. Specific focus must be placed on mobilizing the key political and officer decision makers in the cities as these are the people that must help shift 'silo' operations, and accept the risks and rewards that come with new approaches.
   - iv. Collaboration with WP8 will help address how value can be assessed and evidenced, e.g. developing D8.6 "Development and application of up-scaling and replication toolbox".

2. ***Further develop this work***
   This report is based on limited available information. There is much more work to be done within Sharing Cities to specify, market-test, produce and implement the various measures. This involves the ('A') measures that have been covered in more depth, and those ('B/C') that are only addressed lightly. This will be part of the ongoing work of WP7. It should also include soft market (pre-procurement) testing of the ideas and thinking with Industry.

3. ***Evaluate and extract synergies across SCC01s***
   Given that the other (presently) 8 SCC01 consortia are addressing broadly similar scope, there are clear and considerable opportunities for synergies. The cross-consortium Collaboration Agreement provides a basis for joint work.
   - i. A coarse assessment of cross-SCC01 consortia measure opportunities should be performed to discover where opportunities lie to develop city-needs-led common solutions.
   - ii. Task Groups involving willing consortia should be established for those priority selected measures to determine where value potential exists and access it. These may also benefit in being task groups that involve industry to bring in that perspective.

4. ***Align with EIP-SCC activities***
   The EIP-SCC provides a basis to engage a broader community of actors from cities, industry, investors, and the like. In essence, opening up the opportunities for exploitation to those beyond the typical H2020 competition candidates. This particularly can offer potential to smaller cities and communities, and can integrate in the innovations from the supply-side.
   - i. Connect with Action Cluster Leaders (as Sharing Cities, or better as SCC01 collaborations) to assess how best these opportunities can be integrated within forward plans.
   - ii. Identify potential opportunities for scale funding, and assess the extent to which the EIP-SCC can develop a deal pipeline that will be attractive to various investment communities.

5. *Align with SDOs (Standards Development Organisations)*

Standardisation will be a significant enabler; one that is presently far too underused. Standardisation is a consensus process typically involving predominantly Industry input. This is good, in that it fosters neutrality (open non-proprietary solutions), however the input of cities in the standards creation process could be enhanced considerably. A challenge that international and national standards agencies are seeking to address.

   i. Align with EC & ESPRESSO project to determine opportunities

  ii. Engage with NSOs and ISO notably on tier 1-2 Leadership Guides and Management Frameworks to engage city decision makers to consider different approaches.

5.2 SPECIFIC MEASURE RECOMMENDATIONS

In addition to the general recommendations above, there are a number of more specific recommendations that are specific to individual measures, and these have been captured in table 5.

Table 7 Specific Measure Recommendations

Measure		Recommendations
1	**Sharing Services Layer (Apps)**	i. No specific recommendations at this stage
2	**Building Retrofit**	i. Continue the ongoing work to determine more about building segmentation-specific scale opportunities; determining areas of city/national-level similarities (thus synergies) and differences
3	SEMS	i. Continue the alignment of logic and architecture between the cities as a basis for developing commonalities thus increasing exploitation potential ii. Further develop the strategy for treatment of use case-specific algorithms to seek opportunities to develop common energy efficiency / RES 'apps' that can lead to enabling substantial energy benefits (all the better where approaches can be shared between cities)
4	eCar Share	i. No specific recommendations at this stage
5	eBikes	i. No specific recommendations at this stage
6	eVeh Charge	i. No specific recommendations at this stage
7	Smart Parking	i. No specific recommendations at this stage
8	eLogistics	i. No specific recommendations at this stage
9	**Humble Lamppost**	i. Continue to drive collaboration across the identified (3-4) EIP-SCC city-clusters to provide a basis for action ii. Progress cross-SCC01 collaboration with the goal to set up a Task Group that can add scale and prove exploitation potential iii. Exploit DIN specification with the intent to move to international status iv. Develop the BSI Leadership Guide & Mgmt Framework to complement the DIN spec, and test with Sharing Cities key actors v. Mobilise Industry (planned EIP-SCC co-sponsored Pavilion event) vi. Seek to access funds to support SME Cluster initiation and ensure a balance between big industry and (local) SMEs

10	USP (Urban Sharing Platform)	With SaaS the software and infrastructure cost & performance is no longer so scale dependent (though there may still be commercial advantages from scale). The components potentially benefitting from scale are the design (including architecture, as a design tool) and configuration. On that basis, initial thoughts (which require further elaboration) include: i. Focus on common design blueprints (including architecture) ii. Sector, or Use-Case-specific application configuration (e.g. application X is suitable for integrating data from EV's) iii. Sharing of experience and case studies of proven technology components, with a quality aspect too – perhaps also considering some form of certification scheme iv. Publication of suitable standards for the platform; data integration via API, communications via IP and physical connection via 3G, Wi-fi etc. v. Continued pro-active collaboration with the EIP-SCC Urban Platform initiative; and other SCC01s

6 CONCLUSIONS

This report represents an important step for the Sharing Cities programme as it moves beyond individual actions on specific measures in each city, to explore the potential (i) within the cities to exploit scale advantage; (ii) between the lead and fellow cities in exploiting synergies and advantages by working collaboratively potentially at all life-cycle stages (needs, specification, design, procurement, implementation, operations), and (iii) by exploring and exploiting synergies beyond.

