# Deliverable

# D6.1 Pilot Operations Plan

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| **0.2** | 27.10.2020 | Nils Walravens | imec | Added evaluation criteria section |
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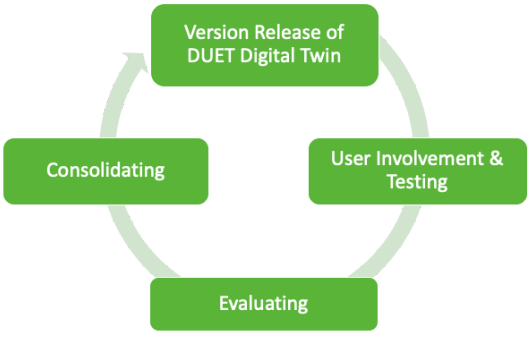
# Executive Summary

This deliverable presents a pilot operations plan for the implementation of DUET Digital Twins in each of the three pilot regions of the DUET project: Athens (Greece), Region of Flanders(Belgium) and Pilsen (Czech Republic). It outlines the current status of the pilot operations and describes the pilot testing cycles as well as the methods and strategy for user engagement along with the four testing cycles:

1. Personalisation of Alpha Release (Cycle 0), following the DUET Alpha Release
2. Closed User Groups (Cycle 1), following the DUET Closed Beta Release
3. Open User Groups (Cycle 2), following the DUET Open Beta Release
4. Sister User Groups (Cycle 3), following the DUET Candidate Release

Each DUET testing cycle requires a larger and a more diverse user group to test and provide feedback for the successful testing and co-creation of the final DUET Digital Twin. Therefore, each pilot must follow the recommended engagement strategy to inform and engage predefined users external to the project in a timely and efficient manner to reap the full benefit of co-creation.

DUET follows the agile methodology, which relies on testing and iteration throughout the project with users internal and external to the DUET project. Therefore this pilot operations plan sets out the details for the testing cycles and evaluation for year two and provides a framework for year three.




The testing cycles will follow each release of the DUET Digital Twin. In a co-creative manner, digital twin users will be (1) engaged in each stage to test and improve the digital twin. (2) the findings from the user involvement stage will be evaluated and shared with the development teams along the categories as presented in chapter 3, and (3) the final findings will be consolidated together with the users in the test cycle reports, which also sets out the specification for the following release & testing cycle. The latter becomes particularly important for the cycles in year three:

All project partners will jointly define the elements for testing and evaluation for cycles two and three during year two and based on the first evaluation testing cycles and feedback derived from them.

Last but not least, this document also presents the high-level project evaluation criteria to measure and monitor the overall progress of the project. These criteria are divided into 4 sub-categories, which are:

1. Impact of Digital Twins on the policy-making process
2. Stakeholder Interactions and Engagement
3. Transferability of Results
4. Business Value

Each pilot testing cycle will, in addition to the epic-based evaluation of each DUET Digital Twin release, already measure the pilots and the DUET Digital Twin solution against these strategically relevant project evaluation criteria. This continuous evaluation will help identify potential challenges as well as opportunities early in the development.

# 1. Introduction

DUET Digital Twins is now entering the pilot deployment phase in the three pilot regions and cities: Flanders (Belgium), Athens (Greece), and Pilsen (Czech Republic). The pilot deployment phase starts with the release of the DUET Alpha version in M12 (November 2020). In order to support this new phase of DUET Digital Twins, this deliverable provides a pilot operations plan to guide implementation and evaluate the success of the subsequent releases of the DUET Digital Twin environment.

The deployment sees all partners of DUET coming together and acting in unison to achieve the strategic goals of the project as defined in *D8.1: Project Vision* to make "it easy for any city, regardless of size, to benefit from opportunities that digital transformation provides [...] and realise the full potential of city data to drive an era of informed, smart and co-created policymaking." As further outlined in D8.1, all pilots are starting from a different baseline in their journey towards digital twins. This makes it necessary to have a clear operations plan for all pilots to enable the translation of the strategic goals (D8.1), pilot scenarios (D2.2) and functional requirements (D2.3) into specific operational and technical objectives.

In summary, this operational plan will:

- briefly present the current status of the project. Specifically the work with and of all pilot regions to date that has resulted in policy scenarios, data collection, the definition of functional requirements, etc.;
- define the desired outcome of DUET with the milestones, i.e. DUET releases and testing cycles including the methodology to engage users for testing, leading to the successful completion;
- provide a roadmap for each pilot, including the objectives of each DUET pilot, the selected policy scenarios for implementation in year two, available data sources and stakeholders to be engaged per testing cycle.
- introduce the epics for year two for the epic-based evaluation during each testing cycle as well as the high-level framework of KPIs with clear and measurable goals as well as the methodology to evaluate these during each testing cycle. This will allow all partners to make the necessary adjustments for the successful deployment of DUET Digital Twins.

# 2. Pilot Status

This chapter provides a brief summary of the actions undertaken in the leadup to the operations phase of DUET. Leading up to the first major milestone of the DUET project - the Alpha release - the pilots have taken a number of steps and measures to prepare for the implementation cycles that follow the DUET Alpha release.

**Pilot meetings**

From the very beginning of the DUET project, *WP2: User-centric design for advanced decision-making practices* and *WP6 Pilot scenarios, deployment, and impact validation* together with all pilot owners have closely collaborated to ensure the necessary interlinkages between all partners and WPs and to ensure the best possible preparation for the start of the operational phase of DUET. For this reason, dedicated bi-weekly pilot meetings have been set-up and operated since M1. These meetings will continue throughout the DUET project and are, particularly for the operational phase that is starting in M13 of utmost importance.

In addition to the DUET Project Meetings, all pilot owners have met with their city stakeholders to gather user requirements and define the most relevant policy scenarios. These initial links have brought the buy-in from the majority of stakeholders within the regional and city administrations and will form as a basis for the evaluation activities of each testing cycle which will be described further below in this document.

**Sprint Reviews**

With the technical work and integration on the DUET Digital Twin, a bi-weekly sprint review meeting has been called by the technical team and the Product Owner. All pilots are informed during these review meetings about technical advancements. Through a survey and the bi-weekly pilot meetings, the opportunity to feedback is provided to all partners. The Sprint Reviews represent an important link for technical and non-technical partners.

**Data Collection**

As a backbone for all releases of DUET, data sources are of key importance. Therefore, all pilots have been making data available and/or have sourced critical open data in the fields related to transport and environment. The result is a growing database of historical and real-time data, including data from Internet of Things, such as air pollution sensors, that is becoming available for the DUET releases which continues to grow as pilots are implementing new sensor (i.e. Pilsen) or are in conversation with the private sector (i.e. Athens) to acquire new data sources. At the time of submission of this deliverable, Flanders counted 22 available data sources, Athens reported 13 available data sources, and Pilsen had gathered 24 data sources which are available for the DUET Digital Twin project. In addition, the consortium has identified international data sources from Open Street Maps and the European Environmental Agency relevant and available for DUET. Data sources are being added by all pilots (and other project partners) on a continuous basis.

