CUTLER

CUTLER - Coastal Urban developmenT through the LEnses of Resiliency

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Abstract	This report is addressed to the policy makers of DG CNECT and follows a pre-specified template addressing questions related to policy making, including: a) description of relevant policy problems and evidence to the task of addressing them, b) potential economic, social and democratic impacts of the project, c) use cases, d) policy implications of intermediate findings, lessons learnt and recommendations, and e) ideas for exploitation and economic models for sustainability.
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Executive summary

This report is addressed to the policy makers of DG CNECT and follows a pre-specified template, provided by the EC. The template addresses questions related to policy making, including: i) description of relevant policy problems and evidence to the task of addressing them (introduction), ii) potential economic, social and democratic impacts of the project, iii) use cases, iv) policy implications of intermediate findings, lessons learnt and recommendations, and v) initial ideas/talks for exploitation and economic models for sustainability. This is the first of three deliverables that will be submitted in M12, M24 and M36.

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POLICYBRIEF

[for EC internal use]

Project title: CUTLER - Coastal Urban developmenT through the LEnses of Resiliency

Call: H2020-SC6-CO-CREATION-2017

I. INTRODUCTION

*Urban development in waterfront cities incorporates a wide range of activities aiming to either **exploit the beauty and opportunities offered by the water element** to foster economic growth (touristic activities, development of recreational and sports facilities in the coast, infrastructure for import/export of goods in ports, etc.) or **alleviate the environmental stresses caused by the water** to protect the city from water-related threats such as floods or erosion (infrastructure against floods, precaution measures against climate change, effective strategies for risk management and prevention, etc.) It is clear that urban development activities in such areas heavily affect all three pillars of the urban ecosystem, i.e. the society, the environment and the economy. To effectively balance between ensuring the well-being of citizens, strengthening the local economy, and protecting the environment, **evidence-based policy planning and implementation is required**.*

*When addressing such problems, policy makers and society at large face a number of fundamental challenges. The different components of the urban system are strongly interwoven, giving rise to **complex dynamics** and making it **difficult to anticipate the impact and unintended consequences** of public action. Urban development policies are subject to **highly distributed, multi-level decision processes** and impact a wide variety of stakeholders, often with conflicting or contradictory objectives. The **increasing growth and availability of municipal datasets** represents a significant opportunity for municipalities and their citizens to develop tools for coping with these problems and enabling interactive urban planning and governance. However, harnessing the potential for economic, social and environmental betterment through analysis of this data requires new configurations of actors and institutes in order to address the **challenges of data access and analysis capacity**.*

*CUTLER aims to establish a **sustainable solution for incorporating big data and data science in the policy-making process**. To this end, an innovative platform is being developed that will help policy makers to **easily design, implement and monitor urban development policies for coastal cities**, based on the wealth of data generated by and in the cities on a daily basis. Using this platform, we will effectively address the challenges mentioned above:*

- *Evidence-based decision making. In recent years there has been an explosion in the amount of data generated daily in the cities by the public administration, the private sector and the citizens. This wealth of data can significantly improve policy making; however, it is still not clear how this can be fully or better exploited. In CUTLER, we propose the **IAMER (Inform, Advise, Monitor, Evaluate, Revise) methodological approach for policy development** that uses big data as the enabler to: a) **inform** policy makers when*

*making evidence-based decisions by presenting them all the available information, b) **advise** them about the estimated impact of planned activities with respect to the resiliency of the city, c) help them **monitor** the progress of enforced measures and ensure compliance with set objectives by visualizing in real-time data obtained from the sensing infrastructures and detecting significant changes, d) allow them to quantify and **assess the impact** of policies based on the data collected by the monitoring mechanisms and the definition of set of Key Performance Indicators (KPIs), and e) facilitate them in **revising** their actions plans in an iterative manner based on KPI values.*

- **Big-data availability and access.** *The basis of CUTLER's big data approach is the sensing infrastructure that is already available in cities and is able to offer a wealth of sensor measurements, user contributed content, and statistical information that will allow us to sense and assess the consequences and impact of urban development policies. More specifically, the following data categories are currently used in CUTLER:*