The latter of which importantly makes links with (i) our Scale-Up and Link cities; (ii) the other cities within the now 9 SCC01 consortia – some 30 lead and up to 100 followers and 'interested' cities, and (iii) through the EIP-SCC, to the broader European cities market.

This therefore directly addresses the EC ambition of real scale of action across European cities. And it is central to our bold ambition to 'trigger' €500 million smart cities investment.

The report looks at the context within which exploitation will occur. It outlines what the 10 measures actually are. It looks at the various city types that will consume these measures. The stakeholders that are central to their exploitation, and the interdisciplinary and life-cycle considerations that affect the success or not of exploitation actions.

The report addresses overall exploitation potential; looking at typical benefits and challenges; addressing the logic of economies of scale; the process of exploitation; and then importantly seeks to address exploitation potential of the portfolio of Sharing Cities measures individually or indeed as 'baskets of measures' where cities can influence the market and value through linking measures together (for instance an urban platform with a set of eMobility measures, at appropriate scale).

Sharing Cities measures will have different exploitation potential and that potential will become evident at different stages of the programme (in theory, and in evidence-based practice). As such we have recognized both the different stages of maturity of the work package development work, and the different potential for economies of scale or other synergies from collaboration and demand aggregation. So for instance eBikes or Smart Lampposts may present earlier and greater trans-EU exploitation potential than more specific eLogictics or locally-influenced building retrofits.

<u>***That***</u> ***there is value to be delivered through judicious scale exploitation is unquestionable***. Indications of where that value may exist have been made, and the forward plans of Sharing Cities include tackling this in an *integrated* and informed manner. As such the content of this report much be kept 'live'.

The report is demand-side biased, as influencing and shaping demand is a pre-requisite for shifting the way the smart cities market has worked (and failed to work) to date. The move away from *Industry-driven technology-led* towards *Demand-driven City-Needs-led* is a step that the SCC01 consortia in general, and Sharing Cites in particular, can significantly influence.

Supply-side influence holds substantial potential, and is recommended as a next stage of activities – of greatest value when explored amongst the SCC01 consortia, however certainly holding potential just within Sharing Cities.

A vital ingredient to exploiting scale is the mobilization of investment. The logic that WP7 has tabled and will follow has specific tasks that are underway to engage the investment community in a manner that they are incentivised to invest – through developing bankable, de-risked, scale bundles of measures. This is included in forward plans, to which we seek to find early candidates to explore.

Five general recommendations with specific tactics for each are made. Plus a number of measure-specific recommendations. The Sharing Cities programme, in collaboration with external partners, will progress these.

7 ANNEX

7.1 BUSINESS MODEL & MEASURE PROFILING

Below are the detailed sheets for each of the Sharing Cities measures noted in section 2.1. These will continue to be developed throughout the earlier stages of the programme as measures evolve. The current version data is included at the bottom of each.

WP 3.1 Building Retrofit (ver 02)

Overview of Measure

Headline summary of measure	Apply deep-retrofit measures to public and private residential properties affecting 15,000 citizens across the six cities and integrating the properties with low carbon energy sources (solar PV, water source heat pump) and electric vehicle charging, all wrapped together by a digital first digitally driven sustainable energy management systems wrapping it all together.
Perceived value case	Significant improvement of citizen quality of indoor life and reduction of energy consumption, energy bill, CO_2 production.
Market maturity Clarity of proposition Status: within cities: experimental / pilot / in-city roll-out / market scale Status: supply market: TRL; competitiveness; regional factors;	While retrofit market proposition is clear and mature, energy retrofit is still a marginal part in building renovation market. Today's technologies and innovative approaches are able to offer an 80% reduction of energy demand of buildings. However, there is a lack of clarity by the consumers regarding energy efficiency retrofits (EER) – benefits, incentives and technical options – leading to a lack of energy savings demand! To improve the energy saving demand in buildings: A regulatory and legislative framework, also at local level, to foster energy savings in general building renovation; A specific PPP facilitator dedicated to energy retrofit of private-owned residential buildings Ambitious programmes for energy retrofit of public buildings
Investor interest: who and level of	Building owners and tenants: Interest level quite low. Financial institution: high level of interest; Banks: medium level f interest