**Policy Scenarios & Functional Requirements**

In year one of DUET, extensive work has been carried out in WP2 to map stakeholders in each pilot (D2.1), define policy scenarios (D2.2) and summarise the main functional requirements for the DUET Digital Twins (D2.3). This work serves as a basis for this pilot operations plan. Specifically, deliverables D2.2 on scenario

specifications and D2.3 on user requirements provide the baseline, which have resulted from co-creation activities of each pilot. As part of the effort for D2.3, the selection of epics of each pilot have been further refined based on agile methodology and based on a number of criteria, such as availability of data, potential legal hurdles, support from policy-makers, amongst others.

# 3. Pilot Operations: Process & Methodology

The release of the Alpha version marks the start of the second year of DUET. It will see the personalisation of the DUET Digital Twins for each region and city and the release of the closed beta version of the DUET digital twin. The Closed Beta Release will be tested among the project consortium partners and a selected group of city domain experts in every pilot region.

By the end of **year two**, a first open beta release of the Flanders, Athens and Pilsen DUET digital urban twin will be available. These digital city twins will be open for policymakers and a broader, interested public and city stakeholders to test. They will contain a variety of relevant mobility, environment and city planning-related datasets containing historical and live city-data. The first series of domain models will exchange information with each other and will interact. Changes in one model (for example a traffic model) will influence other models (for example an air quality model) and vice versa. An integrated Digital Twin integrated technical approach will deliver the necessary building blocks, designed for re-use in other cities and regions. During the **third and final year of DUET,** it is the project's ambition to have an operational and user-tested Digital Twin available in Flanders, Athens and Pilsen with a richer set of available data and with a broader range of interacting models.

In this chapter, the milestones (releases) of the DUET project will be presented along with the methodology and process to test and validate each release leading up to the next successful next release. Furthermore, the stakeholders testing each release will be defined, and methods for engagement for each stakeholder group will be outlined.

## 3.1. Milestones

The Pilot Operations Plan follows the timeline (see Figure 1) of DUET Digital Twin Releases as defined by all partners from the start. The timeline starts with the first Alpha release of the DUET Digital Twin and ends with the Candidate Release in M30, which will allow exchanging data models and APIs between all pilot regions and cities to test transferability and scalability of DUET Digital Twins:

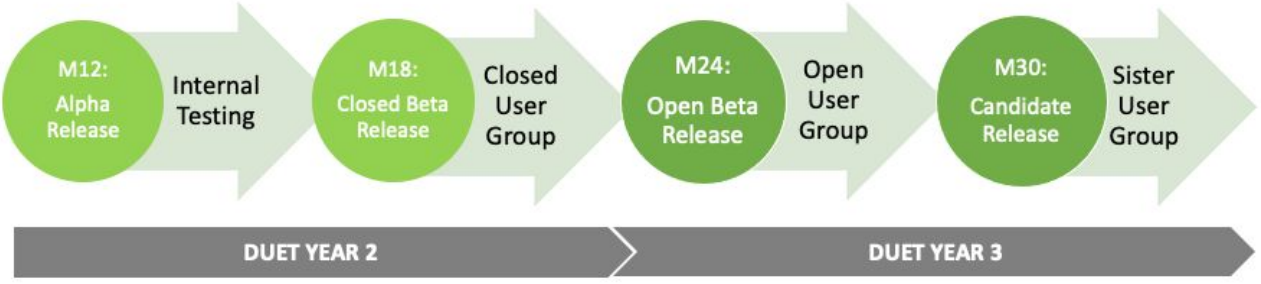



**Figure 1: Timeline DUET Releases & Testing Periods**

Each release is followed by a period of testing, the so-called pilot testing cycles. While the first testing will be carried out internally with the ambition to personalise each regions' or city's digital twin, the testing will include a larger and more diverse number of testers external to the DUET Digital Twin project. The stakeholders for each testing cycle and methods for their engagement will be explained in the next chapters following an overview of the structure that is followed for each pilot testing cycling.

## 3.2. Pilot Testing Cycles

Each release of the DUET Digital Twin will be followed by a so-called pilot testing cycle (Figure 2) featuring four important steps:

1. Release of DUET
2. User Involvement & Testing,
3. Evaluating, and
4. Consolidating

The release of DUET is followed immediately by a phase that involves users of DUET and tests the release with them for functionality, usability, among others. The testing phase with user groups of the DUET Digital Twin is followed by the evaluation phase. In this phase, feedback from the second stage will be aggregated following a clear matrix with recommendations to "Fix, Add, Improve or Remove" (Table 3) features of the DUET Digital Twin and will serve specifically the technical partners with critical feedback for the development of the subsequent BETA release. This allows for feedback to be translated into the next release of DUET. The evaluation phase is followed by a consolidation phase which includes a lightweight process to confirm the findings from the evaluation. As part of this last step of the testing cycle, all feedback will be consolidated in the form of the Pilot Testing Cycle Reports (D6.3-6.5).

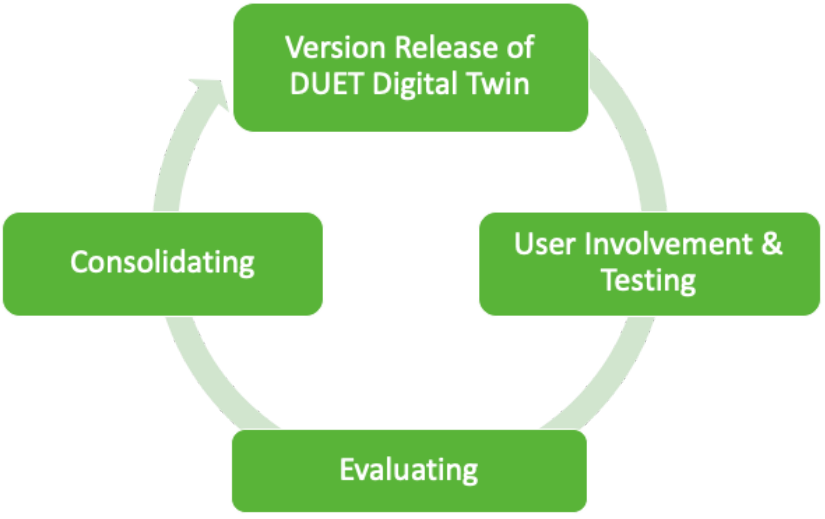



**Figure 2: Pilot Testing Cycles following each DUET Release**

In total, the DUET project has foreseen four testing cycles starting at month 13. An overview of the testing cycles is provided in Table 1 below.