  - *Data generated by **hard-wired sensors** in real-time, such as air and water quality measurements, rainfall and run-off data, etc. as well as archived (historical) environmental data. This data will be used to sense the environmental impact of policies.*

  - ***User-contributed content** from online participatory platforms or social networks that allows engaged citizens to act as living sensors of the city. This data is used to extract opinion trends and estimate public sentiment and, thus, sense the social consequences of a policy.*

  - *Data from **official statistics**, such as data from National, European or international Statistical Agencies or local chambers (e.g. Gross Domestic Product, city taxes, employment rate, touristic visits, intra and inter-industry data, household budget surveys, etc.) This data will be used to sense the economic activity.*

  *Currently, data from more than **350 environmental, social and economic data sources** and more than **50 different data owners** in four pilot cities are collected by the platform's data collection mechanisms, which are able to handle effectively different types of sources (data streams, databases, static documents, web pages, etc.) A **legal framework** clearly summarizing the legal requirements for data collection and processing based on a novel legal taxonomy has also been established, ensuring adherence to GDPR and other EU and national legislation.*

- **Big-data analysis capacity**. *Significant software and hardware resources are necessary to manage big data due to its richness and real-time aspects. To address the challenge of analytics capacity both in terms of hardware infrastructure and expertise in data analysis, an **interdisciplinary team of experts** has been assembled to build the CUTLER platform: a) cloud-infrastructure providers, offering the technologies to collect, store and process the data in very large scales, b) public officials, providing local information and specifying the requirements guiding the developed solution, c) data analysts, capable of extracting knowledge from different data sources, and d) software integrators, capable of streamlining different pieces of software to offer services. The CUTLER platform will act as a **Software-as-a-Service Solution** for City Data Science. It is based on a **flexible and horizontally scalable cloud architecture** that can be easily customized to meet the specific needs of different cities and uses **open source technologies** for data management and processing.*

- **Decision support platform**. *Decision-making of public bodies must follow fixed rules and procedures. These are laid down in formal rules of procedure or even in legislation and determine which actors from the administration, politics and possibly from the society need to be involved, how they need to be involved and in what sequence. The CUTLER platform not only accommodates for the complex decision making processes in public administrations but offers a decision-support system that enriches the local decision-making processes with **evidence through big data, public participation** procedures and elements of **foresight and***

scenario planning methodologies. A **baseline Business Process Model** is under development for implementing a generic policy process in municipalities incorporating these capabilities offered by the CUTLER platform. **Business Process Engines** will be employed to execute and steer the Business Processes.

- *Policy impact modelling. Modelling the impact and consequences of decision-making in public administration is an extremely challenging task, currently based on intuition, subjective opinions, and past experience. The emergence of big data can help decision makers make more balanced and reasoned decisions; however, this requires extensive analysis. To this end, CUTLER introduces big data analytics to* **translate information provided by the data into evidence and actionable knowledge**. *Big data are meaningful only if measured by appropriate KPIs, which in CUTLER's case are defined in terms of environmental impact, social consequences, and economic activity. These KPIs will assist the decision-making process of each city and will drive the necessary corrective actions and re-planning. To this end, we have developed:*

  - *A **generic economic model** to assess the economic impact of policies at a regional level based on a wide variety of micro and macroeconomic data. The generic nature of the model, which combines econometric and input-output models, contributes to its sustainability in time while it enables its use in several other cases than just the pilots. The model is also linked to EU Regional Resilience Indicators (RRI), which measure an economic system's resilience at regional level.*

  - ***Environmental models** to accommodate the special needs of each pilot city. Our approach is based on the definition of a set of (a) descriptive and (b) performance indicators, suitable for each city. The former are used for defining the situation in each pilot and providing additional information (e.g. height of rainfall, groundwater levels, flood maps, etc.); the later are employed for quantifying phenomena and for assessing the progress towards established objectives (e.g. decrease of groundwater level during rainfall, decrease of flooding events in the city, etc.).*

