



Self Assessment Towards Optimization of Building Energy

Deliverable 9.3

First progress report

Deliverable Lead: FC.ID

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EXECUTIVE SUMMARY / ABSTRACT / SCOPE

This deliverable summarizes the SATO project progress after the first semester of execution. It includes progress details for every initiated work package, milestones completion, and use of resources. Overall, the project is on track according to the plan, without any outstanding problems affecting its normal execution.

Horizon 2020 Energy Efficiency

Technical Progress Report

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| Project acronym and number: | SATO (GA 957128) |
| Date of submission of the report: | 31/03/2021 |
| Period covered by the progress report: | October 1 st 2020 to March 31 st 2021 |
| H2020 call topic: | LC-SC3-B4E-10-2020 - Self-assessment and self-optimisation of buildings and appliances for a better energy performance |
| Project start date: | October 1 st 2020 |
| Project end date: | September 31 st 2023 |
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1. Progress of work plan in the period

The following sub-sections present one table per work package (WP) that had development in the report period. WPs 4, 5, and 6 have not started within the period of report, hence no table is included. The tables describe the work related to WP key objectives, and the corresponding progress status.

1.1 Work package 1

| WP 1 – Specifications and Requirements for SATO | | | |
|--|---|----------|---------|
| Key objectives | Progress | On track | Delayed |
| Identification of relevant stakeholders and their roles related to the user-centred self-assessment and optimization SATO concept. | Work from this topic resulted in the submission of the first deliverable (D1.1) of WP1 that focuses on the identification of relevant stakeholders and their interaction with the SATO platform. The main outcome of this deliverable was the identification of the main actors that will use SATO as well as their needs in terms of interfaces and functionalities of the interface. It became clear that SATO must be cost effective and simple to use to take advantage of the current user enthusiasm around artificial intelligence applications to energy system control. This survey of 105 potential SATO users will provide inputs to T5.1, T5.2 and T5.5. | ✓ | |
| Definition of platform, data security and privacy requirements. | Work from this topic resulted in the submission of the first deliverable (D1.3) of WP1 about the requirements for the SATO platform, SRI, and IT security. The main outcome of this document was the identification and description of the six main functional requirements for the SATO platform and more than a hundred non-functional requirements (divided into twenty-one non-functional criteria). Work done in T1.3 during this first six months of SATO will provide guidance for subsequent discussions and decisions that will take place in all tasks of WP2 and for the Deliverable D1.4. | ✓ | |
| Definition of the system architecture of the SATO platform | The work towards this goal has considerably evolved during the period of interest of this report. FC.ID has been leading the definition of the architecture of the SATO platform, which was briefly introduced in D1.3 and advanced it in WP2. The results from this work will be part of D1.4 and D2.1. Additionally, FC.ID has promoted discussions (by email and online meetings) with several SATO partners to identify the energy management solutions they have in place to start planning their integration with the foreseen SATO platform architecture. | ✓ | |
| Definition of requirements for the | The progress of the work has been satisfactory. So far, the terminology and categorization to be used in the SATO project for the energy systems and components are defined. Through a | ✓ | |

