


Smart Survey Implementation

Grant Agreement Number: 101119594 (2023-NL-SSI)

Work package 1

Coordination and integration

Deliverable 1.3: Smart advanced stage report

Version 1.1, 2025-06-27

Prepared by:

Remco Paulussen (CBS, The Netherlands)
Martin van Sebille (CBS, The Netherlands)

Work package Leader:

Remco Paulussen (CBS, The Netherlands)
e-mail address : r.paulussen@cbs.nl
mobile phone : +31 (0)6 2123 0392

Index

Part 1: Overview and outcome of the Smart Survey Implementation project

1. Scope and Overall Achievement

Trusted smart surveys have revolutionized data collection by combining traditional survey techniques with modern technological advancements. These surveys intelligently combine self-report questions with smart features collected via sensor-enabled devices such as smartphones, wearables, and other devices, aiming to enhance data quality, reduce burden on participants, and provide more timely and granular data.

The goal of the Smart Survey Implementation (SSI) project was to develop, implement, and demonstrate the concept of trusted smart surveys, showcasing a complete, end-to-end data collection process. This involved a) engaging citizens as active contributors, b) acquiring, processing and combining data from smart devices, and c) ensuring strong privacy safeguards.

The project adopted an organizational structure based on smart survey design levels, focusing on Methodology (WP2), IT Architecture (WP3), Logistics (WP4), and Legal-ethical (WP5). By prioritizing this design approach over an application-based structure, the project aimed to develop, test, and evaluate smart services through topical and realistic case studies.

WP1 Coordination and integration

Context and overall objectives

While a significant portion of WP1 focused on project coordination, it also encompassed informational subjects such as terminology, definitions, and the current state of affairs regarding Smart Surveys Implementation (SSI) smart solutions. An important research component of WP1 was the perception survey. Another important topic was governance, but that will be described as part of the Future Outlook.

One of the primary objectives of SSI was to develop effective push-to-smart recruitment and motivation strategies. It was hypothesized that various instances of smart surveys, such as a smart household budget survey enabling receipt scanning and uploading, and a smart time use survey with daily stop-track segmentations, require tailored strategies. Additionally, it was believed that individuals and households commonly have objections and hesitations about smart features in general. The SSI smart perceptions survey, formally known as New Ways of Measuring Survey (NWMS), was conducted in Italy, Netherlands, and Slovenia to identify both general and topic-specific motivations and objections among the general population. The perception survey aimed to achieve several specific goals, including gathering input to tailor and address respondent concerns in smart survey data collection strategies, offering alternative modes to respondents, understanding respondent preferences for data control and minimal involvement during data collection, informing legal-ethical officers about respondent perceptions, and assessing how achieving these goals depends on the survey topic and the country and the National Statistical Institute.

Results and achievements

The main conclusions from the evaluations of the perception survey were:

- In all three countries, around 20% of invited samples participated in the smart survey and the vast majority performed at least one smart task;
- There are strong country differences in both hypothetical and actual willingness depending also on the smart task that is asked;
- As conjectured, less willing persons more often report weaker digital skills and more concern on data security. Privacy concerns turn up as the most prominent predictor in all three countries.
- Being able to control data that are collected is rated as important in all three countries, but by itself is not an argument against going smart. Respondents that do go smart, rate it as more important than those that do not.
- As clues for improving tactics:
  - Offer alternatives to those that perceive themselves as less digital, but also assist them in going smart;
  - Be very clear about how and where data are stored and how respondents can control their data, i.e. remove all suspicion of data being open to a wide range of users;
  - Tailor recruitment and motivation, because hesitations vary across persons and are hard to predict based on information available prior to a survey;
  - Tailor to the context and specific smart task, in particular, make sure the utility of going smart is logical and legitimate

More information on the perception survey and the results can be found in the deliverable *SSI deliverable 1.2 - Smart baseline stage report Coordination and integration v1.1*, which is published on CROS.

WP2 Methodology

Context and overall objectives

In pursuit of developing a comprehensive research methodology for the implementation of smart surveys, we identified four major challenges that hinder the integration of smart surveys into European Official Statistics data collection:

1. Effective recruitment and retaining participants for smart surveys, particularly in difficult-to-reach societal groups.
2. Use of machine learning models to enhance Human-Computer Interaction in smart surveys.
3. Designing smart surveys from a User Experience (UX) or usability perspective, involving respondents, and managing human-computer interaction with sensor data after being processed by machine learning models.
4. Integration of data from smart surveys with traditional survey methods by estimating the mode effect (i.e., differences of smart vs. traditional data collections). To address these challenges, the project will conduct a number of small and large-scale field tests until the end of the project in 2025.

In practice, it is highly likely that there are multiple successful methodologies for conducting smart surveys, and these may vary based on local circumstances. For instance, in some countries interviewers may play a significant role in both recruitment and retaining participants (issue 1), as well as in enhancing the usability of the app (issue 3).

However, some countries may rely to a greater or lesser extent on traditional non-smart surveys in combination with smart surveys to produce official statistics (issue 4). Additionally, as a final example, the data available for training and re-training machine learning models in smart surveys may differ both between and within countries over time (issue 2). One of the key objectives of this work package was to determine which combinations of smart survey designs are effective and which are not. To accommodate the variations between countries, we conducted field experiments and usability tests in multiple countries to gain comprehensive insights.

The ultimate aim of this work package was to identify trade-offs between design features in smart surveys. One significant trade-off relates to recruitment and retaining participants (issue 1) versus the mode-effect (issue 4). For instance, providing alternative data collection modes, such as web or paper diaries alongside smart surveys, may potentially increase response rates during survey recruitment. However, this approach may lead to differences in data across the various modes (mode-effects: issue 4). The greater the number of alternative modes offered, the more challenging it becomes to estimate mode effects and integrate data from multiple modes.

Another trade-off pertains to the use of machine learning models (issue 2) and the usability of smart surveys (issue 3). Smart surveys are designed to measure things that respondents may find impossible or very challenging to answer, such as the start time of a specific activity or the exact expenses during grocery shopping. Effective machine learning models can enhance the usability of the response task for the respondent. For example, automated classification of images from shopping receipts can reduce the burden on respondents and improve the accuracy of measurements. However, if machine learning models perform poorly, due to low-quality images or difficulties in classifying products, respondents may be presented with inaccurate results (data). When respondents need to manually correct data from machine learning models, it can lead to usability issues (issue 3) and potentially impact the engagement of participants (issue 1).

The ultimate goal of this work package was to provide insights into these trade-offs by conducting field experiments that involve varying design aspects of smart surveys.

Results and achievements

The main conclusions from WP2 Methodology are:

- Recruiting participants for smart surveys remains a major challenge
  Response rates were very low (2–3%) when participants were invited via postal mail only, as in Belgium and Germany. Higher response rates (22–43%) were achieved in Norway

and France, where interviewers (CATI or face-to-face) were used. Non-personal invitations alone are insufficient to engage the general population in smart surveys.

- Non-response bias is significant and systematic
  Participants in smart surveys tend to be younger, higher-educated, native-born, and from higher-income households. CATI interviewer involvement helps reduce this bias by supporting less digitally literate groups.
- Advertising smart features can increase their usage
  In Germany, mentioning the receipt scanning feature in the invitation letter led to higher use of that feature, without lowering participation. Promoting the benefits of smart functionality (e.g., saving time) can improve engagement and data quality.
- Machine Learning (ML) can effectively support automation but has limits
  ML was successfully applied to OCR, COICOP classification, and GPS-based predictions. However, ML errors require human intervention in many cases—especially when training data is limited or localized adaptations are missing. High-quality, representative training data is essential and must reflect national receipt formats, languages, and shop types.
- User experience is critical for success
  Respondents appreciated automation but were often frustrated by low OCR accuracy, confusing interfaces, or lack of control. Usability testing revealed the need for better error correction tools, clearer feedback, and simpler interfaces. Trust and perceived data privacy also played a key role in willingness to engage.
- Mode effects are real and need to be accounted for
  Switching from traditional paper-based surveys to smart surveys can improve data accuracy, but also introduce inconsistencies due to increased missing data or altered response behaviour. Adjustments and calibration are needed to integrate smart data with existing survey data.
- There is no single 'correct' smart survey methodology
  Design choices must reflect survey topic, country-specific context, available infrastructure, and legal/ethical frameworks. A smart survey is best seen as part of a continuum, from mostly traditional to highly automated. Early decisions on how "smart" the survey should be can guide choices throughout the design process.