Business Case

Existence and scale of case studies to demonstrate value	There are several initiatives across EU, under the 2010 Energy Performance of Buildings Directive and the 2012 Energy Efficiency Directive combined with national/local legal framework, to promote energy efficiency retrofits. So far, instead of deep energy retrofit, lighting and HVAC equipment replacement and renewable energy systems are the most frequently adopted measures because they are simple and easy to implement, and have lower payback periods.
What form of value and for whom	Energy consumption savings (high percentage) for building owners. Better air quality in the nearby. Improvement of internal comfort in buildings. Politicians: regeneration of urban areas, reduce energy poverty, quick way to create jobs. Households: comfort, energy bill.
Unintended effects and risks; competition issues and risks	Free riders (households who would have undertaken the energy efficiency retrofits even in the absence of public incentives); rebound effect; neglecting the residential market because of the small scale; competition issues due to

	bundled energy and services (ESCO). Uncertainty of future energy prices.
Interest & level of priority for cities (demand); industry (supply); investor (money)	High interest for cities (less energy bills and better air quality). High interest for Industry (especially construction industries). Limited from investors.
Return on Investment / Payback – marketed / real	Different RoI according to renovation level and existing incentives at national/local level. For sharing cities EE measures, between 10 and 20 years. Deep retrofits help achieve greater energy savings for less effective measures (Energy savings up to 20%) payback times may be between 2 and 5 years
What is the case for demand aggregation?	Demand aggregator at what level? Strong if at city level; not adequate at a transnational level. Public procurement lowers the price, gives confidence and increases the rate of implementation. Community procurement lowers the price, increases the rate of implementation, scale up.
Critical unknowns, concerns, blockers	Uncertainty of future energy prices, long-term energy savings forecast uncertainty, misperceived energy costs, welfare and building energy performance.

Business Model

What is / are the prevailing business model(s) currently adopted in the market?	• ESCO model; • TPF (third party financing); • Direct investment by the building owner
What failings do the current market and/or business model have that inhibit scale adoption?	Lack of demand aggregation; lack of revenues from energy savings for consumers; high up-front costs; lack of information.
Ownership of Assets: which sector; what level of clarity; change of ownership over time	Assets are owned by private citizens, companies and by the municipality
Operation of asset / service(s), and any change(s) in sight	
Potential for performance contracting	Significant.

Financing

Level of funding typically required at a city-specific level	Very significant but depends on both the retrofit level and market segment. Varied per work packages and target: from 25€/m^2 to 800 €/m^2.
Source of funding typically used	Internal budget; Financing by third parties; Financing by the Energy service company .
Upfront vs life-long finance considerations	Energy efficiency improvements are seen as CAPEX and energy savings reduce future OPEX (energy costs). Consumers can overcome high CAPEX constraints through different financing mechanisms and future energy savings allowing them to have money available for other consumption options.
Barriers to funding experienced or perceived	Demand fragmentation; uncertainty of the real savings; long payback time; difficulties in evaluating the other benefits (increase of RE value; better

	comfort), consumer's creditworthiness.

Procurement

Procurement process(es) applied	Public procurement according to national regulations; Private procurement.
Issues, concerns, blockers	Lack of commitment and incentives to demand aggregation and prosumers activities; inefficient dissemination of EER benefits.

Critical Change

What are the critical 2-3 issues that must be resolved in order to strengthen the case for scale adoption of the measure?	Incentive to technical and geographic demand aggregation. New business models to face up-front cost barriers of deep energy retrofits. Information availability. Energy savings as revenue source for consumers.

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Record submitted by: Cecilia Hugony & updated Andre Pina, CH update 31-12-16

WP3.2: SEMS (ver 01)

Overview of Measure

Headline summary of measure	Design and implement a 'Sustainable Energy Management System' (SEMS) to integrate and optimise energy from all sources in districts (and interface with city-wide system); including demand response measures.
Perceived value case	Significant cost, energy & GHG savings. The inclusion of a SEMS 'predictive control and optimisation' algorithm is believed to deliver additional efficiency savings of c10-15% over and above the control achieved in 'current generation' energy management systems.
Market maturity Clarity of proposition Status: within cities: experimental / pilot / in-city roll-out / market scale Status: supply market: TRL; competitiveness; regional factors;	Energy management system proposition is clear – integrating disparate energy sources within a smart grid. Proposition with optimisation functionality is likewise growing, with multiple private sector organisations offering commercial products. No commercial product is believed to exist presently that meets the 'predictive control and optimisation' ambition outlined in the SEMS design. London will test the proof of concept, and it is envisaged Lisbon and Milan will also attempt to apply the principles in their test districts. There presently is likely to be low confidence in the value case (as it's untested outside academic circles).
Investor interest: who and level of	Local authorities/ DNO's/Energy Tech Companies. Awareness and demand needs to stimulated. Proof of concept and demonstration of 10-15% savings is key to proving business case.