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| energy performance self-assessment framework and services. | <p>questionnaire for use case responsible and project partners, the building systems, energy components, and appliances to be included in the SATO assessment framework have been defined, including which performances the framework should be able to assess. Key variables, performance indicators, benchmarks and thresholds for assessment and services have also been defined as well as the required methods to determine them, including measured building variables and mathematical methods. The work is now being reported and summarized to be published in Deliverable D1.2.</p> | | |
| Definition of user stories, use cases and operational test experiments. | <p>The progress of the work in Task T1.4 has been satisfactory. By now, EDP CNET has defined a methodology to define the SATO use cases and operational test experiments according to the IEC 62559. A first set of high-level use cases has been defined and clustered into different areas. A workshop has been organized by EDP CNET with all Consortium Partners to refine and complement the first set of use cases. Thereupon, EDP CNET has developed and released a use case template to be filled by the partners to detail the high-level use case description. Some Consortium partners have already provided their feedback. A second workshop will be organized at the beginning of April to define use case specific metrics and assign use case responsibilities for the detailed description of the identified use cases in Deliverable D1.5.</p> | ✓ | |
| Definition of an evaluation and demonstration framework based on predefined key performance indicators. | <p>The progress of the work in Task 1.5 is according to schedule. So far, a solid methodology has been identified to derive the evaluation and demonstration framework from the work being carried out in Task T1.4 and from Deliverable D1.5. Based on the identified set of use cases and operational test experiments as well as KPIs defined as part of the self-assessment framework of Task T1.2, EDP CNET has identified performance metrics that will allow to verify and evaluate the achievement of the use cases and demonstration activities of SATO against the envisaged performance threshold. This work will serve as a base to conduct the evaluation and validation of the demonstration activities in WP6. Once Deliverable D1.5 is concluded, an assessment tool will be implemented in Microsoft Excel and the work will be published in Deliverable D1.6.</p> | ✓ | |
| Validation and refinement of the business cases. | <p>Since the initiation of T1.6 “Extension and Validation of Business case, Business model and financing for SATO platform and A&O services”, CORE is in collaboration with partners working in Task T1.1 and Task T1.4 to identify and validate the actors that will interact with SATO and to describe the value that each use case will bring to them. The different actors identified include building occupants, building owners and managers, energy providers, aggregators, and citizen energy community managers. CORE is analyzing the specific needs of the customer segments and their expectations from using the services that will be offered. This is backed up by market research to validate the customer segments, identify their</p> | ✓ | |

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| | problems and pains and specify opportunities for SATO to alleviate them and to provide a financially sustainable offering. To support the added value that SATO is going to offer to the different actors, CORE is taking into consideration the current trends of energy consumption profiles of each customer segment based on literature review. | | |
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1.2 Work package 2

| WP 2 – Development of integrated technical Platform for SATO | | | |
|--|---|----------|---------|
| Key objectives | Progress | On track | Delayed |
| Streamlining the inputs from WP1 into the overall SATO concept. | Many requirements identified in WP1 have been directly considered in the decisions of the overall concept of the SATO platform. FC.ID has been evolving the design of the architecture as novel contributions come from the decisions, requirements and specifications of other SATO partners. Some initial overview of the SATO platform was already presented in deliverable D1.3 and newer versions with more detailed components and data flows will be described in deliverable D2.1. | ✓ | |
| Develop SRI calculation related capabilities into the SATO platform. | The SATO platform has adopted several best practices for modern architecture design, which include the concepts of data lakes, software defined infrastructures, and streaming platforms. All of them contribute to ingest data faster and to prepare enhanced trustworthy data to serve as input for processing related to the SRI calculation, to the self-assessment framework and to the energy management services that will be developed. | ✓ | |
| Upgrading existing devices to non-intrusively monitor and manage building environment. | The work towards this objective started in task 2.2 by assessing the existing sensors that the external platforms and pilot energy management systems will provide. By using inputs from T1.2 and T1.3, the partners are analyzing the requirements on new sensors and control mechanisms, and on the methodology to incorporate them into legacy equipment. The development of the middleware that will aggregate the different platforms and pilot energy management systems has also started. Finally, the development of hardware and software modules to enable Wi-Fi and Bluetooth device location has also been initiated. | ✓ | |
| Development of platform extensions and aggregation of the modules into the SATO | The work related to this objective is being developed mainly in tasks 2.2 and 2.3. It started in the WP2 kick-off meeting held by the end of January, where the Smart Energy Lab presented the main objectives, interdependencies, and the planned tasks for T2.3. Related to T2.4, the first meeting with FC.ID team was also held to plan the integration work to be conducted. | ✓ | |