**Table 1: Overview of Testing Cycles**

| Cycle | Name | Time | Objective |
|---|---|---|---|
| 0 | Personalisation of Alpha Release | M13-M18 | This cycle personalises the DUET Alpha release (led by WP5) and will test internally for functionality and usability by the consortium partners to provide feedback to the technical partners of the consortium. |
| 1 | Closed User Group | M19-M24 | This test cycle is an opportunity for each pilot to test their personalised DUET Digital Twin with a small number of colleagues across relevant departments to explore the usability and functionalities of the digital twin. |
| 2 | Open User Group | M25-M30 | During this test cycle of the DUET Digital Twin, the number of testers will increase, and while testing functionalities and usability will remain the main testing objective, the users will use this release in parallel with traditional city operations and policy-making processes. |
| 3 | Sister User Group | M31-M36 | Data models and APIs will be exchanged between the pilot cities to explore the concept of Policy Ready Data as a Service and test scalability and transferability of the data models between the Twins. Outcomes of policy collaboration will be shared to explore how Digital Twins can be used towards common National or EU level policies. |

In the following, each step of the pilot testing cycle is described in more detail.

### 3.2.1. User Involvement & Testing

The user involvement and testing phase will start immediately after each release with an online briefing for all pilot leads as part of the Sprint Review meetings and/or the DUET Pilot Meetings, in which the product owner together with the technical coordinator explains the features of the relevant release and what and what not to expect from each release. The active involvement of the relevant user groups and testing begins immediately after this briefing. The methods to involve the relevant stakeholders depends on each phase and stakeholder group and will be described below.

The user group who is testing each release of the DUET Digital Twin depends on the respective release and can be described in the table as follows:

**Table 2: Overview of user groups, focus and methods during each testing phase**

| Release Version | User Groups | Testing Focus | Methods |
|---|---|---|---|
| Alpha | **Internal**<br>● Consortium Partners | ● Functionality<br>● Usability | ● Briefing<br>● Online Workshop |
| Closed Beta | **Internal**<br>● Consortium Partners<br>**Closed User Group**<br>● City Domain Experts | ● Functionality<br>● Usability | ● Briefing<br>● Online Workshop<br>● Local digital workshops |
| Open Beta | **Internal**<br>● Consortium Partners<br>**Open User Group**<br>● City Domain Experts<br>● City Policy Makers | ● Functionality<br>● Usability<br>● Acceptance<br>● Policy-Making Support | ● Briefing<br>● Workshops<br>● Survey<br>● Interviews |
| Candidate | **Internal**<br>● Consortium Partners<br>**Sister User Group**<br>● City Domain Experts<br>● City Policy Makers<br>● Regional / National Stakeholders<br>● Citizens | ● Functionality<br>● Usability<br>● Operationality<br>● Policy-Making Support<br>● Scalability<br>● Transferability | ● Briefing<br>● Workshops<br>● Survey<br>● Interviews |

### 3.2.2. Evaluating

Based on the outcomes and feedback collected during the testing phase through the phase-relevant tools and methods, a first draft of the evaluation report based on Table 3 and the pre-defined epics for each release for each testing cycle will be produced (which will be the basis for the testing cycle report). Each draft report will briefly summarise:

- The composition of the user groups and number of testers
- Methods and tools for testing
- Main findings for from user involvement and testing

### 3.2.3. Consolidating

In this phase, the preliminary evaluation following the user involvement and testing will be consolidated and structured. This phase aims at validating the initial findings from the draft user report and generates additional immediate feedback which will be structured along categories (Table 3) to help achieve the KPIs as defined by the start of the DUET project. As part of the consolidation phase, users will be invited to share additional feedback through a lightweight process, where all testers of a phase are invited to join a webinar. Using co-creative tools such as Mentimeter[1], an online live survey tool, and Miro[2], an online whiteboard tool

[1] https://www.mentimeter.com/
[2] https://miro.com/

that allows for co-creation with stakeholders in different locations, a final validation of the initial evaluation phase will take place.

In parallel, the pilot evaluation criteria (chapter 5) will be applied and measured in this phase using surveys for quantitative feedback and interviews for qualitative evaluation of DUET Digital Twins.

**Table 3: Feedback Categories for Pilot Testing Cycle Reports**

| Category | ADD | REMOVE | IMPROVE | FIX |
|---|---|---|---|---|
| **Description** | Features and functionalities which have been identified by the user groups during the testing and feedback phase as relevant for a successful digital twin, but are not yet part of the release or the roadmap for upcoming roadmaps and therefore should be added. | Features and functionalities of the respective release which have been identified by the user groups during the testing and feedback phase as irrelevant or unnecessary - contrary to previous assumptions - and therefore should be removed. | Features and functionalities which have been identified by the user groups during the testing and feedback phase as unclear, confusing or otherwise insufficient. These features are nevertheless critical for the success of the Digital Twins and therefore need to be improved according to user needs. | Available features and functionalities which have been identified by the user groups during the testing and feedback phase as broken / not working, but are considered relevant for the Digital Twin and therefore need to be fixed. |

In the following section, methods and a strategy for engaging the users for each testing cycle will be explained in more detail.

## 3.3. Methodology for User Engagement

To ensure the successful implementation of the pilot testing cycles, each pilot needs to engage a variety of stakeholders which are increasing both in number and in diversity by each testing cycle from internal to closed, open and sister user groups. In the following, methods and strategies are described which will help pilots to engage users for the closed, open and sister user groups. (Starting in M19, M25, and M31 respectively). The presented methods will be adapted to local realities. All methods are currently by design digital to take into account national and local measures aiming at containing the ongoing COVID-19 pandemic.

Firstly, the stakeholders who will be engaged in each user group are defined in Table 4. At this stage, the table does not feature cycle 0 (M12-M18) as the stakeholders are the DUET project partners.

**Table 4: Foreseen engagement of stakeholders per user group**

| User Group | Stakeholders (*including brief description*) | No.of Stakeholders involved per pilot | Total no. of stakeholders involved |
|---|---|---|---|

| | | | |
|---|---|---|---|
| Personalisation of Alpha | • DUET Project members<br>*Representatives of the DUET project partners* | min. 2 | 35 |
| Closed User Groups | • City / Region Domain Experts<br>*Experts working in the relevant domain (urban planning, environment, mobility of a pilots' city or region)* | 5 | > 15 |
| Open User Groups | • City / Region Domain Experts<br>• City / Region Policy Makers<br>*Policy-makers from the Mayor's office who will apply digital twin technology in the future to support decision-making processes* | 10 | > 30 |
| Sister User Groups | • City / Region Domain Experts<br>• City / Region Policy Makers<br>• Regional / National Policy Makers<br>*Decision-makers from the regional and national level to explore how digital twins can be used towards regional and national policymaking.*<br>• Citizens<br>*The interested public including experts, students, and policy-advocacy groups (e.g. NGOs)* | 20 | > 100 |

Each user group and each testing cycle requires the contribution of different stakeholders and methods to co-create the DUET Digital Twins. We define co-creation as an active, creative and social collaboration process between producers (i.e. DUET project) and customers (Users of the DUET Digital Twin)**.** Therefore, the involvement of users throughout the testing cycles is a fundamental dimension to the successful development of the DUET Digital Twins.

To achieve active collaboration with the predefined user groups and its relevant stakeholders, a multi-method approach will be applied throughout the testing cycles to involve the variety of stakeholders (Table 5) using different quantitative and qualitative methods depending on the objective and the stakeholders in question.