Business Case

Existence and scale of case studies and previous policies that demonstrate value	Cases: Aware of similar energy management systems being deployed by other H2020 programmes, however not aware of the deployment of a 'predictive control and optimisation' model. Siemens (key UK partner) have been involved in 'Triangulum' and 'Dr Bob'. The latter involved a 'Local Energy Management System' (LEM) deployed in each building – to be aggregated and used to generate future forecasts and analytics. (Currently liaising with Siemens for further detail. Would welcome information sharing on any other initiatives).
What forms of ('hard'/soft') value, for whom, that provide criteria for decision	'Hard': Energy consumption % financial savings for city administration/local authorities. If proven at the pilot level, and designed with scalability in mind, there is potentially great additional value and greater application opportunities. For London (initially), there could be the opportunity to deploy a city-wide UPS/SEMS platform that interfaces heating and other energy systems with a future nuclear/wind grid to provide local undertakings to 'plug and play' a smart control facility. This would enable London to take part in the response and balancing markets and could be replicated by all large European cities over time. 'Soft': Facilitates/connects multiple smart energy devices and connects to an open data platform (USP) bringing very evident benefits for society - eg transparency by opening up data. Some can be measured ('hardened'). Most benefits/UC's are therefore bound up with other WP's (2,3,4), and may need to be positioned jointly. The primary unique SEMS UC is the additional 10-15% savings achieved via a predictive control and optimisation algorithm. Presently still unclear as to whether Lisbon and Milan will 'apply' SEMS in exactly the same way. Currently it is unclear whether the application of the 'predictive control' mechanism will be deployed here – dependent on further resource discussions. Efforts are being made to align designs to enable replication across the Sharing Cities programme – final designs to be confirmed in Sept 2016 workshop.

	Aside from this- a potential opportunity to test the concept across London has arisen via a 'Innovation in Infrastructure systems' competition from Innovate UK. If deemed suitable for application – funding could be acquired to test the joint SEMS/USP model across several London districts/Housing associations. At the time of writing the competition application is being considered.
Unintended effects and risks; competition issues and risks	The primary scale up/replication risk is proving what is an untested concept, and the multiple unknown risks/challenges that will arise through this pilot.

While the design is ongoing, it is highly likely that SEMS will sit as a module within the USP, meaning it is likely to be packaged/sold as part of the USP proposition. The possibility of scaling and replicating by housing outside of the USP needs to be explored further – the USP is key to provide a lot of feed in information (eg weather, cost data etc), and will generate much of the analytics.

The critical IP associated with SEMS will be the algorithm (designed by Siemens – with academic input at present). There is a risk around keeping all aspects of SEMS open source. Or charging too much for certain components and thus making the business case less appealing.

Additional risks: non-recognition/acceptance of financial benefits by LA's – and may not fit into their own energy and smart cities strategies. |
| Interest & level of priority for cities (demand); industry (supply); investor (money) | Interest for all is presently low, due to lack of awareness, and the embryonic nature of the technology and commercial application. If consumption savings (and cost by proxy) of 10-15% can be achieved (as is envisaged), it's felt there is the potential for high demand.

Within LA's in London – this could be quick with GLA and other London partner input. Industry and investor likely to be slower. Unclear what anticipated demand could be for Lisbon and Milan and follower cities, although assumed to be similar. Presently still unclear as to whether Lisbon and Milan will 'apply' SEMS in exactly the same way. |
Return on Investment / Payback – marketed / real	Unclear at the moment. Depends on the cost associated with the Siemens algorithm, and the degree to which this can be made open source (if at all). Any solution will need to be cost effective. Range of investment and associated payback needs to be included/estimated in next document revision.
What is the case for demand aggregation?	Unclear. Every SEMS will be applied to a different set of energy infrastructure and local need. However, if on a licensing basis – the potential to aggregate purchase of the algorithm on a bulk basis though. Further exploration required. Despite the current scale up challenges in terms of replicating SEMS in London and Milan – if successful in the Innovate UK bid – this would allow a good opportunity to test this out across London.
Critical unknowns, concerns, blockers	The critical SEMS algorithm has not been created yet – meaning a lot of this is hypothetical. Further practical considerations will arise around scaling up depending on the commercial model/agreement Siemens have in place – to be discussed further.

Business Model

What is / are the prevailing business model(s) currently adopted in the market?	Variable / range. Potentially could be LA's through to outsourced operations; or utility? Still an emerging area – so few examples to learn from.
What failings do the current market and/or business model have that inhibit scale adoption?	SEMS product not yet ready for the market

Off the shelf 'existing' energy management systems can be constrained by closed protocols limiting connectivity? A lot of private sector organisations in this market!?

Individualistic city design and operations (both Depts in cities, and cross cities) limits demand aggregation potential |
| Ownership of Assets: which | Varied models would potentially exist: city owned; to utility or other party |

sector; what level of clarity; change of ownership over time	owned and managed. City owned, privately managed? Some private owned, privately operated (eg campuses/mini grids?)
Operation of asset / service(s), and any change(s) in sight	City (local authority) operated, or third party operator?
Potential for performance contracting	Significant. Possible to incentivise via energy and cost savings, and potential to bundle in development of additional smart services?!

Financing

Level of funding typically required at a city-specific level	Too early to say, although not likely to be significant in relation to the investment in the energy infrastructure that the SEMS will connect?
Source(s) of funding typically used, and new forms that could be accessed	Too early to say?
Upfront vs life-long finance considerations	Opportunity for little upfront cap-ex cost, if a shared savings agreement was in place? Potentially more attractive to risk adverse investors?
Barriers to funding experienced or perceived	Lender confidence. Initial lack of awareness or understanding – very technical and potential for non expert audience to be put off? Price and financing model would be key – currently a number of unknowns with Siemens and other partners.