Much more information and results can be found in the deliverable *SSI deliverable 2.3 - Smart advanced stage report Methodology*, which is published on CROS.

WP3 Developing Smart Data Microservices

Context and overall objectives

The primary objective of this work package was to develop microservices to achieve the overarching goal of creating and demonstrating the concept of Trusted Smart Surveys. This included realizing a proof of concept for the complete end-to-end data collection process and demonstrating a robust solution. Work package 3 operated at the development level, focusing on the creation of platform-independent microservices as integral components.

Various microservices had been indicated to be developed and integrated among which the receipt scanning microservice, the geolocation microservice and the energy microservice.

The main objectives of WP3 were to:

- Develop and containerise the selected microservices.
- Develop the APIs between the microservices and the core platforms.
- Document the microservices and APIs.
- Support platforms and NSIs to include the microservices in the core platforms.
- Perform a "pentest" (security, penetration) and stress test (load performance).
- Describe the architecture of the core platforms.
- Describe the architecture of the (developed) microservices.
- Describe and execute the deployment strategy for both the core and microservices.
- Keep and maintain a public GitHub repository to make the microservices available as open source.

Results and achievements

The main conclusions from WP3 Developing Smart Data Microservices are:

- Microservices are a practical and scalable solution for integrating smart data into official statistics
  WP3 successfully developed modular, platform-independent microservices that can be integrated across different national platforms.
- Each microservice benefits from a layered architecture, combining:
  - A generic, reusable core (non-domain-specific), and
  - A customized, survey-specific extension (domain-specific), allowing for adaptability across countries and statistical domains.
- The Receipt Scanning Microservice is fully functional and tested
  It includes both an OCR engine and a COICOP classification module. Integration with platforms like MOTUS has been completed; further implementation in other NSIs is feasible. AI models are accurate and significantly reduce respondent burden, though some manual verification remains advisable.
- The GeoService Microservice provides high potential for Time Use Surveys.
  Clustering and transport mode detection are progressing. Further refinement and real-world testing are needed for full production use. Integration into data collection platforms is underway.
- The Energy Microservice is in an exploratory, proof-of-concept phase
  A feasibility study has been completed. More development is required before operational integration.
- Microservices are designed with privacy and security in mind

All personal data stays within the core platform. Microservices only receive anonymized or pseudo-anonymized identifiers (UUIDs).

- Containerization and open-source deployment lower the barrier to adoption
  Microservices are packaged using Docker and designed to work within Kubernetes environments. Full documentation and training materials are shared via GitHub.
- Collaboration between technical and methodological experts is crucial
  Integration requires joint work across IT, statistics, UI/UX, and data protection teams. Successful implementation depends not only on software quality, but also on organizational readiness.
- Further harmonization and reuse of microservices across NSIs is recommended
  The modular structure allows for sharing components like OCR or classification services across countries. This promotes cost-efficiency, consistency, and faster innovation in the ESS (European Statistical System).

Much more information and results can be found in the deliverable *SSI deliverable 3.4 - Smart advanced stage report Developing Smart Data Microservices*, which is published on CROS.

WP4 Logistics

Context and overall objectives

The primary objective of WP4 was to provide specific guidelines to assist NSIs in adapting their business processes to incorporate smart features into their surveys. The outcomes were designed to benefit not only the consortium participants of the Smart Surveys Implementation (SSI) project but also all ESS NSIs.

The main goals were to:

1. Describe the statistical **business process** regarding the specific aspects concerning smart solutions. By that we mean all the process activities that need to be conducted preparing and executing a smart survey. The GSBPM and BREAL will be used as a framework. The GSBPM will to that end be elaborated where necessary.
2. Describe a **maturity model** with maturity criteria. Maturity here refers to the maturity of an NSI to use smart surveys, but also the maturity of a smart solutions to be used.
3. Develop a **benchmark** that can be used by NSI's in practice. This benchmark helps NSIs to assess themselves in terms of maturity and provides guidelines for further application of smart surveys.

In order to achieve this, we also needed to address some other topics:

- We needed a **taxonomy** of smart solutions. That is because the business process can look different for different types of smart solutions.
- We needed to identify the different **actors** in the business process that will be affected by smart solutions. Actors should be mapped to the process.
- **Microservices** and **machine learning modules** will support the business process. So, we needed to make clear how they fit into the business process.

- We needed to describe a **PDCA-cycle** for development of the business process and for the development of microservices and ML-modules. This is because development is not a one-time effort, NSI's should be able to maintain it in the future.
- In the end we needed to **demonstrate** that **the benchmark** actually works in practice, by applying the benchmark to (at least two) end-to-end solutions existing within NSI's.

Results and achievements

The main conclusions from WP4 Logistics are:

- Smart solutions have significant impact on business processes
  Implementing smart surveys requires NSIs to rethink and adapt their existing survey processes, including new roles, tasks, and infrastructure (e.g. mobile apps, data handling, helpdesk).
- A structured maturity model supports gradual development
  The Smart Survey Maturity Model (SSMM) helps NSIs assess their current position and provides a roadmap to grow from awareness to full optimization. Level 3 (“Production”) is the minimum threshold to deploy smart solutions operationally.
- Process building blocks provide a flexible, reusable design framework
  NSIs can use these blocks to tailor their survey processes to specific smart features. Blocks can represent new activities (e.g. training staff on app usage) or highlight standard tasks requiring extra attention.
- Smart solutions are diverse and require classification
  A formal classification of smart solutions (based on device, data type, task location, and error handling) helps in generalizing design principles and aligning logistics, IT, methodology, and legal aspects.
- Machine learning in smart surveys requires ongoing maintenance
  Smart features often rely on AI/ML models (e.g. for OCR or classification), which must be continuously monitored and updated due to data drift and changing usage patterns.
- PDCA cycles are critical to continuous improvement
  The Plan-Do-Check-Act framework ensures smart surveys evolve in response to technological, legal, and operational changes. PDCA cycles should be applied not only to the survey process but also to ML models and logistics.
- Cross-functional collaboration is essential
  Implementing smart surveys impacts multiple domains: R&D, IT, logistics, legal, HR, and data production. Clear governance and communication across these domains are necessary for successful deployment.
- One-size-fits-all process models are not feasible
  Due to varying national contexts, technologies, and survey goals, NSIs must adapt the tools, models, and recommendations to their local situation. Flexibility is key.
- The methodology, IT design, and legal compliance must be aligned
  Smart solutions can only be deployed responsibly when their technical implementation, methodological soundness, and legal justification are developed in harmony.

- Smart surveys introduce new risks and responsibilities
  Issues such as data accuracy, privacy, device compatibility, and respondent engagement must be actively managed, monitored, and evaluated throughout the process.

Much more information and results can be found in the deliverable *SSI deliverable 4.3 - Smart advanced stage report Logistics*, which is published on CROS.

WP5 Legal

Context and overall objectives

From a legal perspective, the ultimate goal was to create one overarching Data Protection Impact Assessment report (DPIA) for surveys that employ one or more smart features from a specified set of smart features. The emphasis on a set of smart features was made because new features may be developed and/or added gradually in time. It was the task of the Smart Survey Implementation (SSI) project to create a first overarching DPIA for features used in the three SSI case studies receipt processing, geolocation (geo-tracking) and energy meter data donation. Given that in time more features and more applications will be added, the general DPIA will, by nature, be a dynamic document.