  - ***Novel methods to sense and predict the social consequences of policies**, based on multi-dimensional data harvested from various online and social media platforms. Public opinion and sentiment about specific policies (not only reaction to current policies but also historical analysis) is extracted from news articles comments and Twitter feeds. Analysis of local dynamics and trends in a region of interest is based on Twitter feeds and social events (GDELT data) taking place in the local area.*

II. SOCIOECONOMIC AND DEMOCRATIC IMPACTS

The cardinal objective of CUTLER is to provide an evidence-based decision-support system for policy makers in public administrations that will help them to easily design, implement, monitor, assess, and revise policy plans & measures based on quantifiable evidence about the effects of their policies. The evidence relates to different dimensions of public life – the effects on the environment, on the economy and the communities that are affected. The platform will help decision-makers come to more balanced and reasoned decisions. The potential impacts of the CUTLER decision-support system are summarised below:

Socio-economic

Policy making related to urban development directly affects the economy and the society in the sense that good decisions advance economic growth and affect positively the lives of people, while bad decisions cost money and affect citizens negatively. The CUTLER platform has the potential to improve public policy effectiveness and precision and increase the city's resilience.

- ***Improve policy-making effectiveness in public administration**. Fusing data that measure economic activity, environmental impact and societal consequences into a **single platform** and under a **single***

business process model increases the effectiveness of the decision making mechanism in public administrations, since at any given point the authorities can **automatically** get guidance in decision making, assess the impact of their policies, monitor the enforcement and compliance of the enforced measures and evaluate their effectiveness. The CUTLER platform will be a paradigm for a new generation of decision support services for public administrations, which combines the policy maker's intuition in policy design and implementation, with evidence-driven procedures and simulations. It is expected to have a **transformational impact in public governance** since it will modernize the decision-making process, making it **more effective not only in terms of results but also in terms of resources and costs required** to design and monitor policies. The platform will offer a multi-faceted dashboard and advanced visualizations that will assist policy makers in all steps of the IAMER cycle, while the embedded Business Process Engine will accurately model the business process mechanisms of public administration, allowing the different stakeholders to use the platform according to their roles. This approach will lead in **decreased costs and better organization and coordination of work**, while it will also make the complex decision making processes of public administration easier to follow.

- **Improve the effectiveness, efficiency and precision of policies.** Big data integration from multiple sources will provide **new perceptions of the city dynamics** that will lead to **better decisions.** Implementing large-scale data collection in almost real-time enables the CUTLER data analysis and visualization tools to present the policy maker with relevant **information and insights in current time** and therefore to **maximize effectiveness** of policies. The massive amount of aggregated data to be processed by the big data analysis components will **increase precision rates,** as opposed to existing solutions that perform analytics on small-scale datasets. The platform's monitoring capabilities will support display of daily, seasonable and dynamic feeds (regarding environmental measurements, economic activity or user-contributed content) and their changes over time, which will allow monitoring of the execution of policy measures and triggering of possible corrective actions for enforcing the policies. Better decisions and close monitoring of their consequences to **ensure policy compliance** will lead to increased gains in terms of decreased costs for dealing with the consequences of failed policies, bad estimations and erroneous assessments. Moreover, reliance on evidence can minimize negative consequences of bad policy measures to the society as a whole.

- **Increase city resilience.** The use of data representing the three pillars of the urban ecosystem (society, environment, economy) in the decision making process and the definition of **appropriate KPIs to quantify the effects of policy measures** in these three areas will lead to decisions that will strengthen city resilience and will lead to **thriving, resourceful, and equitable cities** that ensure the safety and well-being of their citizens, strengthen local economies and protect their natural resources.

<u>Democratic</u>

Increasing output legitimacy and input legitimacy through the CUTLER platform

Citizens see public policies as legitimate, if the outcomes of said policies promote the interests of all citizens - commonly referred to as "the public good" - and not only special interest, for example, of powerful stakeholders in the political process. This refers to the output dimension of **democratic legitimacy**. The **resilience lens** applied by the CUTLER platform ensures that urban development policies in waterfront cities will not favour economic growth over society's well-being or environmental protection. The overall philosophy of the proposed solution ensures **balance between economic growth, environmental impact and societal consequences**, thus, supporting **output legitimacy** in practice.