Regulatory, Policy & Procurement

Procurement process(es) applied	OJEU typically a requirement for any initiative?
What existing or needed (inter-)national regulatory and (local) policy actions will support?	All energy reduction and renewables regulation eg EU 2020 Local energy generation directives? Mayors policies: Decentralised energy target, Energy for Londoners
Issues, concerns, blockers	Potentially not many incentives or procurement mechanisms that facilitate demand aggregation

Critical Change

What are the critical 2-3 issues that must be resolved in order to strengthen the case for scale adoption of the measure?	Developing SEMS in a way that is scalable and commercially viable means removing a lot of current barriers/outstanding questions: • Clarify the commercial/legal questions – can we work with private partners to design a SEMS that is fully 'open' in spec and where the IP (algorithm) can be shared and replicated in a cost effective way? • Proof of the concept (10-15% saving) via a pilot – can the 'predictive control and optimisation algorithm' consistently generate the savings envisaged • Can multiple energy infrastructure practically be deployed/interchangeable with the SEMS –eg can we include renewables, e-mobility etc, and balance this? Requires more piloting and testing

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Record submitted by: Rick Curtis, July 2016

WP3.3 Shared eMobility (ver 1) – NB this BM&F template addresses all emobility measures in one. Independent sheets are in discussion

Overview of Measure

Headline summary of measure	Provide the framework and technological conditions for the implementation of shared e-Mobility solutions, allowing the delivery of new and efficient services to citizens and to cities. These solutions include e-Car-sharing (cars, EVSE), e-Bike-sharing (including user-based bike reallocation with rewards), EV Charging (to benefit from density effect), Smart Parking (with or without charging) and e-Logistics (Optimization of logistics EVs routing).
Perceived value case	Visible shared eMobility demonstrators/use cases.
Market maturity Clarity of proposition Status: within cities: experimental / pilot / in-city roll-out / market scale Status: supply market: TRL; competitiveness; regional factors;	Shared e-Mobility solutions are in an early stage of development, especially concerning the provision of services in a sustainable way. Shared e-Mobility technologies and integration platforms are still in an experimental phase in the market. The Mobi.me platform is running in several international markets for some years, in mobility and e-Mobility solutions (including in shared solutions) – namely in e-car, e-bike and EV charging stations. Integration of e-Mobility solutions is still scarce in most part of EU cities. Mobi.me platform allows the integration of e-Mobility services from different operators. Car-sharing and bike-sharing are realities in some EU cities since the late decade. Not the same for e-Car-sharing, e-bike-sharing or e-logistics solutions There are commercial/market solutions oriented to vertical e-mobility services. High level developments and proprietary platforms, from multinational companies. No e-sharing mobility integration observed. There are few examples in the EU of eLogistics initiatives.
Investor interest: who and level of	Shared e-Mobility solutions (services and platforms) are attractive for private and public investors, due to high growth market expectations.

Business Case

Existence and scale of case studies and previous policies that demonstrate value	Cases: (supported by Mobi.me platform) • Portugal: national e-Mobility programme (e-cars and EV charging stations); Cascais city: e-Bike-sharing initiative; Porto city: Municipality fleet monitorization (bus, cars and e-cars) • Spain: e-Bike-sharing initiative in Barcelona; • Brazil: Curitiba e-Cars Municipality programme; Other cases • Malaga (eMobility management) • Cardiff (public data management) • Rio de Janeiro (Control and Operations Centre) • Amsterdam Smart City Platform There are no EU or national specific policies to support the integration of e-Mobility services and solutions. National legislations must be adapted to the new forms of mobility (e-Mobility; Shared e-mobility).
What forms of ('hard'/soft) value, for whom, that provide criteria for decision	'Hard': • Financial savings for city administration, due to a higher efficiency in the coordination of mobility policy (); • Less driving accidents (); • Air pollution decrease (); • Decrease of costs and time-spending related to new mobility habits of city citizens

	Soft: Improvement in the life quality of city`s citizens and visitors/tourists;
Unintended effects and risks; competition issues and risks	Unintended effects: could be non-recognition / communication / receipt of financial benefits by society; privacy concerns from public security (citizens`s data) use etc. Risks include: (i) lack of demand in the first years; ii) lack of citizens engagement to these new concepts of mobility ; (iii) not establishing means to take financial gains to bottom line; iv) different levels of maturity of eMobility solutions (eLogistics are in a less development stage than eCars or eBikes solutions).
Interest & level of priority for cities (demand); industry (supply); investor (money)	Med/Hi interest for cities and growing significantly. Similar for Industry. Med from investors – possibility of using EU funds for some Municipality e-mobility projects.
Return on Investment / Payback – marketed / real	To be defined.
What is the case for demand aggregation?	Strong. National/EU procurement to shared e-Mobility solutions and integration can boost innovation and competitiveness at national/local level.
Critical unknowns, concerns, blockers	Reliability and quality of the services provided. Support of Municipalities to e-shared Mobility Financial sustainability.