The main goals of WP5 were:

1. Identify legal requirements specific to shared smart microservices.
2. Determine what may be considered informed consent for different smart features.
3. Determine decision rules in making trade-offs between in-house processing and in-device processing, i.e. data minimisation/privacy by design versus quality control, including role of Privacy-Enhancing-Techniques (PET)
4. Determine guidelines for third-party-involvement
5. Make updating of DPIA for new smart features more efficient
6. Harmonize ESS-wide legal perceptions of NSI's
7. Confront legal requirements with ethical/NSI-policy requirements

Results and achievements

The main conclusions from WP5 Legal are:

- The modular DPIA strategy is reusable and scalable
  The report confirms that it is feasible to build DPIAs (Data Protection Impact Assessments) using a modular approach. This allows for more efficient and consistent risk assessments for smart surveys, which can also be shared between National Statistical Institutes (NSIs).
- The three smart feature case studies show that legal and ethical risks vary significantly by application
  - Receipt scanning/uploading is relatively easy to implement from a legal and ethical standpoint, with limited risks.
  - Location tracking presents both a large accuracy gap and a significant output gap, making it more complex and demanding clear justification and communication.

    - Energy data donation is promising but remains technically and legally underdeveloped, requiring further study.

- Clear distinction between application-independent and application-dependent modules is essential
  This separation supports reuse across surveys and countries and helps to standardize DPIA practices within the European Statistical System (ESS).
- Privacy-by-design and transparency towards respondents are crucial
  Respondents must understand how their data is processed, how they are informed, and what control they have over their participation and data use.
- Respondent perception is key to ethical acceptability
  Public acceptance of smart features varies by country and context. Therefore, perception surveys and ethical assessments must guide implementation decisions.
- DPIAs must be reviewed and updated periodically
  The report recommends applying a Plan-Do-Check-Act (PDCA) cycle to DPIAs to keep them up-to-date as technology and public expectations evolve.
- Collaboration between NSIs is strongly encouraged
  Sharing DPIA modules, experiences, and risk evaluations across statistical institutes in the EU improves efficiency and harmonization.

Much more information and results can be found in the deliverable *SSI deliverable 5.3 - Smart advanced stage report Legal*, which is published on CROS.

Overall results and impacts

The main impact of the SSI project is that it will be easier for statistical institutes and research organisations to implement smart surveys, especially HBS and TUS-like surveys, and applying the lessons learned, like effective recruitment, how to retain and involve the participants and how to integrate this data with traditional survey methods.

The project released two mature services: one for receipt scanning and COICOP classification, and another for geo-location, mode of transportation and HETUS classification. These services have been used in various usability and field tests during the project and are provided as open source code (via GitHub). These are integrated in the MOTUS platform of hbits, but an NSI can also decide to develop an own app, like CBS The Netherlands, INSEE France, and SSB Norway.

When statistical institutes and research organisations want to use smart surveys, they can use the maturity model to check whether they are ready to support smart surveys. One should reach the production level in order to be able to do so. For designing and modifying existing processes to support smart surveys, the project provides the process building blocks. Also, the PDCA cycles, including the methodology and training of machine learning models, are described in detail. And from a legal and ethical perspective, the project provides guidelines to setup and describe the required DPIA to conduct a smart survey.

2. Stakeholder Engagement

During the project several meetings were organised to promote the work of the SSI project, both internally and externally. Important to mention are the five informational meetings held on October 20th, 2023, March 22nd, July 5th, November 22nd, 2024, and February 21st, 2025. During these sessions, presentations and demos were given to update the audience on the status of the project. All sessions were well-visited by interested parties within and outside the consortium, including participants from Austria, Finland, Latvia, Luxembourg, Sweden and the UK.

SSI final conference

On 3 and 4 April 2025, the closing conference and workshop took place in Heerlen, The Netherlands. The event was attended by 45 participants from various countries. In the appendix the minutes and pictures of the results of the SSI conference are included. The presentations can be found on the Eurostat CROS portal.

The conference brought together national statistical institutes (NSIs), universities, and a commercial partner to share the progress made and lessons learned during the SSI project in integrating smart technologies into official statistics. With a strong focus on user-centric design, privacy, and collaboration, the event highlighted innovations in smart surveys, like geo-tracking, receipt scanning, and energy monitoring.

Discussions covered methodology, machine learning applications, user experience, and the legal complexities of data collection, such as Data Protection Impact Assessments (DPIAs). Pilot tests across Europe demonstrated varied respondent engagement, shaped largely by trust, ease of use, and perceived value. A maturity model and multiple governance scenarios were introduced to support NSIs in scaling up smart solutions sustainably.

Main takeaways:

- Smart surveys are promising but must prioritize privacy, simplicity, and communication with respondents. They must be transparent, secure, and easy to use to gain public trust.
- Legal and ethical preparedness - especially around DPIAs - is essential and still developing.
- Microservices like geo-tracking and receipt scanning must be intuitive and well-integrated. They should be reusable and platform-agnostic to support scalability.
- Effective recruitment, clear communication and onboarding strategies, including incentives and interviewer involvement, significantly affect participation.
- Ongoing collaboration, especially through Eurostat leadership, is vital for shared development, knowledge exchange and sustainability.
- NSIs must balance innovation with organizational maturity to avoid implementation pitfalls.

The conference concluded with a call to embrace change, foster community, and ensure that smart survey solutions remain respondent-friendly and methodologically robust.

3. Future Outlook

As the Smart Survey Implementation (SSI) project concludes its advanced stage, the European Statistical System stands at an important juncture. The project's work over the past years has not only shown that trusted smart surveys are technically and methodologically feasible, but also that they can offer clear advantages in terms of data quality, operational efficiency, and respondent experience. At the same time, the project has made it equally clear that these benefits are conditional. They rely on robust organizational readiness, legal clarity, technological maturity, and, perhaps most crucially, public trust.

One of the central conclusions of the project is that there is no single “correct” smart survey model. Successful implementations vary depending on the national context, survey topic, and available infrastructure. Some countries may lean more heavily on traditional methods, using smart features as optional add-ons. Others may move toward fully automated data collection using sensors, apps, and machine learning. The future of smart surveys must therefore be approached as a continuum, where NSIs make strategic choices about how “smart” a survey should be, and under what conditions automation should be applied. These choices must balance accuracy, cost-efficiency, respondent burden, and ethical considerations.

Looking ahead, one of the most promising and impactful developments would be the establishment of a shared central smart solution across Europe. This approach, identified in Part 2 of this report as “Scenario 4: NSI joins consortium to jointly provide central smart solution”, envisions a joint infrastructure for developing, maintaining, and deploying smart survey components such as microservices for Receipt Scanning and Geolocation. A centralized solution offers significant advantages: it avoids duplication of work, reduces long-term maintenance costs, and promotes methodological and technical harmonization across countries. It could also provide smaller NSIs with access to tools and infrastructure they might not otherwise be able to afford or maintain.

However, implementing such a shared solution comes with real challenges. It requires robust governance, clear legal agreements, and a long-term commitment from both Eurostat and national institutes. Questions about data ownership, system liability, update responsibilities, and cost-sharing must be answered. Yet these challenges are not insurmountable. The experiences of open-source collaboration and code-sharing within the SSI project, especially around the receipt scanning and geolocation microservices, have already laid a solid foundation. A European-wide smart survey ecosystem is achievable, provided there is institutional coordination, sustained funding, and mutual trust.

In parallel to infrastructure, the importance of methodological integration cannot be overstated. As smart features are deployed, NSIs must be able to account for mode effects, validate the accuracy of smart-collected data, and ensure that it can be reliably combined with traditional survey data. The SSI project has contributed valuable tools and frameworks in this area, but much work remains to refine, adapt, and institutionalize these

methodologies. Cross-country cooperation in this domain would strengthen data comparability and enable meaningful benchmarking.

Equally important is the need to focus on the respondent perspective. The perception surveys conducted in the project showed that public willingness to participate in smart surveys is shaped by several factors: trust in the NSI, understanding of how the data will be used, perceived burden or effort, and the nature of the smart feature itself. While respondents are often open to using smart features if they understand the benefits (such as convenience or reduced time), concerns around privacy, surveillance, and loss of control remain significant. Future efforts must therefore place user experience and communication at the center of smart survey design. Interfaces should be intuitive, error-tolerant, and transparent. Participants should have clear control over what data is shared, and how it is used.