Among the quantitative methods used are online surveys and online voting. These quantitative methods will be complemented with qualitative methods, including workshops including open feedback as well as semi-structured interviews.

Table 5 outlines the methods for each cycle and stakeholders, including the objective and the tools applied for each method.

**Table 5: Co-creation methods per stakeholder group and objective**

| Stakeholders | Method | Objective | Tools | Cycle |
|---|---|---|---|---|
| Internal (Pilot teams) | • Workshop<br>• Interview<br>• Survey | • User Experience & Usability of DUET<br>• Functionality of DUET<br>• Monitor pilot progress based on criteria for pilot evaluation | • Demo & Miro (online whiteboard) for all pilots<br>• Semi-structured interview guide<br>• Online questionnaire | 0,1,2,3 |

| | | | | |
|---|---|---|---|---|
| City Domain Experts | • Workshop<br>• Survey<br>• Interview | • User Experience & Usability of DUET<br>• Test co-creation activities | • Demo & Miro (online whiteboard) per pilot | 1,2,3 |
| City Policy Makers | • Workshop<br>• Interview | • Policy-Making Support | • Demo, Online Voting, Open Feedback | 2 |
| Regional / National Policy Makers | • Workshop | • Policy-Making Support | • Demo, Online Voting, Open Feedback | 3 |
| Citizens | • Webinar<br>• Survey | • User Experience<br>• Operationality | • Demo, Online Voting, Open Feedback<br>• Online questionnaire | 3 |

To ensure the participation of the relevant stakeholders per pilot and per testing cycle, a simple yet effective **strategy for engagement** is proposed and will be evaluated together with the pilot leads on a regular basis in the bi-weekly DUET pilot calls (see chapter 2).

The strategy is divided into two streams catering for the engagement of city/regional stakeholders (Cycle 1,2) and the engagement of stakeholders external to the city (Cycle 3).

**A. Internal Engagement Strategy (Alpha / Closed Beta / Open Beta Releases)**

The engagement strategy for successful co-creation with the potential users of the DUET Digital Twin is based on four steps: Identification, Outreach, Interaction, and Follow-up. The steps are detailed in the following:

1) **Identification:** Each pilot identifies the relevant persons in the departments relevant to the policy scenarios (see next chapter). This preliminary identification of specific stakeholders will be made for each user group before the release of the DUET closed beta version.
2) **Outreach:** Pilot leads will announce the upcoming DUET releases to the identified persons and share regular updates on the project with the city-internal stakeholders. The pilot leads will be able to build on the activities and outreach done during year 1 (see D2.1).
3) **Interaction:** The pilot leads, together with consortium partners and stakeholders, will agree on dates and times for workshops and meetings (see Table 5) at least four weeks before the interaction taking place and at least two weeks after a DUET digital twin release.
4) **Follow-up**: The pilot leads will share updates with internal stakeholders by email or in-person meetings following the co-creation activity to keep them informed and engaged over the duration of the project.

**B. External Engagement Strategy (Candidate Release)**

While the four steps for engagement remain the same for internal and external stakeholders, the execution and engagement of the stakeholders external to the city administration will deviate. The steps are outlined below.

1. **Identification:** Identification of the relevant external stakeholders building on work carried out in D2.1. These activities specifically geared towards the pilot testing cycle three following the candidate release will start already during cycle 1.
2. **Outreach:** Pilot leads will contact the identified stakeholders and inform them about the DUET project and invite them to a local webinar (or, if the COVID-19 situation allows, for a physical event)
3. **Interaction:** Pilot leads, with support from the pilot coordinator, will prepare an interactive event to present the candidate release of DUET to the external stakeholders. Using interactive tools, feedback will be generated.
4. **Follow-up:** Engage stakeholders during the interactive webinar and follow-up with stakeholders attending the webinar.

In the following, the status and objectives for each pilot region will be detailed in the pilot operations plan.

# 4. Pilot Operations Plan

This chapter provides more detailed information about each pilot and its ambitions for using Digital Twins for improved, data-driven decision-making. It provides an overview of the selected scenarios for implementation in each pilot and the overview of data sources needed and stakeholders to be engaged during each cycle of the pilot testing as outlined in chapter 3.

It also provides an overview of the epics that the alpha and closed beta version will have to fulfil in year two. To evaluate each DUET release, the project has agreed to pursue an evaluation based on these epics. As the project also adheres to the agile methodology, the epics are at this stage only described for year two and subsequently the cycles 0 and 1. For year three, and the second and third pilot testing cycles, the epics will be defined by the consortium partner during year two.

The table below gives an overview of the user and system-oriented requirements which the DUET Digital Twin will have to fulfil by the end of year two and year three respectively. In addition, the table also shows the objectives for dissemination and exploitation of DUET Digital Twin by the end of year two and three respectively. The objectives listed below are serving as foundation for the project evaluation criteria outlined in chapter 5.

**Table 6: Requirements for function, dissemination and business aspects of DUET in year 2 and 3**

| Year 2 | Year 3 |
|---|---|
| *Functional system oriented* | |
| • Aerial 3D model<br>• 2 smart city domains<br>• Simulations based on historical data (where available)<br>• Some of the needed datasets are shared by data owners<br>• What-if analysis of medium complexity (short-to-medium term impact of construction works and traffic on noise levels and air quality)<br>• 5 IoT sensor types connected<br>• 15 different datasets used in total<br>• 2 or more models exchange events | • Aerial 3D model with enriched semantics<br>• 3 smart city domains<br>• Simulations based on real-time data<br>• Most/all of the needed datasets available<br>• What-if analysis of high complexity that measure medium to long-term impact<br>• 10 IoT sensor types connected<br>• 30 different datasets used in total<br>• 5 or more models exchange events |
| *Functional user related* | |
| • Internal testing<br>• Closed user group<br>• Comprehensive testing guide with instructions, scenarios and feedback questions<br>• 35 internal testers<br>• 15 testers in a closed user group | • Open user group testing<br>• Candidate testing (cross-pilot)<br>• Citizen testing at local events<br>• Comprehensive testing guide developed<br>• 30 testers in open user group<br>• Inspiring results of cross-border testing<br>• 50 citizen testers<br>• 6 alternative policy designs suggested by citizens based on their experience with the DUET digital twins |
| *Dissemination* | |
| • DUET Digital Twin project website + | Same as in Y2 plus |

| | |
|---|---|
| application website<br>• Pilot specific dissemination material<br>• Joint webinars with sister projects<br>• Conference presentations<br>• Publications<br>• New promo videos and testimonials<br>• Increased popularity | • Training webinars<br>• Online course<br>• Workshops<br>• DUET starter kit<br>• DUET case study collection<br>• DUET best practice award |
| *Business* | |
| • Longlist of exploitable results<br>• Preliminary market study<br>• IP issues identified<br>• H2020 Exploitation Booster<br>• Integration of 3rd party models and data<br>• Joint business model explored | • Shortlist of exploitable results<br>• Market review<br>• All IP issues resolved<br>• Booster outcomes incorporated<br>• Joint business model applied<br>• Javelin board<br>• 3 buyers interested |

While the table above highlights the overall cross-cutting requirements and objectives which the DUET solution will have to meet, each pilot will start from a different baseline. This means that due to these different starting points of each pilot in their Digital Twin journey - and more generally speaking in their digital transformation journey - different levels of maturity will be achieved in each pilot respectively.