However, a "public good" is only meaningful in relation to the preferences of citizens. If there are mechanisms that introduce these preferences into the political process and translate them into political decisions and if those mechanisms are transparent then this strengthens the **democratic input legitimacy**. Several of CUTLER's

*functionalities will **leverage the role of citizens**, ensuring **democratic processes in urban environments** as well as **transparency** and **increased trust** in public administrations. More specifically:*

- *CUTLER will deploy various **participatory components involving citizens** and societal stakeholders. Accordingly, the CUTLER BPM contains methodologies of **effective public consultation** and **co-creation of policies** and will incorporate their results in its decision support system. Citizens and other stakeholders are therefore included well beyond the consultative stage of the traditional standard policy-development process. Co-creation sessions for policy making are currently under way in the pilot cities, involving policy makers, citizens, business and environmental stakeholders to concretize policy plans. The public participation component of CUTLER allows citizens to **directly co-shape policy decisions**, thus, ensuring a **democratic process**. This will **improve the relationship between citizens and public administration** since it will allow them to have an honest dialogue about measures affecting everyday life in the city. For example, in Antwerp, co-creation sessions allowed the city and citizens to jointly decide to implement a garden street that will help the city reduce the risk of flooding and will protect it against climate change.*

- *CUTLER's opinion mining algorithms support **soliciting citizens' opinions, complaints, ideas and suggestions** in waterfront cities, thus, allowing public administration stakeholders to have a clear idea about how citizens are affected by enforced policies or how these policies are perceived and evaluated by citizens. Our analysis is not limited to a particular location, as the policy maker would be interested in the impression of a topic worldwide, e.g., if a city intends to develop sports facilities in the waterfront, the decision makers would be interested to understand the positive and negative aspects of such a measure in similar cities all over the world based on citizens opinions as expressed in their Twitter feeds or in the comments section of relative articles. Such an approach establishes **good governance policies** that take the society's opinions into consideration and allow citizens to **co-shape policy measures in an indirect way**.*

- *The CUTLER data analysis and visualization tools for extracting actionable knowledge out of big data induces **increased transparency** of the processes in public administrations and, thus, overall **increases trust of the citizens in local governments**, as people also get to understand that objective data-driven policies are implemented.*

- *The CUTLER platform directly contributes to the EC's vision for public services and **open transparent government**:*

  - *It uses already available **open data** from the public and private sector as well as content publicly contributed by citizens to inform better decisions.*

  - *It provides the framework for **open** and more transparent decision-making **processes** in public administration by employing Business Process Modelling, enhanced with foresight methodologies like scenario planning and augmented by big data analysis and public participation.*

  - *It establishes the foundation for providing **open services** related to policy-making. CUTLER will be a SaaS tool; however, the proposed technologies and components can be used for providing open services based on open processes and open data.*

- *Finally, CUTLER contributes to the EC's eGovernment Action Plans for digital public services by*

  - ***Modernizing public administration**. The CUTLER platform is an efficient and effective decision-making tool that allows local stakeholders to design and implement resilient urban development policies in a user-friendly, transparent and simple way. But the near real-time capabilities of the CUTLER big data applications allow not only for the formulation of more accurate and precise policy measures. They also make results as well as unintended consequences of policies instantaneously accessible, which provides a continuous evaluation of measures in public*

administrations. Insofar, the CUTLER platform improves the practice of policy making itself and therefore reduces the administrative burden.

o **Enabling cross-border mobility**. *The CUTLER platform can be easily customized to meet the specific requirements of different cities around Europe thanks to: a flexible cloud architecture and widget-based dashboard; data collection mechanisms that cover all possible data source types; algorithms for big-data analytics that effectively model the impact on the economy, the society and the environment in a generic way; a baseline Business Process Model for implementing a generic policy process in municipalities that can be easily customized to the reflect local decision-making processes.*

o **Enabling the engagement of various stakeholders** *such as public administration officials, SMEs, technology experts and legal experts in the development of the platform and the definition of its functionalities.*