This also implies the need for continuous improvement cycles, both for the smart technologies and the organizational processes that support them. The PDCA (Plan-Do-Check-Act) cycle proposed within the project is particularly well-suited to guide this process. It ensures that as user needs evolve, technology matures, and legal frameworks shift, smart surveys can remain effective, ethical, and aligned with best practices.

From an operational standpoint, capacity building will be critical. The project revealed that success depends not only on technical innovation, but also on the ability of teams to collaborate across domains—IT, legal, statistical methodology, communication, and data protection. Investing in training, documentation, and shared learning environments will ensure that knowledge and best practices are not lost, but spread across the ESS community. A formalized network or smart survey community, supported by Eurostat or the ESS governance structure, could help institutionalize this exchange and accelerate collective progress.

Finally, the legal and ethical dimension must remain front and center. The modular DPIA approach developed in WP5 offers a flexible way to assess and manage privacy risks across different smart features and survey types. In the future, these modules should evolve into a living legal framework, updated regularly in response to emerging technologies, legal developments, and public expectations. Rather than treating data protection as a compliance burden, NSIs should see it as a design driver—helping to build trust, clarity, and fairness into smart data collection from the outset.

A central pillar for the successful future of smart surveys is the establishment of a robust and forward-looking governance framework, particularly in the context of a shared smart survey infrastructure. The SSI project clearly illustrates that while many technical components, such as microservices, methodological tools, and legal templates, can be developed independently, their full value is only realized when embedded in a coordinated, interoperable, and jointly maintained system. A shared smart solution offers the greatest potential for cost efficiency, consistency, and innovation, especially for countries with limited resources or technical capacity. However, to achieve this, participating NSIs must move beyond ad hoc collaboration

and commit to a joint governance structure that defines roles, responsibilities, funding models, update mechanisms, and legal safeguards. Eurostat is ideally positioned to provide leadership in this space, acting as a facilitator, custodian, and coordinator. Such collaboration not only prevents duplication of effort, but also strengthens the integrity and credibility of the European Statistical System as a whole. In a digital age where public trust in data collection is both fragile and vital, a unified approach (technically, legally, and ethically) is not just beneficial, but necessary. Only through shared governance can the vision of scalable, secure, and respondent-friendly smart surveys be sustainably realized across Europe.

In conclusion, the SSI project has provided the European statistical community with a blueprint for moving forward. The key now lies in transforming this blueprint into a working, evolving system—one that is technically sound, legally robust, methodologically rigorous, and trusted by the public. With continued cooperation, investment, and leadership, the vision of a shared, scalable, and sustainable smart survey infrastructure can become a reality—one that supports the production of high-quality, modern statistics for years to come.

4. Communication of Project Achievements

In March 2024, a dedicated project site Smart Survey Implementation was published on the new Eurostat CROS portal: https://cros.ec.europa.eu/dashboard/trusted-smart-surveys. All deliverables, 16 in total, are published on this project site. Besides the final deliverables, also general information, the presentations and demos of the informational meetings and final conference and also available.

Early February 2025, the factsheet describing Trusted Smart Survey was published on CROS as part of the ESS Innovation Agenda portfolio: https://cros.ec.europa.eu/book-page/trusted-smart-surveys. This factsheet was made by Eurostat with input from the SSI project.

The source code and documentation of the three developed smart services for Receipt Scanning and COICOP classification, Geo Service including mode of transport and HETUS classification and Energy Usage are made available as open source via Github.

Presentations and conferences

During the project several meetings were organised to promote the work of the SSI project, both internally and externally. Five informational meetings were organised in 2023 thru 2025. During these sessions presentations and demos were given to update the audience on the status of the project. All sessions were well-visited by interested parties within and outside the consortium.

The project and the results were presented at 13 conferences, including dedicated sessions on the Q2024 conference in Estoril, Portugal, the NTTS2025 conference in Brussels, Belgium and will be presented at 3 more conferences after the project has finished, like the upcoming ISI WSC 2025 conference The Hague, The Netherlands.

On June 17th, the results of the SSI project with a main focus on the methodology part were presented during the Working Group on Methodology in Luxembourg.

Part 2: SSI Smart advanced stage – Governance

During the SSI project, two overall[1] services were developed and tested in various field test and usability tests. These services can be used and integrated in an end-to-end flow supporting the applicable smart surveys. The related microservices are provided as open source under the EUPL v1.2 license, which implies that the software can be freely installed, used and even modified[2] by anyone. This ensures that NSIs and other interested parties can freely use this code and integrate these services within their production systems. This does not guarantee however that all NSIs will be using the same version of the services and share their experiences and new developments on these services. More agreements are needed to achieve the ESS goals on standardization and harmonization.

The two more mature services that are released are:

- Receipt scanning service
  This service receives an image of a receipt, it then scans this picture, derives all the text, determines the labels and returns the information detected, like the name and price of each article. The service uses several machine learning models. These models have to be trained per country, per language, and even per type of shop in order to correctly process the content of the receipts. The more the models have seen annotated tickets per country, per language, per shop the better it recognizes the different parts and the related information.

  There is also a COICOP (classification by individual consumption by purpose) module that predicts a COICOP code for a given product name. This module will also be released as part of the microservice, but is still experimental and these features are not yet integrated.

  This microservice has been developed to improve data collection related to household spending, and has been integrated into several national experiments with the Household Budget Survey (HBS).

- Geo service

  This service receives various geo-points (gathered through the app that the respondent installed) and it then derives stop and track (route) clusters, the mode of transportation and the stop motive. Even though the latter two modules will be released, these are still experimental and not integrated yet in the microservice.

  This microservice has been developed to improve data collection related to time use, and has been tested in several countries to improve the Time Use Survey (TUS).

[1] Note that these services are actually a combination of several separate microservices (for example, the receipt scanning and COICOP microservices).

[2] Note that if the software is redistributed, the software and its modifications are still considered free open source and the original authors should be mentioned.

This microservice has been developed to improve data collection related to time use, and has been tested in several countries to improve the Time Use Survey (TUS).

Even though both services are now released and can be used freely, there is still room for improvement, and actions how to train the models need to be defined. To align these developments, governance is needed. Effective governance ensures that the outcomes of the project remain impactful and that the collaboration between the eleven parties transitions smoothly into a sustainable operational model.

Governance refers to the framework of rules, practices, and processes by which further developments are directed and controlled. It involves the decision-making structures, roles, and responsibilities that ensure sustainability, effectiveness, and alignment with its goals after its formal conclusion. As this is on the ESS level, other NSIs outside the current project consortium could join.

Note that this chapter does not express our governance view as gathered by all the experiences of the individual NSIs, but rather a governance view in isolation of the experiences within this project. Some of the conclusions might contradict viewpoints of a given NSI.

Components in scope

Before governance can be discussed, we first need to look at the components that are in scope. The (micro)services presented are just a piece of the puzzle. Looking at the broader picture, five components can be identified: apps, collection platforms, services, methods, and knowledge.

1. App (front-end)[3]

   Looking at the studies (like HBS and TUS) and the services developed, the related smart surveys are supported via apps, which interact with the respondents using a diary approach. The app can be downloaded from the app stores. This can be a dedicated app specifically made for a specific study. Or an agnostic app, which is fed with a design (read: configuration designed with and received via the collection platform) that tells how the app should respond the moment a user logs in.

   An example of a dedicated app is the @HBS app, initially developed by CBS for their HBS survey and of which the code is used by several NSIs to create their own version of the app. This app supports mainly the frontend and requires integration with the in-house data collection systems for the backend processing.

   An example of an agnostic app is the MOTUS app, developed and provided by hbits. MOTUS consists of a platform and an agnostic app. The MOTUS platform supports the data collections processes (see collection platform) and designing how the app should

[3] Depending on the type of smart data, this can be both a mobile and web app.

function for a certain survey. By this, the (same) app can be used for TUS, HBS or other studies and questionnaires. The agnostic MOTUS app receives this design, which tells the app how to interact with the respondent. This app is used by several NSIs.

An app can be part of the smart collection platform, or developed by the NSI itself, a consortium[4], or an external party as custom work for the NSI. Advantages of an external party is that because the construction and management of app development are outsourced, the NSIs can focus on the core, namely the services with which the data is collected and the quality of the final statistics is determined. Advantages of local development or via a consortium is that there is no dependency on an external party. Note however, that often there are still dependencies between internal departments.