Business Model

What is / are the prevailing business model(s) currently adopted in the market?	EU cities using market proprietary mobility platforms, most part for vertical services only. Different business models: one-in-all solutions; or solutions provided according the different needs of the cities. Annual fees. Fees per transaction. Limited current innovations for shared eMobility solutions. ……
What failings do the current market and/or business model have that inhibit scale adoption?	There are no stable solutions in the market. Cities are adopters, not involved in the design and conception of the services/platforms (with some exeptions) Capex/Opex robustness; Sustainable business models ….
Ownership of Assets: which sector; what level of clarity; change of ownership over time	**Platforms and integration:** Most part of the eMobility platforms are owned or managed by big companies/multinationals (CISCO, INDRA, MICROSOFT, SAMSUNG, IBM…); Some cities collaborate with R&D/universities for the development of eMobility integration solutions (FORTH platform, Greece). **eMobility solutions:** eMobility services from private sector mostly (e-car and e-bike-sharing) or in partnership with Municipalities/Public entities eLogistics initiatives found in some private companies(ex. Post companies; Transportation companies)
Operation of asset / service(s), and any change(s) in sight	Operation of e-Mobility solutions (and e-shared) – several solutions: private sector; in partnership with Municipalities/Public entities; licenced by public entities to the private sector. …
Potential for performance contracting	Significant. Improvement of life quality of citizens and tourists/visitors are a potential base for the supply of new services/solutions.

Financing

Level of funding typically required at a city-specific level	Initial funding: to be defined (hardware/software/development costs).
	Annual costs: to be defined (annual fees for eMobility integration services - maintenance and operation - depends of the level of transactions, for example).
	Annual maintenance costs for Shared e-Mobility solutions also depend on the existence level of demand.
	….
Source(s) of funding typically used, and new forms that could be accessed	Municipality budget.
	EU funds.
	Private funds (Companies investment; including venture capital)
Upfront vs life-long finance considerations	Energy & Maintenance costs sustainability in the Opex.
Barriers to funding experienced or perceived	Funding shortage for innovative and risk projects.
	Lack of confidence in the financial sustainability of the business models.

Regulatory, Policy & Procurement

Procurement process(es) applied	No specific framework for e-Mobility integration services. Under the national/EU public procurement legislations.
	eMobility solutions (e-Car; e-Bike; e-logistics): EU countries have procurement legislation covering some of that services.
	Shared e-Mobility solutions: EU and country level legislations might be adapted.
What existing or needed (inter-)national regulatory and (local) policy actions will support?	Some (national) regulatory change is required for municipalities to use citizens`s data (privacy; security); sell power for eV charging; sell (geo-fence) data; etc.
	National/EU legislation for the "collaborative economy" – legal framework for the new business models.
	Strengthening of local policy to support cross-cutting (departmental) benefits.
	Policy to support 'demand aggregation' for smaller municipalities.
Issues, concerns, blockers	Few incentives or procurement mechanisms that facilitate demand aggregation.

Critical Change

What are the critical 2-3 issues that must be resolved in order to strengthen the case for scale adoption of the measure?	• Legal framework for e-Mobility solutions and the "collaborative economy" • Incentives for demand aggregation • Availability of tools, templates and proof points to make decisions simple • Funds for financial support for Shared e-Mobility solutions

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Record submitted by: Bob Moura Santos, 11-8-16

WP3.4 The Humble Lamppost (ver 02)

Overview of Measure

Headline summary of measure	Upgrade city lampposts to LED to gain the RoI benefits (of energy and operational savings) and *in parallel*, multi-purpose these assets to enable delivery of smart city services; and in so doing develop a common design that is fundable and can be exploited by other cities. Bring attractive funds / loan terms to expand volumes from H2020 commitments to bolder levels.
Perceived value case	Visible smart city demonstrator. Significant efficiency & GHG savings.
Market maturity Clarity of proposition Status: within cities: experimental / pilot / in-city roll-out / market scale Status: supply market: TRL; competitiveness; regional factors;	Smart lighting (LED) proposition clear and mature – any lack of clarity is around best deployment of controls (CMS). 'Smart' features is far less clear collectively; though individually each solution is (technically) clear – low confidence in the value case. LED replacement is only implemented ~10% EU-wide. 'Smart' overall at pilot / experimental stage. Industry solutions at relatively high development level. Ongoing innovation (greater choice), and reduction of costs observed.
Investor interest: who and level of	Investors incentivised by LED only; see 'smart' as risky (lack of technical understanding; or brought in once too detailed).