## 4.1. Athens

Athens is the capital of Greece. With 3 million people living in the city and the urban metropolitan area, it is the largest single urban agglomeration of DUET. The city has identified a growing need to transform digitally to enable economic growth and social convergence. With this in mind, Athens has identified the following goals for the DUET Digital Twin:

- Understand city relationships and overcome engagement barriers with stakeholders
- Create new business value based on data-driven insights;
- Co-create digital services with the active engagement and participation of citizens;
- Generate a decision-making approach using common standards for greater interoperability of digital tools;
- Improve the effectiveness of policy design and implementation.

Compared to the Flanders and Pilsen pilots, Athens has no infrastructure for data-driven decision making in place prior to the start of DUET.

### Policy Scenarios

From the start of the project, the focus of the Athens pilot was on the policy area environment and pollution reduction, as this has been identified as a key challenge for the city. During the first year, Athens has defined and prioritised three scenarios for its Digital Twin (see Table 7).

**Table 7: Scenarios for Athens Pilot**

| Stakeholder | Scenario |
|---|---|
| City Policy Maker | As a city official, I would like the city to achieve an environmental change, green spaces to be increased and promoted such as the National Garden of Athens and finally alternative ways of transport/mobility to connect the green spaces/areas. |

| | |
|---|---|
| City Domain Expert | As a city employee, I will suggest green routes within the city in order to decrease the pollution level. Moreover, I will raise awareness through diverse environmental initiatives in order to incorporate new behavioural attitudes in our everyday life. |
| Citizen | As a citizen, I would like to assist the city in promoting green routing within the city and to contribute to the improvement of my city's environment. Finally, I also actively take part in initiatives that focus on my city, to express my opinion and to contribute to a greener Athens. |

### Data Sources

To achieve the policy scenarios, a variety of data sources will be needed. Table 8 below outlines the data sources that have been identified by the Athens pilot as available and relevant for the predefined policy scenarios. The table presents a snapshot of what is currently available. The full list is available online[3] and the list of data sources is growing over the period of DUET.

**Table 8: List of Preliminary Data Sources - Athens Pilot**

| Data Name | Type<br>Datasets, model, database, tool, catalogue | Release<br>Data is required for which release? |
|---|---|---|
| Atmospheric measurements | Datasets | Closed Beta |
| Air quality measurements | Dataset | Closed Beta |
| Air quality index | Tool | Closed Beta |
| Measurements of air pollution | Datasets | Closed Beta |
| Daily Report on Air Pollution Levels | Dataset | Closed Beta |
| Air quality | Data & Tools | Closed Beta |
| Urban Transport | Datasets | Closed Beta |
| Geospatial Information Portal | Maps and Layers for Maps | Alpha |
| Boundaries of Municipal Communities of the City of Athens | Geospatial Datasets | Alpha |
| Neighbourhood limits of the Municipality of Athens | Geospatial Datasets | Alpha |
| Boundaries of Districts of the City of Athens | Geospatial Datasets | Alpha |
| Road plan for City of Athens | Database + API | Alpha |
| Historical Center of City of Athens | Geospatial Datasets | Alpha |
| Services of the City of Athens | Geospatial Datasets | Alpha |

[3] https://docs.google.com/spreadsheets/d/1xrlheOOE76aDtS1GWJR2j0FBrKJ_TI6pXCeTCMvBJPo/edit?usp=sharing

### Stakeholders

As part of the work on D2.1, the Athens pilot has already predefined a relevant set of stakeholders. Table 9 below shows the stakeholders who will be engaged during the pilot testing cycles to co-create the DUET Digital Twin (see chapter 3).

**Table 9: Athens Stakeholders to be engaged per testing cycle**

| Stakeholders | Relation to project | Type | Cycle |
|---|---|---|---|
| DAEM | Internal | Project Partner | 0 |
| GFOSS | Internal | Project Partner | 0 |
| Department of Resilience & Sustainability, City of Athens | External | Domain Experts | 1 |
| Urban Planning Agency | External | Domain Experts | 1 |
| Social Solidarity Agency, City of Athens | External | Domain Experts | 2 |
| City of Athens, Mayoral Office | External | Policy Makers | 2 |
| Public Transport Associations | External | Domain Experts | 2 |
| Citizens & Citizen Groups (e.g. Atenistas) | External | Interested Public, NGO | 3 |
| Athens Digital Lab | External | Domain Experts | 3 |
| Bike Associations | External | Advocacy Groups, NGO | 3 |

## 4.2. Flanders

Flanders is one of the three Belgian regions with 6 million inhabitants. 13 so-called centre cities that are already cooperating in the Smart Flanders programme,who and smaller towns form the smart region. For the region, the DUET Digital Twin constitutes an opportunity to open available Smart City data to citizens, companies and service providers and to use the available (government) data for co-creative policymaking. The main objectives for the DUET Flanders pilot are:

- Creating a Smart Region where all involved players can access available services and data;
- Support cross-silo cooperation between sectors;
- Involve citizens and companies active in policy-making processes to improve the quality of decision;
- making and acceptance of the outcomes;
- Setting up transferable services and data standards to maximise efficiency and open the market.

## Policy Scenarios

The Flanders pilot has selected a total of six scenarios (Table 10) linked to the policy domains mobility, health & environment, and spatial planning.

**Table 10: Scenarios for Flanders Pilot**

| Stakeholder | Scenario |
|---|---|
| City Domain Expert | As a public servant of the mobility department, spatial planning department and environmental department, I want to know the impact of road closures, road redirections in the city and more specifically in neighbourhoods. |
| City Domain Expert | As a public servant of the mobility department and spatial planning department, I want to have insights into the mobility flows and on how changes in the traffic flow influence mobility. |
| City Domain Expert | As a public servant of the mobility and environmental protection department, I want to know the level and impact of air and noise pollution, the reasons and the impact on citizens well-being in the city. |
| Citizens | As a citizen, I want to know the impact of new city developments, and I want to participate and co-create to mitigate the impact. |
| Citizens | As a citizen, I want to have an idea about the mobility flows in my city and neighbourhood. |
| Citizens | As a citizen, I want to know the level and impact of air and noise pollution, the reasons and impact. |

## Data Sources

To achieve the implementation of the six scenarios by the end of year three, a variety of data sources will be needed. Table 11 below outlines the data sources that have been identified by the Flanders pilot as available and relevant for the predefined policy scenarios. The table presents a snapshot of what is currently available. The full list is available online[4] and the list of data sources is growing over the period of DUET.