The advantage of an agnostic app is that the medium and content are separated. Development and maintenance costs are saved because a separate app does not have to be created for each specific study. In addition, this offers the option to outsource the app development to a specialized party and to keep the substantive development of (micro)services and the algorithms that are included within the NSI. The disadvantage is that such an app is more complex, because it must be more generic than a dedicated app. Thus, the development of such an app takes more time and effort. This option is therefore mainly useful when scalability over studies and over NSIs is important, taking into account standardisation as well as country variations (via configurations).

2. Collection platform

The collection platform consists of the internal systems that are needed to arrange the logistics around the data collection. Thus supports activities and information about which respondents need to be approached when and by with which means (distribution of letters, questionnaires, etc.), in which mode and with which this approach can actually be carried out. Note that pre- and post-processing steps of statistics production, like sampling, are out-of-scope for the collection platform as presented here and are supported by other processes and systems in our governance view.

Most NSIs already have such a system in place for current collection processes. However, the question is whether these systems can be adapted easily to support the collection of smart surveys. For example, at CBS the collection system supports each mode via a dedicated channel. In order to support collection using apps, a new (app) channel had to be implemented. Even though the architecture supports this, it was still a delicate and time-consuming operation. Another option is of course to implement a new dedicated collection system to support smart surveys.

Regardless, there is also the choice whether to develop dedicated apps per type of survey (like HBS or TUS) or to develop an agnostic (or generic) app. In the latter case, the

[4] Consortium: a group of NSIs, and possibly an external party, provides services to other NSIs

collection platform needs to be able to create a design that the app then receives and executes. In the design you can record the flow and set/configure all kinds of parameters, such as the look-and-feel, branding, observation period, use/no use of services, classifications to be used, etc. In view of the high development costs, building and managing such a platform can in principle only be done by an external party that specializes in this. Dedicated platforms (like MOTUS from hbits) support agnostic apps by default, allowing to support different apps for different surveys using the same platform (code base).

3. Services (backend)

   A service is a kind of packaging for the method/algorithm that can be read and called/used by an app. For example, the receipt scanning service includes cutting out receipts (recognizing contours), Object Character Recognition (OCR) to read texts and document understanding to map those texts (is it a store name, an article name, a price, a quantity, etc.). These are three modules combined into one service, where the service is an IT service that can be used (indirectly) by the app.

   Services can be built and managed by an external party, a consortium or locally. The disadvantage of investing in an external party is that the knowledge about development is then also external, unless an open source license has been agreed upon. Hosting can also be done by an external party, a consortium or locally. The advantage of external hosting or hosting by a consortium is that you do not have to set up and manage servers locally. However, it likely creates data security and legal challenges.

4. Methods (algorithms in services)

   Methods are the algorithms that are implemented (programmed) in the services. Examples of this include text recognition (OCR), document scanning, classification (COICOP), start-stop detection, means of transport detection, stop motive detection, etc. These methods often involve machine learning models, which require training. This methodological expertise lies mainly with NSIs and research partners, such as universities.

   Methods can be developed and managed by an external party, a consortium or locally. Like with services, the disadvantage of investing in an external party is that the knowledge development is then also external.

   The training of machine learning models can also be done by an external party, a consortium or locally. Models are trained with annotated data, which is in best case standardized. Therefore, specific developed tools might be needed and these tools also need to be developed and deployed. The advantage of external training or training by a consortium is that you do not have to set up local facilities for this. The disadvantage is that the data required for training needs to be external, which might be an issue in case of privacy-sensitive data (might require to setup contracts).

5. Knowledge (expertise of smart collection)

   Knowledge or expertise of smart collection concerns the substantive know-how and hands-on experiences about the possibilities of smart collection and how these can be applied in the research designs and ultimately lead to output. This includes the entire process from design, data collection, processing, analysis to the dissemination. This is knowledge that is only available within NSIs (local or consortium, in relation to the specific goals of official statistics). The advantage of a consortium is that you can reuse each other's knowledge and learn from each other.

All components and options together can be depicted as follows:

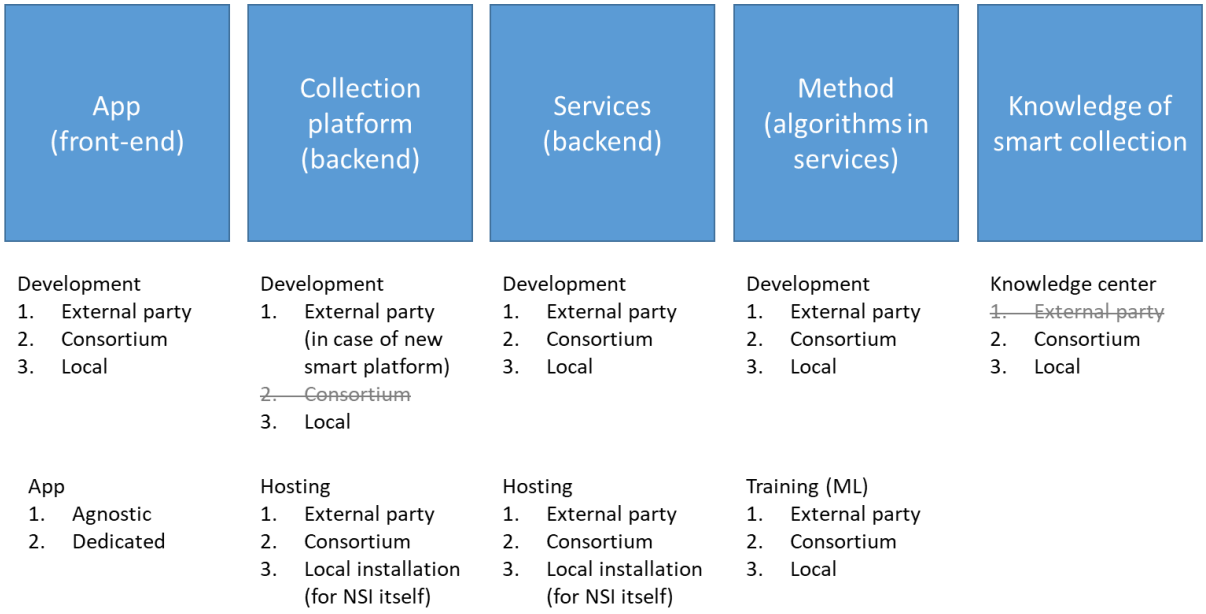

Figure 1: overview of components and options

Scenario's

Looking at the total overview, each NSI can choose between various options to support smart surveys. The most feasible scenarios seem to be:

1. NSI completely supports itself
2. NSI joins consortium to jointly build components and share code
3. NSI joins consortium to jointly build services
4. NSI joins consortium to jointly provide central smart solution

In the next paragraphs each scenario is described in more detail.

NSI completely supports itself

This first scenario is straightforward. The NSI does everything by itself, whereby it still has the choice to involve an external provider for parts of the developments. For each smart survey a dedicated app is developed, including the required services and methods, and any machine

learning models required are developed and trained. The services (to be more precise, the software) developed by the SSI project can be used if desired. To minimise the runtime dependency and the risk of privacy-sensitive data going outside their premises, the NSI could host everything itself (on premise).

From a governance point of view this scenario is very clear: there is hardly any central governance needed. Even though the NSI has its own solution, the experiences and knowledge gained using the smart surveys are shared between NSIs on a need basis.