Business Case

Existence and scale of case studies and previous policies that demonstrate value	Cases: principally LED-only replacement – several city cases (up to ~2yrs experience). Various 'smart' pilots: Santander, Glasgow, BCN, … No known policy measures that incentive adoption of 'smart' features.
What forms of ('hard'/soft') value, for whom, that provide criteria for decision	'Hard': Energy consumption financial savings for city administration; and maintenance savings (both high percentage: 30-80%). Dimming & trimming through central mgmt system (CMS). Public safety crime, driving accidents, air pollution fines) Proof of taking 'smart city journey' for politician / city officials. 'Smart' features can be very evident for society (eg pervasive WiFi; 'push to talk', sense of safety, transparency thru opening up data). Some can be measured ('hardened'). Some offer revenue potential (eg geo-fencing data for retailers & events managers; CCTV data for parking companies)
Unintended effects and risks; competition issues and risks	Unintended effects could be non-recognition / communication / receipt of financial benefits by society made worse if upgrade causes any issues; privacy concerns from public security (CCTV) use etc. Risks include: (i) doing LED-only 1st and thus damaging business case to retrofit smart features; (ii) not establishing means to take financial gains to bottom line. Competition for LEDs high causing price drop. *Integrated* smart lamppost solutions and 'smart' features nascent and fragmented (pricing is still volatile).
Interest & level of priority for cities (demand); industry (supply); investor (money)	Med/Hi interest for cities and growing significantly. Similar for Industry – perhaps more. Limited from investors (tho for a few it's growing).
Return on Investment / Payback – marketed / real	Marketed as LED 50-80% savings. 5-8 yr RoI. Real evidence less prominent, and less significant; though certainly still significant.
What is the case for demand aggregation?	Strong. Unique city lampposts &/or individual procurement are detrimental to value, confidence, innovation, speed of implementation.
Critical unknowns, concerns, blockers	Value case for 'smart'.

Business Model

What is / are the prevailing business model(s) currently	Variable / range. From city owner and operated lighting, through to outsourced

adopted in the market?	operations; and shift of ownership to utility (or for a few ANO party). Limited current innovations for performance contracting (only for outsourced), or combined 'smart' / LED business models.
What failings do the current market and/or business model have that inhibit scale adoption?	Individualistic city design and operations (both Depts in cities, and cross cities) limits demand aggregation potential; sometimes mitigated by service provision or indeed ownership by utilities or outsourced service providers who can help aggregate demand. Desire / 'fashion' to go quickly for RoI from energy savings only causes cities to neglect 'smart' options. Capex/Opex trade off often breaks the ability to address time-based RoI models, thus scale take up. Energy metering at too macro a level or power supply only during night can limit adoption of 'smart' options.
Ownership of Assets: which sector; what level of clarity; change of ownership over time	Varied models exist: from city-owned lampposts (majority); to city, owned provider managed (several); to utility or other party owned and managed (few).
Operation of asset / service(s), and any change(s) in sight	Currently limited to 'lighting dept'. Increasing acceptance that 'smart' options exist – so intrigue from snr level folk and other depts. Move to outsource operations, and potentially asset transfer.
Potential for performance contracting	Significant. Base the deal on quantum energy savings, and weave in clauses to include funding of smart services.

Financing

Level of funding typically required at a city-specific level	Significant though not major infrastructure investment. <u>Very</u> varied per-lamppost cost benchmarks: range from €400-8,000. Detail on "pole upgrade vs LED only"; "LED vs CMS & 'smart' features" hard to come by
Source(s) of funding typically used, and new forms that could be accessed	Small tactical upgrades typically from internal budgets. Larger scale with sovereign funds. E & S EU with elements of structural funding. Some bank loans. Emergence of asset transfer SPVs with more freedom to exploit data / offer paid 'smart' services.
Upfront vs life-long finance considerations	Typically investment is capitalised (unless city service provider / utility owns, or eV charge / SPV invests). Energy & Maintenance costs transcend capex.
Barriers to funding experienced or perceived	Lender confidence. Projects are too small and 'irritating' to attract serious investors (eg EIB). Interest in swift financial energy bcase, not in harder to measure 'smart'.

Regulatory, Policy & Procurement

Procurement process(es) applied	OJEU typically a requirement for any initiative. In some countries / cities framework contracts exist within which change can be made via private sector service provider
What existing or needed (inter-)national regulatory and (local) policy actions will support?	Some (national) regulatory change is required for municipalities to sell power for eV charging; sell (geo-fence) data; etc Strengthening of local policy to support cross-cutting (departmental) benefits. Policy to support 'demand aggregation' for smaller municipalities
Issues, concerns, blockers	Few incentives or procurement mechanisms that facilitate demand aggregation

Critical Change

What are the critical 2-3 issues that must be resolved to strengthen the case for scale adoption of the measure?	• Clarity of value case for 'smart' • Incentives for demand aggregation • Availability of tools, templates and proof points to make decisions simple *Record submitted by: Graham Colclough, v02 6-4-16*

WP4 Urban Sharing Platform (USP) – (ver 03)