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| platform. | Working meetings have since then occurred between EDP Comercial, Smart Energy LAB and EDP NEW to address the re:dy solution, its role on the project, and to specify the development of the interaction between the SATO platform and the re:dy platform. The same approach was followed regarding SIEMENS and the Desigo platform. For the integration with EDP re:dy, the development of an AWS backend platform that will communicate with re:dy or other IoT devices for research purposes has already started. | | |
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1.3 Work package 3

| WP 3 – Development of SATO Self-assessment framework | | | |
|---|--|-----------------|----------------|
| Key objectives | Progress | On track | Delayed |
| Develop a self-assessment framework that can support the types of assessments and scales. | The work on this objective is carried out in Task 3.8 - Integration of self-assessment framework into the SATO platform. This task starts in month 9 (June 2021). The grounds for the work to be carried out in T3.8 are being defined in T1.2, T2.1 and T2.4. Since the work on these tasks is on track, we expect T3.8 to start without any limitation in June 2021. | ✓ | |
| To develop a library of recommended automatic parameter and system identification methods to be applied in the smart self-assessment and optimization framework. | The work on this objective is carried out in Task 3.1. The work in the first period has been carried out in close collaboration with the work of Task 1.2, which defines the requirements for the SATO framework including definitions of key variables and indicators to include. A literature study on the potential parameter and system identification methods to be applied has been carried out. The methods use different approaches in relation to set-up and data collection, system modelling and mathematical methods. The next step will be to match relevant identification methods to the different key variables and performance indicators that will be defined in Task 1.2. | ✓ | |
| Develop data quality assessments that enable fault tolerance methods, to allow a better data store at the platform level. | The work on this objective is carried out in Task 3.2. In the first three months, the work focused on the definition of a data quality framework infrastructure that can be well integrated within the SATO platform data flows, and on implementing the first assessment modules. This work has been supported by the first requirements analysis in task T1.3 and the work in task 2.2. The work is currently on track and will follow in close collaboration with tasks in WP2 regarding the development of the SATO platform. | ✓ | |

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| <p>Develop a sensor placement assessment able to decide sensor locations for a desired minimum level of energy performance.</p> | <p>The work on this objective is carried out in Task 3.3. It has been almost two months since the beginning of the task – Development of sensors and BIM based sensor placement assessment for desired level of SA&O of building and appliances. Several subtasks have been started: a) Spatial analysis of sensors requirements based on the work made in WP1 and WP2; b) BIM entities identification to be studied according to sensors requirements and the open standard IFC; and c) Development of a mock-up of set of rules to provide self-assessment and self-optimization of energy performance. The work is currently progressing well in these three vectors and some others will be started to reach a higher level of definition.</p> | ✓ | |
| <p>Develop a database for reference energy performance of specific appliances or types of appliances.</p> | <p>The work on this objective is carried out in Tasks 3.4 and 3.5. The development of an information database is being led by FC.ID with the collaboration of POLIMI. The European Product Database for Energy Labelling (EPREL) has been identified as a primary source of information on energy performance of appliances, and as a reference to which the real-life assessments to be developed should be compared. In addition, the partners are currently performing literature surveys on the assessment of the energy performance of appliances. CORE has reviewed related literature regarding the typical consumption of devices, the way energy consumption is affected when operating under various loads, and the energy consumption profiles of occupants/tenants. By considering these concepts, CORE is designing a machine learning-based comprehensive energy performance assessment methodology. Finally, FC.ID is focusing on methodologies to monitor various types of appliances with the aim of developing utilization-based real-life assessments.</p> | ✓ | |
| <p>Develop building and equipment energy performance assessments considering the metrics and benchmarks defined in T1.2.</p> | <p>The work on this objective is carried out in Task 3.6. Measurements and analysis of continuous time series of data will provide the basis for defining more specific and relevant benchmarks for continuous evaluation of building operation. The work has mainly been related to the search of analysis methods to continued quantification of benchmarks based on data time series. Methodologies should allow for adaptation of existing or new benchmarks – also for subsystems and components and new benchmarks related to building and system dynamics.</p> | ✓ | |
| <p>Develop a user a building/occupancy behaviour extraction library to enable real-life user dependent</p> | <p>The work on this objective is carried out in Task 3.7. The work in the first three months has focused on collecting information related to user preferences and user actions from relevant previous projects as well as studying literature related to monitoring and prediction of user actions and preferences. Work has also been carried out to develop a dynamic occupancy assessment framework using Wi-Fi/Bluetooth scanners and the necessary data processing</p> | ✓ | |