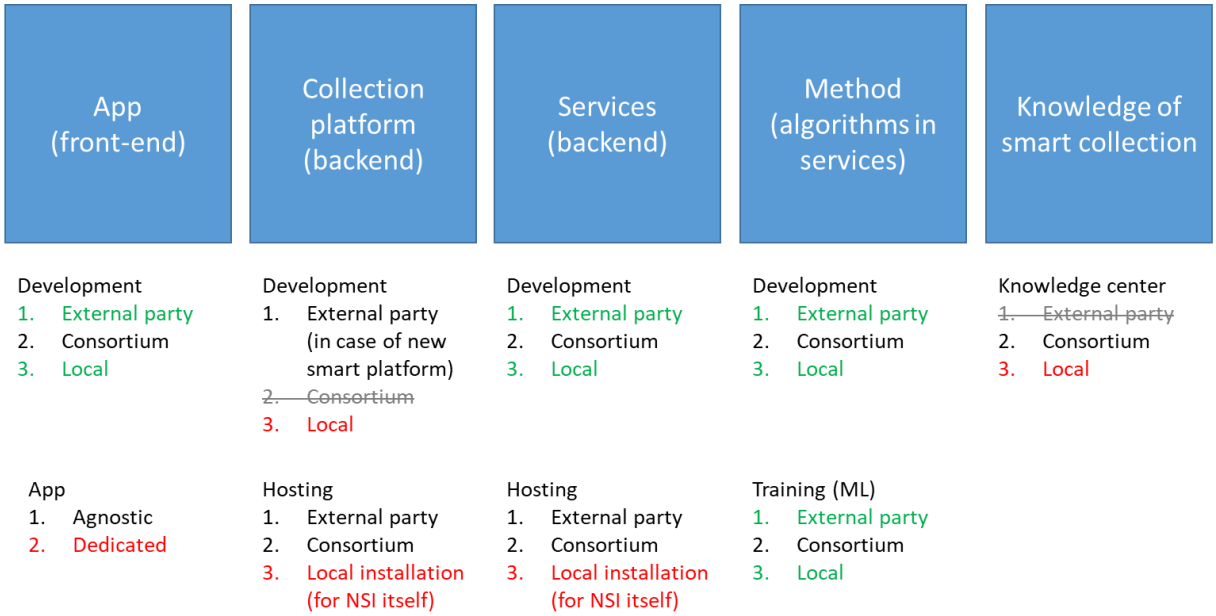

Figure 2: scenarios NSI builds or buys dedicated apps

NSI joins consortium to jointly build components and share code

From a governance point of view, this is the first interesting scenario. In this scenario, NSIs share experiences and also jointly build methods and components and share code. The organisation and processes of the consortium are less formalised. When and where needed the NSIs work together and the results are shared and supported on a best effort.

An example is that In the past, the code of the @HBS app of CBS was shared with INSEE (France) and other NSIs so that they had a quick start. As you can imagine the codebase of for example the HBS app for one NSI is very similar to any other NSI and sharing the code is not only beneficial to the receivers, but also to the providers if they receive feedback (like validation or new ideas).

Another example is that in the SSI project a first COICOP module was developed, which has not been implemented and integrated into a full service yet. Maybe, for some methods it is not needed to have a service, but suffices to share the code. See for example the SNStatComp awesome list, where all kind of statistical components are shared by NSIs and other parties.

These components are provided as open source and can be used freely with best effort support. A similar approach can be taken for developing and sharing smart components.

An NSI still needs to build their own dedicated app, like in the first scenario, but it now can select and use available components and code, which are shared. The more components are available, the less own development is needed. Of course, the resulting smart survey still needs to build, integrated, tested and taken into production.

A consortium of NSIs and other institutes that are interested in and working on smart surveys would still be desired. Within this consortium, you can share best practices and discuss the weak spots. If you have similar problems or ideas, the partners interested can team up and work together on a solution, be it a service, method, component or even some code snippets. The results can be shared, similarly as or even via the SNStatComp awesome list. Per solution you can also decide on the level of governance and support.

Note that the consortium or the individual NSIs should be careful with selling their code and support. It is unclear whether this is legally allowed, because in that case the consortium might be considered a competitor, disturbing the commercial market. There are strict rules and you must demonstrate compliance with these rules every year.

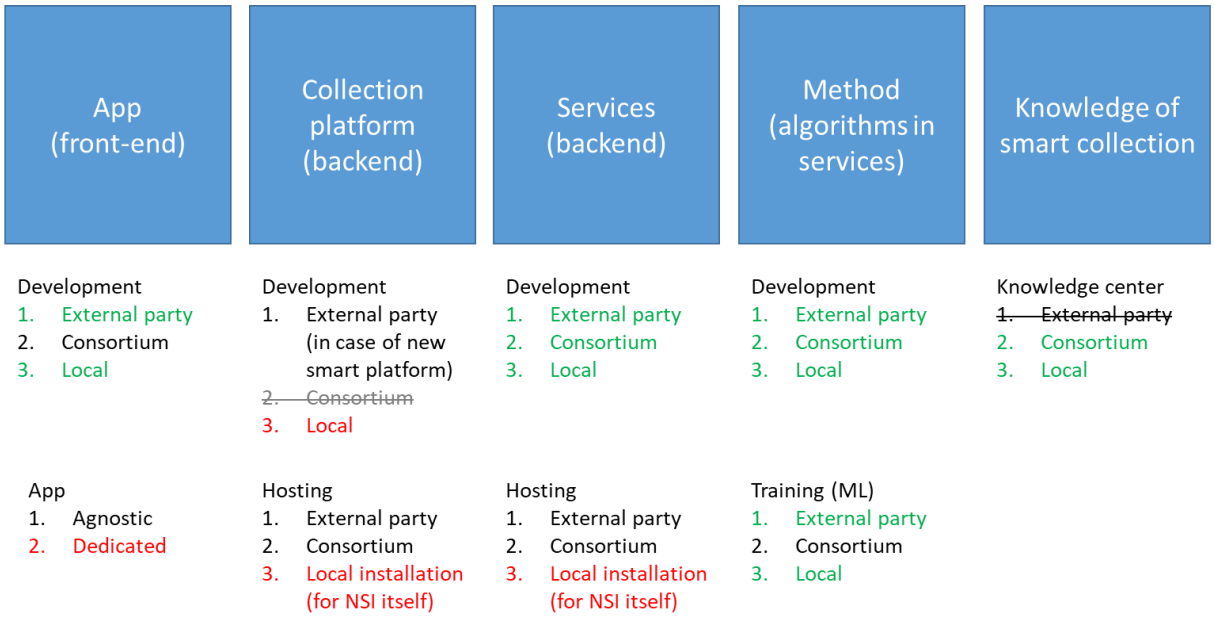

Figure 3: scenario consortium builds components and share code

NSI joins consortium to jointly build services

This scenario has a lot of similarities with the SSI project itself. In this scenario, each NSI makes their own decision on the collection platform and how to develop the apps. For example, during the SSI project, for the HBS survey, Statbel/VUB (Belgium) and Destatis/UMA (Germany) used MOTUS from hbits as their platform with the agnostic apps, while CBS (The Netherlands), INSEE (France) and SSB (Norway)[5] developed their own dedicated app. The services around receipt scanning and geodata however were jointly developed as a consortium[6]. The receipt scanning service, including COICOP, was developed by hbits, CBS, and Destatis, while the geo-service was developed by hbits, CBS, and ISTAT (Italy). Design, development and testing were a joint effort. Hbits coordinated the activities and also took care of the integration of the modules into the specific services. The hosting of the services (deployment strategy) can differ per NSI.