**Table 11: List of Preliminary Data Sources - Flanders Pilot**

| Data Name | Type<br>Datasets, model, database, tool, catalogue | Release<br>Data is required for which release? |
|---|---|---|
| GRB LOD 1 (Spatial reference database 3D LOD 1) | Geospatial dataset | Alpha |

[4] https://docs.google.com/spreadsheets/d/1xrlheOOE76aDtS1GWJR2j0FBrKJ_TI6pXCeTCMvBJPo/edit?usp=sharing

| | | |
|---|---|---|
| GRB 2D Baselayer | Geospatial dataset, geospatial web service | Alpha |
| Digital height model Flanders (1 meter, 5 meters, 25 meters, 100 meters) | Geospatial dataset | Alpha |
| Orthophoto high scale (10cm) | Geospatial dataset, geospatial web service | Alpha |
| Antwerp LOD 2 model | Geospatial dataset | Alpha |
| Gent LOD 2 model | Geospatial dataset | Alpha |
| Antwerp LOD 3 model | Geospatial dataset | Alpha |
| Road Network (Midscale) - 2D | Geospatial dataset | Alpha |
| Central database of postal addresses (CRAB) | Geospatial dataset, web service | Alpha |
| Loop-based traffic data (1-minute delay) | Dataset | Closed Beta |
| Dynamic speed limit and lane indicator signs (RSS) traffic management data | Dataset | Closed Beta |
| Telraam Citizen science - traffic counts and speed counts | Dataset | Closed Beta |
| Air quality - HQ sensors (multiple elements) | Dataset | Closed Beta |
| Luftdaten / Leuvenair - air quality sensors | Dataset | Closed Beta |
| Anonymized/Pseudonymized ANPR data - Federal police platform | Dataset | Closed Beta |
| Anonymized/Pseudonymized ANPR data - Local data platforms (local police or city) | Dataset | Closed Beta |
| Meteo info (via VMM measuring stations) | Dataset | Closed Beta |
| Road signs geospatial register | Dataset | Closed Beta |
| Kortrijk - Parking data (on-street and public parking spaces) | Simulation model | Open Beta |
| Empty and neglected business premises / Leegstaande en verwaarloosde bedrijfsruimten - Flemish vacancy inventory | Dataset | Open Beta |

| | | |
|---|---|---|
| KBO (Crossroad bank of companies - Nace activities) | Dataset | Open Beta |
| Geospatial referenced register of installed cameras on public domain | Dataset | TBD |
| Crime and infringements geospatial register | Dataset | TBD |
| Road accidents | Dataset | Open Beta |
| Antwerp Bike-sharing stations Velo | Dataset | Open Beta |
| Antwerp Car Charging stations | Dataset | Open Beta |
| Antwerp Hospitals | Dataset | Open Beta |
| Antwerp Doctors | Dataset | Open Beta |

**Stakeholders**

As part of the work on D2.1, the Flanders pilot has already predefined a relevant set of stakeholders. Table 12 below shows the stakeholders which will be engaged during the pilot testing cycles to co-create the DUET Digital Twin (see chapter 3).

**Table 12: Flanders Stakeholders to be engaged per testing cycle**

| Stakeholders | Relation to project | Type | Cycle |
|---|---|---|---|
| AIV | Internal | Project Partner | 0 |
| imec | Internal | Domain experts | 0 |
| Smart Flanders - City Stakeholders | External | Domain Experts | 1 |
| Flemish Environmental Agency | External | Domain Experts | 1 |
| Flemish Public Works and Mobility Agency | External | Domain Experts | 1 |
| Land Use Agency | External | Domain Experts | 1 |
| VVSG | External | Policy Experts, NGO | 2 |
| VITO | External | Domain Experts | 3 |

## 4.3. Pilsen

As a mid-sized city and regional economic and touristic hub in the western region of the Czech Republic, Pilsen is looking to resolve challenges which are posed for transport and city planning. Pilsen's main ambitions are to focus on the interrelation between transport and noise pollution in a 3D environment and to find measures leveraging DUET Digital Twins to reduce noise pollution taking into account the factors that

play a crucial role in the city ecosystem, e.g. urban design, urban morphology, land use, street distribution, street environment and green infrastructure. Key outcomes from DUET for Pilsen include:

- Tools to support data-driven policy-making including traffic and noise pollution modelling tools, a visualisation tool, and sensor data orchestrator;
- Creating visual insights providing data-based evidence for policy making across the targeted policy areas;
- A virtual space for entrepreneurs, start-ups and spin-offs that can boost their innovations on top of the Twin visual insights and open data.

### Policy Scenarios

Based on the main objective of the Pilsen pilot, four scenarios have been identified as a priority for implementation (Table 13). The scenarios are linked to the policy domains public engagement, health & environment, and urban planning.

**Table 13: Scenarios for Pilsen Pilot**

| Stakeholder | Scenario |
|---|---|
| City Domain Expert | As a city urban planning expert, I want to connect existing data resources of the city to the digital twin and make sure they are up-to-date, interoperable, and include all available attributes, with the goal to make my daily work more efficient thanks to working with different data sources in a single environment. |
| City Domain Expert | As an urban planner, I want to understand trends in the historical noise levels (at various spatiotemporal resolutions) and predict/model future scenarios, with the goal to take measures to reduce noise levels (such as sound walls, rerouting traffic, green space, physical interventions, noise absorption materials). |
| City Domain Expert, Citizens | As a city 3D expert, I want to create high-resolution 3D models of selected public buildings or areas (e.g. the cathedral or football stadium) with the goal to stimulate the further use of the 3D data (both commercial and non-commercial) by the data enthusiasts, students and professionals. |
| City Domain Expert | As a city urban planning expert, I need to work with the 3D representation of the city (which for my work is sufficient in a lower level of texture detail), with the goal to achieve a higher quality of the public space, by using tools that allow to better simulate, plan in scenarios (e.g. related to the urban planning, ), and regulate the future development of the city. |

### Data Sources

To achieve the implementation of the four scenarios by the end of year three, a variety of data sources will be needed. Table 14 below outlines the data sources that have been identified by the Pilson pilot as available

and relevant for the predefined policy scenarios. The table presents a snapshot of what is currently available. The full list is available online[5] and the list of data sources is growing over the period of DUET.

**Table 14: List of Preliminary of Data Sources - Pilsen Pilot**

| Data Name | Type<br>Datasets, model, database, tool, catalogue | Release<br>Data who is required for which release? |
|---|---|---|
| Heating source of buildings | Map, database | TBD |
| Traffic detectors | database + API, tool (web app) | Alpha |
| Traffic model | database + API, tool (web app) | Alpha |
| DIY air quality sensor | dataset | Open Beta |
| Digital technical map | database, web map | Open Beta |
| Cadastre (national register) | online access | Open Beta |
| RUIAN (national register) | online access | Open Beta |
| Pilsen GIS data | database | Open Beta |
| Pilsen Urban Plan (land use) | database, web map | Open Beta |
| Air quality sensor data | database | Closed Beta |
| Floating car data | database + API | Closed Beta |
| Noise map (model) 2017 | database, web map | Closed Beta |
| 3D data | | |
| 3D model of the buildings | database | Alpha |
| Digital surface model | database | Alpha |
| Digital terrain model | database | Alpha |
| 3D City centre | database | Alpha |
| 3D noise data | database | Alpha |
| Other Open Data | | |
| Pilsen Open Data | database | Closed / Open Beta, selection of datasets to be made |
| Public Transportation Data (PMDP) | | |
| amounts of public transport passengers | dataset | TBC |
| real-time position of public transport vehicles | database | TBC |
| public transport routes | dataset | Closed Beta |
| public transport stops | dataset | Closed Beta |

**Stakeholders**

[5] https://docs.google.com/spreadsheets/d/1xrlheOOE76aDtS1GWJR2j0FBrKJ_TI6pXCeTCMvBJPo/edit?usp=sharing

As part of the work on D2.1, Pilsen has already predefined a relevant set of stakeholders. Table 15 below shows the stakeholders which will be engaged during the pilot testing cycles to co-create the DUET Digital Twin (see chapter 3).