III. USE CASES

CUTLER sets out to reuse established big data sensing infrastructures to enable evidence-driven policy making, aiming at coastal urban development. The proposed solution is implemented and assessed in the context of four pilots in **four waterfront cities**: *Thessaloniki (Greece), Antalya (Turkey), Antwerp (Belgium), and Cork County (Ireland). The cities have already established their pilot plans for using the CUTLER platform to design, monitor and assess specific policies. In the following, we briefly present these plans and explain how the platform will be used to provide improved decisions related to urban development.*

Thessaloniki: *In the pilot of Thessaloniki, policy planners will use the CUTLER platform to design, implement, monitor, and evaluate a* **new controlled parking system at the waterfront area facing Thermaikos Bay**. *The Municipality of Thessaloniki is a densely inhabited area and most of its districts have more than one use, i.e. they are not strictly residential but also include professional spaces, hotels, shops, entertainment areas, hospitals, etc. As a result, people move towards or out of all day and night long and there is high demand for parking space. Since both residents and visitors have to be served, the available parking space needs to be controlled. Since November 2017, a new controlled parking system has been introduced in some municipal districts and the available parking space has been divided into white and blue sectors, destined for visitors and permanent residents respectively. Visitors pay a fee to park their vehicle in white sectors. Residents are holders of parking cards that allow them to park their vehicles in any spot of a blue sector of their district. The system is supervised by the Municipal Police. The Municipality of Thessaloniki aims to use the CUTLER platform as a policy design tool that will help them* **optimize the controlled parking system** *by means of: redistribution of parking spots for visitors and residents, aiming to reduce the number of fines for illegal parking and increase citizen satisfaction; evaluation of the environmental impact based on real-time sensor data and recommendation of policy changes for further improvements; evaluation of the economic impact and introduction of moderations in the financial policy aiming to increase profits; support to the Municipal Police in their supervision duties (e.g. redesigning patrols based on parking sector occupancy and illegal parking patterns extracted by analysing the data available from the e-parking application).*
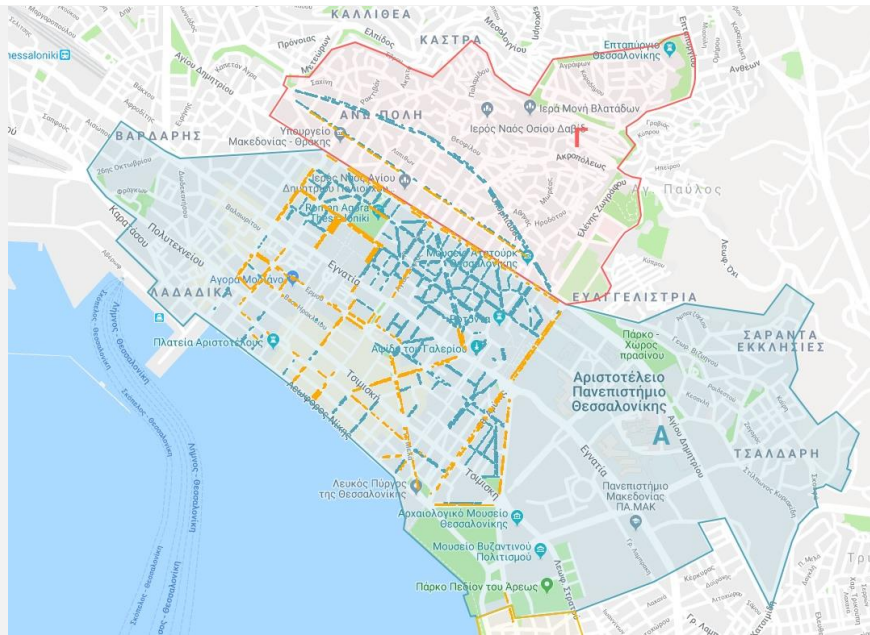
Controlled parking spaces destined for visitors (shown in yellow colour) and permanent residents (in blue) in the 1st and 3rd Municipal Districts of Thessaloniki.