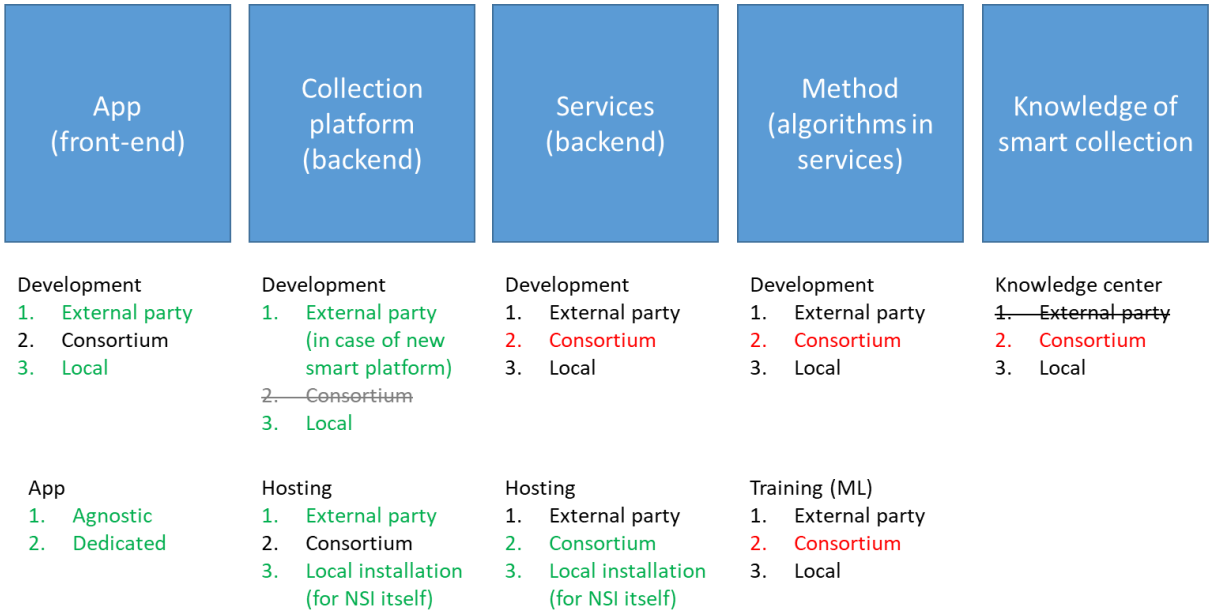

Figure 4: scenario consortium builds services and methods

For the future, it would definitely be beneficial to further maintain (develop, integrate, update, train) these services and new ones (like the energy service) as a consortium. Benefits are to develop these services, methods and machine learning models together (economy of scale), share experiences and do improvements. Also, the training of the machine learning

[5] Note that some dedicated apps did not incorporate the service yet due to timing issues, but all NSIs acknowledged that their architecture would allow to do so.

[6] Note that even though hbits is a commercial party (spin-off of VUB), it was considered and treated as a full member of the consortium with equal rights concerning the developments of the services.

models can be done together[7] and experiences gained can be reused. Otherwise each NSI need to do this by itself, which for sure requires more resources.
There are however also quite a few risks with this governance approach. It is necessary to make good agreements about roles and responsibilities, decision making, budget, resources, code control (deviations), etc. During the SSI project it became clear that not all partners were operating at the same speed and that individual members were bound by internal decision making procedures within NSIs, which caused some friction and tension. These topics are becoming even more important the closer you get to actual production.

For an individual NSI, there is also a certain risk that in case of production issues between the app and the services it is unclear where the responsibility lies of resolving the problem. Contractual agreements, like Service Level Agreements (SLAs), will be required to manage expectations. To minimise the runtime dependency and the risk of privacy-sensitive data going outside their premises, the NSI might decide to host the service themselves.

NSI joins consortium to jointly provide central smart solution

This scenario even goes a step further. Instead of only developing services together, we decide to jointly develop, maintain and support a central smart end-to-end solution. So, basically all activities are shared.

During the project, an example of this approach was how Statbel, VUB, Destatis, UMA and ISTAT performed their field tests and usability tests. They all used the same (similar version) MOTUS platform[8] from hbits, generating the (agnostic) apps needed for their specific tests by specifying the design. The deployment of the platform differed though. Statbel, UMA and ISTAT used a centrally installed platform (see deliverable D3.4 for more information), while Destatis uses MOTUS as a native installation for their own production data collections.

This scenario only seems viable with a consortium that contains an external party that already has such a platform and supports multiple deployment scenarios. Developing such a platform from scratch will take many years and is not an option. In such a consortium you could have a clear division of responsibilities: the external party is responsible for development, containerization and hosting (even though hosting of the different containers could be at different places), while the NSIs are responsible for the method, the machine learning models and the training of these. Benefit for the NSIs is that they share the development costs, but more importantly that they know exactly how the methods work.

---

[7] Note that the machine learning models might need to be trained per country and even per type of store in case of the receipt scanning service. However, if the required training data is obtained, the training of the models themselves can be done centrally.

[8] Note that the MOTUS data collection platform uses the microservices as containerized services. These containers can be hosted on different places, if desired, and can be shared or separated.

Involvement of external parties is usually difficult, because you do not always get insight in the methods applied, thus you do not know how the data used for the statistics has been derived.

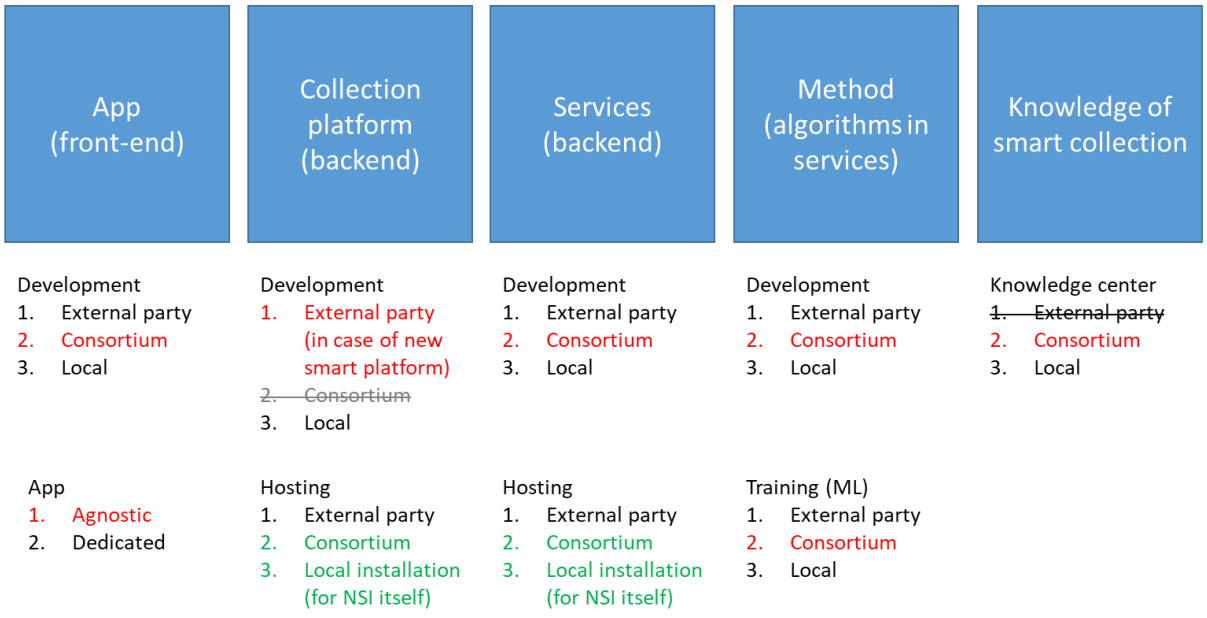

Figure 5: scenario consortium provides central smart solution

Comparison of the scenarios

In order to compare the scenarios, twelve criteria are defined. The four scenarios are scored against these twelve criteria which are explained in the following section. See Table 1: comparision of scenarios at the end of this paragraph for an overview of the scores of each scenario by criterium.

- Control NSI on smart solution

  This criterium shows the degree of control and freedom the NSI has when designing its solution. When the NSI develops the app and services itself or when the app and services are developed by an external party for the NSI, then the NSI is fully in control. This is also the case when the NSI uses shared components that are made available. When smart services are used, the NSI is still in control but preferably should not change the services[9]. Finally, with the smart solution the NSI can tailor its app, but within the functionalities provided by the platform. It might imply that the solutions and UI/UX respondent journey cannot be tailormade completely. There might be a certain base that each NSI shall adopt and dedicated functionalities for the NSI will be limited.

[9] The source code can be changed. This is allowed by the EUPL license, as long as the changes are re-submitted to the repository or open sourced like in a fork.

- Managing smart solution

  This criterium shows the degree of control the NSI has of its full smart solution. Each NSI has already systems in place to which the solution and services need to integrate. For example, an NSI can have its own authentication and authorization service. This service needs to be integrated for the respondents to be able to login. Also, the NSI might require single sign-on for its personnel. And at the end of a survey, the results might need to be integrated in the NSI collection systems. Looking at the different scenarios, the scores are similar to the previous criteria.