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| equipment and building energy assessments. | techniques that will provide real-time occupancy levels and approximate location of occupants within the building. | | |
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1.4 Work package 7

| WP 7 – Economic Evaluation, Exploitation and Replication | | | |
|---|---|----------|---------|
| Key objectives | Progress | On track | Delayed |
| Development of clear business models for the different stakeholders such as occupants, energy service providers, grid operators, aggregators, or manufacturers. | Development of clear business models for the different stakeholders is related with T7.3 - Exploitation plans. This task is expected to start at month 25 according to the DoA. | ✓ | |
| Assurance of compliance with regulatory frameworks and solid solutions certification strategies. | <p>On December 7th 2020, WP7 kick-off meeting took place. On January 20th 2021, a specific kick-off meeting with SONAE, CORE and FC.ID was organized, to begin discussions related to the definition of the work-plan for T7.1 Compliance and Certification Plans.</p> <p>SONAE already had internal meetings and discussions: (1) for the definition of a plan of development for D7.1 Certification Plan; and (2) to gather information, through the analysis of the Grant Agreement and the Consortium Agreement, about: the scope of the Project (devices and services to be developed); the application of GDPR and Intellectual Propriety (background) rules in the Project; and, finally, the rights and obligations associated with the results produced with the Project. Furthermore, SONAE analyzed the dependencies of T7.1 with different tasks from WP1 (particularly, T1.2, T1.4 and T1.5), WP2, WP3 and with the other tasks from WP7 (T7.2 and T7.3), defining internal objectives in what concerns to the development and time of the exchange of the various inputs.</p> <p>Finally, SONAE, FC.ID and CORE met again in March to share the progress made internally by each of the partners and to define a fine-tuned schedule for the development of D7.1.</p> | ✓ | |

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| Development of replication strategies to reach a broad marked uptake of the SATO solutions with potential analysis of different building typologies in the European building stock. | Development of replication strategies is related with T7.2, Replication plan of the SATO SA&O platform and services, expected to start at month 21 according to the DoA. | ✓ | |
| Creation of exploitation plans for commercial and non-commercial partners of the consortium. | Creation of exploitation plans is related with T7.3, Exploitation plans, expected to start at month 25 according to the DoA. | ✓ | |

1.5 Work package 8

Below are presented the WP8 actions completed between M1-M6 of SATO project, carried out by POLIMI and CORE, in consultation with the rest of the partners. During this time emphasis was given in building awareness for the project and reaching the first targeted audience.

| WP 8 – Market Actors Engagement through Communication and Dissemination | | | |
|---|--|-----------------|----------------|
| Key objectives | Progress | On track | Delayed |
| To actively involve additional stakeholders to the project (end-users, ESCO, building owners, facility managers, grid operators), in order to get their commitment to the design and implementation of the | <p>The Dissemination and Communication Plan has been defined and shared within the Consortium. The related deliverable <i>D8.1 - Dissemination and Communication Plan</i>, including project identity, has been submitted in accordance with the timing specified in the GA.</p> <p>Partners have started to inform and communicate with multiple audiences to introduce the SATO project and the first activities in progress.</p> <p>Lists of potential interested stakeholders have been created to be involved in different activities (e.g., completion of the questionnaire developed in T1.1 and distributed by each Partner to collect information and promote the project at national level). These contacts will</p> | ✓ | |