Antalya: *The Municipality of Antalya is crossed by **Düden Brook**, a natural stretch of water that falls into the Mediterranean Sea. Düden Brook runs through a densely populated area but also through protected natural beauty areas, while it creates two **waterfalls** that are important tourist attractions. The area surrounding the first waterfall in the beginning of the river is considered as both a natural and an archaeological protection zone, while it also serves as an open recreational and green space for local residents. The Municipality of Antalya aims to use the CUTLER platform as a decision making tool that will allow them to design, monitor and assess **policies for increasing visitor numbers** and protecting the natural habitat in the first waterfall area by means of: redesigning recreational facilities in touristic areas to accommodate visitor needs based on analysis of visitor profiles as extracted by surveys and social media; improving the infrastructure and transportation facilities to increase accessibility by analysing mobility habits and patterns from visitor surveys; protecting the environment by monitoring water flow, water level, air and water quality; promoting the area to possible future visitors aiming to increase profits.*

The first waterfall in Düden Brook.

*Antwerp: The Antwerp pilot case is embedded in the overall ambition of the Flemish Region of Belgium to take action in the face of the increasing impact of **climate change** on urban areas. Increasingly, policy actors at regional and local level are confronted with the need for detailed, high-quality real-time data monitoring regarding climate impact and adaptation scenarios. To address these climate change challenges with regard to rain water, the City of Antwerp is working on a **Strategic Urban Water Plan** covering the whole city. The plan focuses on what actions the city and city stakeholders (such as citizens and businesses) need to take to protect themselves from the effects of climate change and floods, in particular. The City of Antwerp will use the CUTLER platform as a monitoring tool that will allow them to **visualize all water-related data** (data from real-time sensors, historic flood data, weather data, flood maps, etc.) in a centralized and transparent manner, but also **prioritize the actions described in the Waterplan and assess the impact of certain measures**. One of the envisioned measures is garden streets, i.e. streets with more greenery where measures that improve water infiltration have been implemented. In the context of CUTLER, a **garden street** is implemented and will be evaluated in the Lange Ridderstraat in Antwerp. The platform will help policy makers to **monitor the impact of the water infiltration measures**, assess their effectiveness and revise future adaptation measures. The CUTLER dashboard could also be used as a (bilateral) communication tool for citizens and other third parties. Anyone who uses the platform can be informed and advised about the climate adaptation policy in Antwerp and the water related problems and urgencies, but can also provide feedback in exchange.*
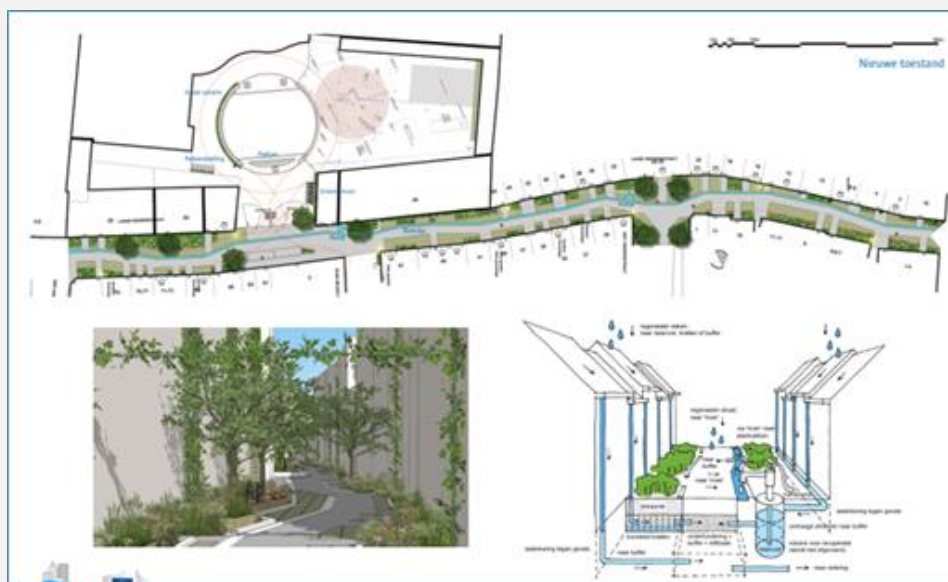
Design of a garden street in Lange Ridderstraat in Antwerp.