Overview of Measure

Headline summary of measure	An **Urban Sharing Platform (USP)** is a logical collection of technical components, capabilities and processes which provides functions and services that enable a Smart City. Its purpose is to aggregate data and control functions from a wide variety of devices and sensors, store, process, correlate the data and present information to the city and citizens which enables better use of the city resources and may provide support for innovative service verticals.
Perceived value case	Generate value from city data, both direct & indirect. Increase efficiency of city infrastructure. Provide advanced decision support for city managers as well as citizens Possibly provide raw and/or correlated data to support innovative service verticals
Market maturity Clarity of proposition Status: within cities: experimental / pilot / in-city roll-out / market scale Status: supply market: TRL; competitiveness; regional factors;	The city platform market is fragmented with few standards & limited implementation at scale, or indeed market leaders. Overall value proposition is still work on progress. There is little common agreement on what constitutes a city platform. It ranges from data collection & processing, to device connection, and city dashboards, to APIs availability for innovative service verticals. Most deployments are pilots or city specific rollouts, and are non-commercial in nature, supported by grants or market investments. There are many suppliers, ranging from start-ups to large enterprises with no dominant players. It constitutes a mix of traditional technology suppliers (IBM, Cisco etc); start-ups (such as Concirrus & urban institute), & city service providers. The global "to be" ecosystem may require integration between providers.
Investor interest: who and level of	Large technology players and infrastructure providers are investing. More traditional investors do not have the market confidence to invest.

Business Case

Existence and scale of case studies and previous policies that demonstrate value	Usual suspects of smart city pioneers all have some platform implementation now: BCN, Bristol, Manchester… No known policy measures that incentive adoption of 'smart' features.
What forms of ('hard'/soft') value, for whom, that provide criteria for decision	'Hard': Potential resource optimisation. Value from city data (e.g.CPH). Value generation form data correlation. Improved decision making. Enabler for other smart city projects, connection across siloed vertical smart projects/ Proof of taking 'smart city journey' for politician / city officials.
Unintended effects and risks; competition issues and risks	Data security and effective identity & access management. Ownership of assets which can benefit from platform. Lack of capability of cities to deliver, maintain and develop large technology projects. Lack of standards and proliferation of proprietary systems, especially legacy.
Interest & level of priority for cities (demand); industry (supply); investor (money)	Med/Hi interest for cities, and growing significantly. Similar for Industry – perhaps more. Limited from investors (tho for a few it's growing).
Return on Investment / Payback – marketed / real	Strong value case, with RoI yet to be proven for city platforms. Fragmented and different value cases per vertical sector adds complexity to achieving the global picture.
What is the case for demand aggregation?	Med: systems are cloud based so should be easy to scale. Issues are lack of standards so choice of solution difficult, and lack of skills to deliver projects are real hotspot for aggregation.

Critical unknowns, concerns, blockers	Value case for 'smart' platform is unclear and will arise from specific value cases eg Sustainable Energy Management System

Business Model

What is / are the prevailing business model(s) currently adopted in the market?	None as such, market is currently driven by grant funding & industry investment and experimentation. New business models are needed to prime market, eg deriving value from raw data as well as correlated data and driving value from API availability to support new service verticals
What failings do the current market and/or business model have that inhibit scale adoption?	City Platforms link IT to infrastructure so cut across city management structures which makes it difficult to identify a senior owner to support adoption. Similarly key industry players are from either a technology or infrastructure base and products are skewed accordingly
Ownership of Assets: which sector; what level of clarity; change of ownership over time	Not so applicable to platform, as technology owned by city. Platform should comply with standards that allow for easy asset integration. (Examples of joint exploitation of data commercially by city & industry in place in eg CPH)
Operation of asset / service(s), and any change(s) in sight	no
Potential for performance contracting	Possibly, in theory the efficiencies in smart cites are driven by the platform so the two could be linked.

Financing

Level of funding typically required at a city-specific level	For platform alone £250k but limited value unless linked to smart infrastructure and extent of data & integration from existing systems. Platform maintenance and development effort over the years will depend upon the level of integration required with smart infrastructure of the ecosystem.
Source(s) of funding typically used, and new forms that could be accessed	Grants & industry investments. Data functions of a platform could replace other expensive city data capabilities based on SAP, Oracle etc. Raw and correlated data from the platform could be of use to the industry to support innovative services.
Upfront vs life-long finance considerations	Cloud type pay per use is preferable, but ongoing platform capabilities development costs should also be considered
Barriers to funding experienced or perceived	Lack of value case and definition of and what a city platform is. Difficult quantify the monetization of the usefulness perceived.

Regulatory, Policy & Procurement

Procurement process(es) applied	OJEU typically a requirement for any initiative. In some countries / cities framework contracts exist within which change can be made via private sector service provider
What existing or needed (inter-)national regulatory and (local) policy actions will support?	Strengthening of local policy to support cross-cutting (departmental) benefits.
Issues, concerns, blockers	Few incentives or procurement mechanisms that facilitate joint delivery

Critical Change

What are the critical 2-3 issues that must be resolved in order to strengthen the case for scale adoption of the measure?	• Strong and clear Definition of urban platform • Value & use case clarification – based on enabling smart projects such as energy mgmt. or smart lighting

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