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| <p>project, and also to broaden the network for the commercialisation after the project completion.</p> | <p>be used throughout the project to create the SATO network, attract experts, disseminate the results, generate market demand, and maximize the project's impact.</p> <p>PoliMi, as leader of Task T8.4, has organized 3 online events at national level aimed to introduce the SATO project to citizens, media, educational institutions, and other stakeholders. In addition, a meeting with policy makers (Mobility and Environmental Agency of the Municipality of Milan) has been organized to introduce the project and develop potential interactions.</p> <p>Partners are also attracting different stakeholders through media networks and newspaper, e.g., AMESEIXAL has published an article about SATO on the Municipal newspaper, which is printed in 78000 copies and distributed free of charge to Seixal population.</p> <p>Further details can be found in <i>D8.4 - Periodic Digital Dissemination Activities Report</i>, submitted according to the GA.</p> | | |
| <p>To foster the full utilization of the results and findings during and after the end of the project, by activating tight relationship with the stakeholders for the full roll-out of the system after the project. Besides, this WP will focus broadly on dissemination and communication of the state of the project as well as key results and development. The dissemination will create awareness and interactions between the consortium and</p> | <p>During the first 6 months of the project the following communication and dissemination activities were implemented to enhance awareness and target specific audiences.</p> <p>CORE is leading the communication activities of the project: the Social Media channels and the SATO website were launched, and communication material was designed, in line with the visual identity and the digital focus of the current situation. Additionally, the first Newsletter and Press Release were issued and delivered.</p> <p>e-Brochure: The SATO e-Brochure was created and uploaded on the website, as due to the COVID-19 restrictions almost all events are now happening virtually. Additional communication material was designed as well: a roll-up banner, a poster, and a leaflet.</p> <p>All the designed material is in accordance with SATO color palette and visual identity and includes some main facts and figures about the project.</p> <p>Social media: The SATO Twitter and LinkedIn accounts were set up the M3 of the project and are active with weekly posts. They have reached 100 and 150 followers, respectively. Partners provide input for the social media according to the social media plan and CORE is responsible for the overall monitoring.</p> <p>Website: The SATO website -created and launched in M3- is also regularly updated with new material and project related news. So far it has attracted 764 visitors and it will continue to be monitored by CORE and updated according to the project's progress.</p> | ✓ | |

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| <p>other stakeholders, in industrial, academic, and public interest groups, as well as policy makers.</p> | <p>1st press release: As part of SATO dissemination activities the 1st press release was published about the work done within the project. The press release was uploaded on the relative section of the website and furtherly circulated through the project's social media. It was also delivered via direct mailing to selected EU and industry organizations and media. A template email was sent to the partners encouraging them to easily distribute the press release to their contacts.</p> <p>1st Newsletter: The Newsletter was set up using the mailchimp platform. The Newsletter counts so far 30 subscribers. The first issue of the SATO newsletter was sent out in March 2021 including a note by the Project Coordinator.</p> <p>Internal communication: An additional tool was launched to provide an online place for exchanging event opportunities, upcoming conferences, and project-related webinars among partners. To have an all-in-one platform experience, the calendar of SATO's repository was used. Finally, to ease the collection and classification of the events (conferences, workshops, meetings with policy maker, etc.) and the different publications (papers, media articles, press release, etc.) two Microsoft Forms have been created and distributed within the consortium.</p> <p>Further details can be found in <i>D8.2 - Project brochure, posters, roll-up and infographics</i> and in <i>D8.3 - Project Web and Social Media Presence</i>, submitted in accordance with the timing specified in the GA.</p> | | |
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1.6 Work package 9

| WP 9 – Project, risk, data, and innovation management | | | |
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| Key objectives | Progress | On track | Delayed |
| <p>Coordination of the activities of the project and coordination of efforts among all partners in order to guarantee an effective operation of the project.</p> | <p>A two-day Kick-off Meeting (KoM) was held near the beginning of the project where management and coordination procedures were communicated to and agreed by all Partners, observing the requirements set in the Consortium Agreement. Work Package (WP) leaders presented plans for each of the WPs. Later, each WP held its own KoM.</p> <p>A project manager has been hired by FC.ID (Cristiana Rosa) to assist in the management of the project and function as the main point of contact between the coordination and the Partners.</p> <p>The consortium has monthly General Assembly (GA) and Project Steering Committee (PSC)</p> | ✓ | |