*Cork County: The Cork County pilot focuses on the future development of **Camden Fort Meagher**, a fort built in 16th century to defend the mouth of Cork Harbour, as a touristic destination. The CUTLER platform will be used to assess specific criteria in relation to **increasing visitor numbers** at the Fort and, in particular, a policy in relation to **improving future access for visitors**. Currently, the Fort receives 18,000 visitors a year and is restricted to openings over the summer months. Access to the Fort is limited to one local road. Parking at the Fort is currently limited to 30 spaces and during times of peak demand, additional parking in the area is not available and therefore visitor vehicles often obstruct local roads and resident access. Cork County Council will utilise the CUTLER platform to inform evidence-based decisions on future access points (by land and sea), facilities (i.e. car parking) and access mechanisms (i.e. modes of transport) to the Fort. The above policy will be assessed against relevant economic, social and environmental data from the Cork Harbour area, e.g. data about weather, wave height, visitor numbers, visitor surveys, traffic etc.*

View of the upper Camden Fort Meagher looking out over Cork Harbour.

IV. POLICY IMPLICATIONS AND RECOMMENDATIONS

*The utilization of big data applications in public administrations has more implications than the improvement of already existing services delivered by public bodies. It rather **changes the structure and practice of policy making** itself since the availability and near real-time processing of vast amounts of data make constant feedback and evaluation loops in the policy development process possible. This should greatly improve policy making. The exact extend to what degree big data applications change the policy formulation process is not yet fully predictable.*

However, in the following, we summarize the main lessons learnt so far and a list of recommendations to improve the effectiveness of the policy making process in public administrations.

Data exist but are not always accessible

*During the last few years, the volume and diversity of the data generated daily in the city by citizens, businesses and the public administration has significantly increased. However, public administrations still fail to fully exploit this data to improve governmental processes. One of the main reasons is that although the data are out there, most of the times public administration stakeholders cannot access them. This may be because the data belong to or are managed by private organizations, civil society organizations, or other governmental organizations or departments of the same organisation. It is thus necessary for the municipalities to open a communication channel that will allow them to **negotiate and cooperate with new partners in order to gain access to information** that can greatly enrich urban planning and dialogue. This procedure, however, raises questions that have to be addressed (e.g. under what conditions should the private sector share data with city authorities; what does it mean for the private sector to become the mediator between the citizen and the city; does the citizen gain leverage as a producer of big data, etc.) The CUTLER experience suggests that this can be done by bringing together an **interdisciplinary team of experts representing key stakeholders**, such as:*

- *public officials, bringing the perspective of local administration;*
- *private sector companies, expressing the interest of SMEs collaborating with governmental agencies;*
- *academia and research institutions, for soliciting the contributions that can be offered from publicly funded initiatives;*
- *experts in law and regulatory issues, for articulating agreements, disputes and terms of collaboration in a legally valid manner.*

Legal issues hinder data collection & processing

During the pilot planning phase, it was made clear that there are a lot of legal issues involved in acquiring and processing the available data, especially in the case of data owned by third parties and sensitive/personal data. Different datasets adhere to different set of rules and regulations, thus, making it extremely difficult for the

*data processors in public administration to know how to handle them. To this end, it is important to have a robust legal framework that will enable policy makers to handle such issues in a standardized way. In order to streamline this process, in CUTLER we developed a **comprehensive, legally sound taxonomy of all the regulatory frameworks** that might potentially apply to the datasets collected and processed by the four city pilots. Additionally, the complex regulatory frameworks were broken down into **specific, well-defined legal requirements.** CUTLER's legal framework allows policy makers to classify their datasets into one or more legal categories ('personal data', 'non-personal data', 'data protected by the sui generis right on databases', 'publicly held documents', 'environmental information', 'spatial information', 'electronic communications data', 'copyrighted data', etc.) and then comply with the legal requirements that are paired with each category. For instance, data concerning citizens' opinion on a planned policy measure must comply with all the requirements stemming from GDPR since they most likely qualify as 'personal data'. Similarly, cities must abide by the rules laid down in the PSI Directive, given the qualification of the said data as 'publicly held documents'.*

Big data analysis requires understanding and cooperation between policy makers and data experts