**Table 15: Pilsen stakeholders to be engaged per testing cycle**

| Stakeholders | Relation to project | Type | Cycle |
|---|---|---|---|
| City of Pilsen | Internal | Project Partner | 0 |
| Urban Planning Unit | External | Domain Experts | 1 |
| Public Property Management Unit | External | Domain Experts | 1 |
| 3D Experts (GIS) | External | Domain Experts | 1 |
| Energy & Heating Unit | External | Domain Experts | 2 |
| Mayor's Office & Deputy Mayor | External | Policy-Makers | 2 |
| Investors / BIM Experts / Entrepreneurs / Students | Externals | Interested Public, domain experts | 3 |
| Citizens | External | General Public | 3 |

## 4.4. Pilot Testing Cycles - Evaluation Criteria

Each pilot testing cycle (as described in chapter 3) will take an epic-based evaluation approach combined with the overall monitoring of the project implementation (see chapter 5). Below, the epics are described per cycle for year 2. As the project has adopted the agile methodology from the start, the epics to support the epic-based evaluation of cycles 2 and 3 during year three will be defined jointly with the rest of the consortium during year two and will be described in the relevant pilot testing cycle report.

### 4.4.1. Cycle 0 - Personalisation of Alpha Release

The below table (16) provides an overview of what the Alpha release should feature. These features will be, where applicable, tested by the consortium partners leveraging the methods as outlined in chapter 3. This cycle will mainly focus on personalising each digital twin for each pilot.

**Table 16: Epics for Alpha Release of DUET Digital Twin**

| Theme | Epic |
|---|---|
| Basis infrastructure - View current state | As a user of the digital twin, I can browse the **3D model of the area of interest** so I can get a detailed look at the surroundings of areas I want to inspect. |
| Basis infrastructure - View current state | As a user, I can browse the **2D road network** on top of the 3D model so I can see where the roads are and can get extra attributes by clicking on the road. |

| | |
|---|---|
| Basis infrastructure - View current state | As a user, I can see the **real-time information** being sent out by **sensors** on top of the 3D model, so I get an accurate indication of the current local status. |
| Traffic model | As a user, I see the **prediction of traffic flows** (e.g. the KUL, P4All model) as calculated in the traffic model of the area, so I can correlate what is displayed by the sensor with typical traffic flows. |
| Traffic model | As a user, I see the **measurements done by the sensors interpolated** (by a model that fuses information coming from different sensors from different sensor types), so I can get an approximation of the **density of people** also in places there are no sensors. |
| Air quality model | As a user, I see the **real-time air quality model** as calculated (by a model that fuses information coming from different sensors from different sensor types), so I can get an approximation of the **air quality** in places there are no sensors. |

### 4.4.2. Cycle 1 - Closed User Groups

Following the personalisation of the Alpha version, the closed user groups in each pilot city will be able to test usability and functionality of the Closed Beta Release of DUET Digital Twins. The below table (17) provides an overview of the Closed Beta Features. These features will be, where applicable, tested by the consortium partners leveraging the methods as outlined in chapter 3.

**Table 17: Epics for Closed Beta Release of DUET Digital Twin**

| Theme | Epic |
|---|---|
| Update DUET Digital Twin (Functional Requirements) | As a user, I can understand the possibilities of the digital twin when I land on the main page so that I can select the right case, pilot, etc. |
| | As an advanced user, I am interested in the extrapolation of a pilot case to my own city. |
| | As an expert user, I want to monitor the effects of my own dataset on the available digital twin datasets and models. |
| | As a user, I can view the digital twin on different devices, e.g. laptop, mobile, tablet. |
| | As a citizen, I can browse prepared cases where the digital twin so that I can see the effect on policy making.<br>As a policymaker, I need some visualisations to document our policy. |
| | Fit gap analysis of alpha viewer vs agreed design. |
| | update UI according to the gap analysis. |
| As a city official, I can assess what the impact is of roadworks on the traffic in my city (Pilsen and Flanders) | As a user, I can inspect segments of the road network in the digital twin, so I can find the correct road I want to generate an experiment for. |
| | As a user, I want to test-change different road attributes so that I can test different traffic scenarios. |
| | As a traffic model, I can see the events that are sent to me, so I can update my state for the experiment. |
| | As a traffic model, I create a scenario based on the event, and I broadcast the outcome. |
| | As a canary, I can tweet when certain events pass on the buss, so I can help debugging. |

| | |
|---|---|
| | As a user, I want to be able to compare a scenario to a baseline by showing difference plots. |
| As a city official, I can assess what the impact is of the traffic on the air pollution in my city (Pilsen and Flanders) | As an air pollution model, I can see the events that are sent to me so I can update my state for the experiment. |
| | As an air pollution model, I create a scenario based on an event, so I can broadcast the outcome. |
| | As an air pollution model, I can send an event with the outcome of the experiment, so the other systems can react to that. |
| As a city official, I can assess what the impact is of the traffic on the noise pollution in my city (Pilsen and Flanders) | As a noise pollution model, I can see the events that are sent to me. |
| | As a noise pollution model, I update myself so I can display the updated noise pollution model. |
| | As a noise pollution model, I can send an event with my updated state so that the other systems can react to that. |
| As a user, I can see live information from specific sensor types in my city/region. | As a pilot, I defined which sensor types are most urgent in my city, so development can analyse and build software. |
| | As a user, I can see live information from specific sensor types in my city/region. |
| As a city official, I can assess the impact of traffic pollution in my city (in order to decide/promote alternative greener routes : Athens) | As a city employee, I will see the green routes within the city. |
| | As a user, I can see live information for alternative routes. |
| | As a user, I can suggest alternate routes. |

### 4.4.3. Cycle 2 and 3 - Open and Sister User Groups

In the second and third user testing cycle, the personalised DUET Digital Twins will be opened for feedback and testing to a broader user group. Furthermore, it will be possible to test additional policy scenarios and add new data sources to the digital twins. DUET has adopted the agile methodology and will work, over the course of year two, to define the additional policy scenarios and user requirements. The epics for the epic-based evaluation will be defined jointly with the consortium partners leveraging the regular DUET Pilot calls, as described in chapter 2 and will follow a similar approach as outlined above.