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| | <p>meetings where an assessment is made on the progress of the different ongoing and upcoming activities within the project.</p> <p>Deliverable 9.1, Project Management Handbook, was prepared by SONAE and submitted. D9.1 is aligned with the H2020 requirements and includes procedures for managing the quality, innovation, project risks, stakeholder management and engagement, gender issues, presentation standards for deliverables and reports to the EC and quality assurance measures. Furthermore, it clearly documents the work breakdown structure (task schedule, lead partner, related deliverables, and dependencies).</p> | | |
| <p>To adequately maintain the communication channels between the beneficiaries and between the European Commission (EC) and the Project Coordinator (PC).</p> | <p>Several mailing lists (general, administrative, and per WP) were created to provide easy communication between Partners involved in specific activities. A web-based platform has been made available, including a file repository and calendar that are shared by the Partners to ease file sharing and archival, and to coordinate activities (https://repository.sato-cloud.eu/). Additionally, a WIKI page has been published where project management and coordination information are easily shared and accessed by all partners (https://wiki.sato-cloud.eu/).</p> | ✓ | |
| <p>Management and control of the project resources (personnel, finance, equipment, etc.), covering the overall legal, intellectual property rights, contractual, ethical, financial and administrative management always in compliance with any consortium agreements.</p> | <p>FC.ID administrative collaborators are available and maintain periodic contacts with the Consortium partners to help overcome problems and doubts related to human resources and financial management.</p> <p>Prior to the preparation of the first progress report, a workshop has been held by FC.ID with all Partners to assess the current state of resource execution in the project.</p> | ✓ | |
| <p>Implementation of a Data and Ethical Policy concerning all project</p> | <p>Deliverable 9.8, Risk, Innovation and Data Management Plans, has been submitted, providing a set of guidelines and best practices for the management and implementation of the project concerning project risks, innovations, and results, as well as data used and</p> | ✓ | |

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| domains, complying with EC rules. | <p>generated during the project. The document focuses on the underlying approaches for risk, innovation and data management used in SATO and defines a set of templates and methodologies to monitor the project's activities in these domains. The document is the first version of D9.8 which will be updated in Month 24 of the project.</p> <p>In the technical domain, the project is developing solutions to embed mandatory data privacy and security mechanisms in the SATO platform, that will be associated to all data sources and services managed by the platform.</p> | | |
| Monitoring of the progress of all technical activities described in the DOA and achievement of results and ensuring that they are delivered on time and to budget by the development of a project risk management and quality assurance. | <p>The progress of the project is periodically monitored through the monthly PSC meetings, where each WP leader presents an overview of the progress, the challenges that are faced, and any risks that have been detected on the WP.</p> <p>Deliverable 9.2, Project Management Plan, was submitted, describing how the project is organized, managed, reported, and controlled. It provides guidance for specific activities such as schedule, cost, risk, quality, communication, and reporting. The document focuses on describing the approaches to manage work packages, project documents, communication within the consortium, the quality of deliverables, project execution and reporting, and risk mitigation.</p> | ✓ | |
| Promote gender equality. | <p>The SATO project promotes a hiring policy guaranteeing equal opportunities. All opened position calls include an equality statement to ensure this to the candidates. The project has successfully hired and involved several collaborators of both genders.</p> | ✓ | |

2. Progress on milestones

| Milestone number | Milestone title | Delivery date in Annex 1 | Means of verification | Achieved | If not achieved, forecast date | Comments |
|------------------|------------------------|--------------------------|-----------------------|----------|--------------------------------|------------------|
| MS 17 | Project website online | 31/12/2020 | Validated by D8.3 | Yes | | Achieved on time |

3. Other issues

Partners have raised concerns related to the impact that the restrictions imposed by the SARS-Cov-2 pandemic may have on the SATO demonstration framework. Specifically, depending on the evolution of the pandemic and the resulting confinement and working restrictions, the pilot preparation and deployment work may be delayed and the recruitment of participant volunteers in the residential pilots may be affected. These risks will be continuously assessed, and appropriate mitigation measures will be adopted.

4. Use of resources

Prior to the delivery of this progress report, the administrative collaborators of the SATO consortium partners held a small workshop to assess the current expenditure of person-month, personnel costs, and other types of expenses. It was concluded that no major deviations happened in this period.