*Designing a big data based decision-support system requires the establishment of an interdisciplinary team of experts that will bring to the table **IT expertise**, on one hand, and **experience in policy making**, on the other. Since in many cases, software developers and public administration stakeholders do not speak the same language or hold different pieces of the puzzle, extensive communication and collaboration is required to jointly design the system. Policy makers should clearly lay out and break down their policy plans and objectives while data analysts should employ suitable analytic techniques and efficient metrics to quantify the progress and effectiveness of the measures. Policy makers and data experts should jointly identify appropriate economic, environmental and social data sources; big-data analytics to efficiently model policy impact in different domains; suitable KPIs to evaluate the efficiency of the enforced measures; and user-friendly visualisations to display all the necessary information in the different steps of the policy lifecycle.*

Introduction of new IT applications into public administration necessitates Business Process Management logic

*Adding new IT systems in general and even more so innovative systems like the CUTLER platform to existing complex decision-making processes is anything but trivial. It requires an **alignment** between already existing organizational processes and newly developed functionalities. Not only lack public administrations the expert knowledge of what a decision-support system based on big-data analyses like CUTLER can offer, but they are also relatively resistant to change since their processes are based in regulations and even laws. This requires a **Business Process Management** that takes organizational requirements of the administrations into account. The use of BPM models can help in this direction, since it provides a systematic approach to research the targeted processes, the involved actors, their tasks and interrelations, and identify the principal access of the new IT application into the organization. BPM is safeguarding that the IT application is useful for the organizational actors and is providing added value to them.*

Public administrations should exploit the flexibility that they have

Even if public administrations are resistant to change, they should fully exploit the administrative domains and tasks where they can be relatively flexible. This can help to involve citizens in public participation and co-creation processes as much as possible as well as to utilize decision-support systems based on big-data analyses to the full extent of their capabilities. Since it can be expected that big data applications change the process of policy formulation, implementation and monitoring in a fundamental way, public administrations should even strive for adapting their decision-making processes in the long term.

V. SUSTAINABILITY TOOLKIT

*The CUTLER consortium involves a wide range of actors having already shown commitment to utilise new technologies for improving decision making related to urban development policies. The public administrations in the four pilot cities aim to **continue using the platform** in their daily policy making processes, extending its functionalities to cover new policy measures. To this end, discussions have already been made about the cloud infrastructure that will be required to host the platform (currently this is provided by DELL).*

The diverse pilots are expected to provide a demonstration of the platform's capabilities in real-world settings that will enable us to collect robust evidence on the platform's usability and usefulness. The technical and user evaluation outcomes will represent a sound basis that will help us make decisions about the mainstreaming of the CUTLER platform beyond the end of the project. The lessons learned during the pilot implementation will help us understand the exploitation potential of CUTLER in different urban environments.

*The overall market vision of the consortium is delivering CUTLER as a near to market **SaaS solution consisting of reusable modules** that will target Public Organizations in a socio-cultural and political context, in order to provide **core and support e-services for policy making**. Core services will include but will not be limited to a standard framework for big data collection from various data sources; big data analytics for sensing economic activity, environmental impact and social consequences; as well as a novel Business Process Model for decision making in public administration. Support services will focus on improving and strengthening the resiliency of the policy-making framework, with respect to the estimated impact of policy decisions. The CUTLER business model will build on the stages of the policy-making lifecycle to provide innovative e-government services based on big data.*

*The **target market** of CUTLER are the **Governmental Agencies** involved in urban decision making, including Ministries, Regional Authorities and Municipalities in the EU and around the world, policy-making agencies, etc.*

*Public sector organisations are subjected to public procurement rules for acquiring new services. In this context, it is anticipated that the consortium will need to build strategic partnerships with local partners in order to be in the position to address market opportunities in each country. The strategy will be to **develop collaboration agreements with consultants and software companies** that already include Public Administrations in their customer portfolio. To this end, we have an already established connection with Infalia, a spin-off company of CERTH that already provides smart city solutions in several municipalities around Europe, and of course project partner DELL that provides advanced IT solutions to governmental organizations. These companies and other IT companies could act as distribution providers for infrastructure components for governmental agencies or as software suppliers that could integrate or link CUTLER.*