# 5. Project Evaluation Criteria

## 5.1. Context

In order to evaluate the overall progress of the development of DUET and its application in each pilot region, four sets of criteria are put forward. These relate to:

- how a digital twin fits in the policymaking process;
- how stakeholders interact with DUET;
- how results are transferred to other cities and regions;
- and the business potential of the solution.

These criteria are informed by the goals set out by the pilots in section 1.3.2 of the DUET DOA, referencing the interaction with stakeholders, how DUET should fit in the policy cycle, the engagement of citizens in the process and so on. The criteria are generic for the three pilots and will allow for comparison between them.

## 5.2. Evaluation criteria

The following table gives an overview of the evaluation criteria to be used by the pilot lead. These will be used iteratively after each development cycle. Each criterion needs to show improvement after every cycle and meet the goal set towards the end of the project. In order to measure these, a combination of quantitative (survey) and qualitative (interviews) tools will be used, as well as simple monitoring of activities by the pilots. Each indicator has its own identification letter and number, and the table below also lists the methodology used to measure the criterion: S (survey), I (interview) S/I (a combination), N (a number the pilot leads need to keep track of). The far right column links the criterion to the objectives listed in the DOA.

Under Task 6.4, the pilots will be provided with a template to keep track of the KPIs, which can be monitored in the project's online file sharing environment. After each cycle, a survey will be sent out to each pilot to monitor the progress of the KPIs. When a percentage is listed as the goal in the table below, it refers to the level of satisfaction measured for that indicator through one or more survey questions. An interview round will also be organised to measure those aspects that require a more qualitative appreciation. The documentation required to organise this is also developed under T6.4.

**Table 18: Project evaluation criteria**

| ID | Outcome | Description/question | Method | Goal | Obj. |
|---|---|---|---|---|---|
| DTs in the policymaking process | | | | | |
| D1 | Acceptance of DUET as a solution | Is DUET perceived as tackling a real problem and providing a sufficient solution? | S/I | 90% | 2.1 |
| D2 | Usability of DUET | Is DUET easy to use for its target audience? (User experience) | S/I | 80% | 1.3 |
| D3 | Expert feedback | How do experts perceive the usefulness of DUET? | S/I | 80% | 1.3 |

| | | | | | |
|---|---|---|---|---|---|
| D4 | Explored policy scenarios | Number of specific policy scenarios explored using DUET | S | 15 | 1.3 |
| D5 | Number of real-time datasets used | Total number of real-time data sets integrated into DUET across all pilots | N | 20 | 1.2 |
| D6 | Number of data model sources | Number of data model sources | N | 10 | 1.2 |
| D7 | Number of simulations | Minimum number of predictive simulations per pilot | N | 5 | 1.3 |
| D8 | Number of co-creation sessions | Number of co-creation sessions organised | N | 30 | 2.1 |
| Stakeholder interactions | | | | | |
| S1 | Number of government stakeholders involved | How many government organisations outside of the project were involved? | N | 15 | 2.1 |
| S2 | Number of external experts involved | How many external experts outside of the project were involved? | N | 30 | 2.1 |
| S3 | Number of citizens involved | How many citizens and citizen organisations outside of the project were involved? | N | 30 | 2.1 |
| S4 | Number of private sector stakeholders involved | How many private sector stakeholders outside of the project were involved? | N | 30 | 2.1 |
| S5 | Stakeholders collaborating with DUET | How many stakeholders outside of the project collaborated with DUET? | N | 100 | 2.1 |
| Transferability of results | | | | | |
| T1 | Cities/regions contacted | How many cities or regions were contacted outside of the project? | N | 300 | 3.1 |
| T2 | Participation to events | How many city or region representatives participated in DUET events? | N | 100 | 3.1 |
| T3 | Shown interest | How many cities or regions voice interest in DUET? | N | 5 | 3.2 |
| T4 | Dataset used | How many data sets are used? | N | 30 | 1.2 |
| T5 | Events exchanged | How many events were exchanged? | N | 5 | 1.2 |
| T6 | Visibility on social media | Total number of social media campaigns | N | 4 | 3.1 |

| | | | | | |
|---|---|---|---|---|---|
| T7 | Social Media Engagement | Average user engagement per social media prime post per channel (i.e. clicks, likes, shares, views etc) | N | Twitter: 50<br>Facebook: 155<br>Youtube: 300 | 3.1 |
| T8 | Quotes | How many quotes from cities does DUET gather? | N | 10 | 3.1 |
| T9 | Public talks | Total number of public talks related to DUET | N | 30 | 3.1 |
| Business value | | | | | |
| B1 | Measure the impact of DUET | What is the added value of DUET over existing solutions, and how does it fit in existing policy processes? (Acceptance, satisfaction) | S/I | 80% | 2.1 |
| B2 | Post-project exploitation plan | Is there a local post-project exploitation plan available? | S/I | 3 | 3.2 |
| B3 | Project clustering | Cooperation with similar projects for increased impact (in number of projects | N | 4 | 2.2 |

To keep track of overall engagement that DUET generates, the pilots will keep track of the total number of engagements they have with participants to the pilot in their region, whether it be citizens, policymakers, companies or other organisations. This is monitored for each iteration of the digital twin, using the table below.

# 6. Conclusion

This Pilot Operations Plan aims to set out an operational framework for the personalisation, testing and implementation of the DUET Digital Twin in the pilot sites Flanders, Pilsen, and Athens in the next 24 months of the project. It gives a brief overview of what has happened in the pilot regions in the first year of DUET to prepare for the operational activities. Further, it maps what is bound to happen in the next two years and what steps to take to arrive at the defined goals.

This Pilot Operations Plan also provides an overview of stakeholders to be engaged by each pilot in the pilot testing cycles, methods for interactive engagement and a recommended strategy for user engagement. Furthermore, it focuses on providing guidance for the implementation and testing of the Alpha and Closed Beta Release of DUET Digital Twins in year two.

Each pilot testing cycle will see dedicated activities and a report, which in turn will be the foundation for a more user-oriented digital twin solution. The aggregated outcomes of the pilot testing cycles will support the respective product owners and technical partners in DUET to deliver a better final product which will enable data-driven policy making to create better insights for the domain experts and policy makers of local and regional administrations. In short, this operations plan will support the development of the DUET Digital Twin solution which will serve cities' needs and help solve challenges of today's cities and regions.

To achieve this, the project has embraced a co-creative approach and follows the agile methodology. This is reflected in this Pilot Operations Plan: It leaves room to test, to iterate, and to improve based on real user needs. This is particularly the case for the operational development of DUET Digital Twins in the third year of the project.

Embracing the agile development approach in combination with co-creation also means that at points, user needs and requirements might differ from what is stated in the original DUET Description of Action. The reason for this is simple: Digital Urban Twins are new for stakeholders of local and regional stakeholders. More often than not, scenarios might not be feasible due to missing data sets or due to a change of priority of the administration. Therefore, DUET has decided to put the users in the centre of development and take a holistic approach to developing such a new and innovative tool as the digital twin.