- Time to market

  This criterium shows the time it needs in order to get into the field with a new survey. Each survey, there will be some changes compared to last time. Sometimes these changes are minor, but in case of new regulations or new insights these changes can be more major. When the NSI develops the app and services itself or an external party on its behalf, then parts of the app (and maybe even the collection platform) have to be redeveloped and the updated app has to be made available in the app stores. This can be long and tedious process. Note that if a (dedicated) app has not been touched for a few years it may be a very time consuming effort to bring the app back on to level with the recent versions of the programming platforms/languages. The chances are high that functionalities/libraries have to be updated and even replaced.

  With a smart platform the process can be much quicker, assuming that all functionalities required are already supported by the platform. In that case, it is just a matter of redesigning the survey in the platform, and the agnostic app will receive this design (configuration) and act accordingly.

- User self-reliance

  This criterium shows the degree of control and freedom the business users (like survey process managers, questionnaire designers, communication experts, etc.) have to make changes to the app. Or to phrase it differently, has the IT department to be involved to make these changes. Looking at the different scenarios, the scores are similar to the previous criterion, which is not strange because the more the user can do herself, the faster you can get into the field.

- Knowledge of developing apps

  Designing and developing apps requires a specific skillset. The user experience is key and the programming languages and environment differ. The requirements set by the Apple store and the Google Play Store should be known and taken into account[10]. Also the process to put the app into these stores should be familiar. For NSIs, it is difficult to gain and maintain these skills. Also, because an NSI does not have many apps, it will be difficult to have enough people on board to guarantee a certain level of service.

[10] Note that new requirements are added frequently and get into effect within a short time period (months rather than years).

External parties can specialize in app development and are much better equipped to develop apps. A consortium for a smart solution can specialize and invest more in app development due to its scale.

- Share experiences and reuse

  One of the goals of the SSI project was to share our experiences and turn these into open source services that can be used by anyone. Any consortium has the same objective: share experiences and make it to the better good. In the first scenarios the NSI is on its own. Of course, it can share its experiences, but this will be more or less on an ad hoc basis. For the consortium scenarios sharing is the default behaviour and attitude, which becomes even stronger the more is at stake (read: used in production).

- Output harmonization and comparability

  One of the main drivers for going smart is data quality, not only for an NSI, but may be even more important across countries and in time. Thus, how comparable are the statistics. Important aspects of output harmonization and comparability, but also transparency and reproducibility, are the standardisation of the (collection) processes and methods. If each NSI takes care of its own solution, output harmonization and comparability are more difficult and can be reached by making sound definitions and agreements on the output expected. The more NSIs work together, like in case of a consortium, the more the processes and methods become standardised and the less difficult output harmonization and comparability becomes.

- Integration with other modes

  How easy would it be to integrate a smart solution with the predominantly non-smart regular data collection, in particular interviewer assistance. So far, response rates within SSI have still been very low. This hints at concurrent non-smart alternatives and personal interviewing elements.

  In order to be able to use and switch between modes, the NSI will likely need to integrate the smart solution with its collection environment. When the NSI takes care of the whole solution or when a consortium creates only services, this can be achieved more easily than when a consortium creates a platform. This depends highly on the openness (integration possibilities) of such a platform and the possibility to share survey data (switching between modes).

- Legal and privacy aspects

  When the NSI takes care of the whole solution, there are no specific legal or privacy aspects other than the usual ones. When the NSI involves an external party to develop and support an app, this can be covered by normal contracts and service level agreements. For this scenario, almost no additional effort will be needed to comply.

In case of a consortium, the ownership and accountability is unclear. It can be nobody or everybody within the consortium. To resolve this, it might be needed that the consortium becomes a legal entity, but for some NSIs that might be a reason not to join the consortium. In the last scenario, there might be an external party that is part of the consortium. In that case, this external party could serve as the formal party. But also in this case, good arrangements need to be in place.

Another aspect that is unclear is who owns the intellectual property and for what part of the software (apps, services and platform). We assume that new services will still be available as open source, but that is up to the consortium to decide. Note that updates of the current services should be shared due to the EUGL.

When the service or the solution is hosted, also privacy aspects become important, especially when privacy-sensitive data is involved. Looking at the surveys HBS and TUS and the receipt scanning service and geo-service, one can only conclude that this is privacy-sensitive data. As a countermeasure, the services can be made 'dumb' (which is the case with the SSI services) by not transferring identifications. For the data within the platform many security measures can be taken, but it is still the question whether the NSI allows this data to be external, not residing at its own premises.

- Roles and responsibilities

  As more parties become involved, the need to define clear roles and responsibilities becomes greater. For example, who takes care of the specifications, development, testing, deployment, but also communication, support, hosting, monitoring, etc. For any consortium these are valid questions. Especially, if no payments are involved, you want that each partner takes its share in the activities.

  Another important aspect is decision making. Who can make decisions, at what levels, and how are these decisions taken (by consensus, voting, or delegation). One question is who decides which functionalities will be supported. Are only generic functionalities supported, or are also specific functionalities supported, even if it is for one NSI only. An option would be that each partnering NSI has a certain amount of credits (defined as a certain development effort) that can be used for specific functionalities.

- Initial costs (capex)

  For each scenario, initial costs are involved. Developing a first app takes a lot of time and requires many resources. Not only the app and its services need to be implemented, but it also has to be deployed (hardware) and integrated in the environment, for example, with the collection system and the authentication and authorization service. This can easily take several man-years of work. Starting with an existing solution/platform (last scenario) might speed up things, but it still needs to be integrated at the NSIs.

  Setting up a consortium addressing all organizational and legal aspects also takes time and effort. Especially if there is no financing, because each partner should then have the belief in the benefits and the courage to take care of the capacity needed.

- Operational costs (opex)

  After the initial implementation has been taken care of, the operational costs varies per scenario. When the NSI supports itself, possibly by involving an external partner, it need to assign dedicated capacity to maintain and develop (new) apps. For example, CBS has adopted agile working and these responsibilities are assigned to a dedicated Agile team. A regular Agile team consists of six fulltime persons. Note that each NSI needs to make these costs and these cannot be shared.

  The costs for maintenance of smart services seems low. From time to time the machine learning models need to be retrained, but that applies to all scenarios. When new functionalities are required these costs can be shared. The main costs are still made to update or develop (new) apps, so the first three scenarios are comparable.

  Looking at the last scenario, the scale of economics comes into play. Operational costs can be shared among all partners. It all depends on the cost model of the involved external partner. For example, hbits has a cost model for the MOTUS platform consisting of a fixed yearly fee per NSI for using and maintaining the service and a yearly fee for providing new functionalities. The latter fee will be lower per NSI the more NSIs use the platform. In comparison with the first scenario, the total costs are just a fraction.

Other aspects are also important but are not included as criteria, because regardless of the scenario these should be taken care of. For example, as explained previously, NSIs need to know how data is collected, thus the exact methods need to be known. If the dedicated apps or the smart services are provided by a consortium or a smart platform is used, the methods need to be transparent to all NSIs.

Criterium	1. NSI supports itself	2. Consortium share code	3. Consortium smart services	4. Consortium smart solution
Control NSI on smart solution	+	+	o	o
Managing smart solution	+	+	o	o
Time to market	-	-	-	+
User self-reliance	-	-	-	+
Knowledge of developing apps	-	o	o	+
Share experiences and reuse	-	o	+	+
Output harmonization	-	o	+	+
Integration with other modes	+	+	+	o
Legal and privacy aspects	+	+	o	- [11]
Roles and responsibilities	+	o	-	-
Initial costs (capex)	-	-	-	o
Operational costs (opex)	o	o	o	+

Table 1: comparision of scenarios
Scores are + (postive), o (neutral) and - (negative)

[11] In case the consortium solution are locally installed then the privacy aspects can be treated as usual and the score could be higher.

In summary, the four scenarios show distinct advantages and disadvantages along the twelve selected criteria. While, none of the scenarios can score positively on all criterions, based on a count of the total number of positive scores, a consortium providing a smart solution (scenario 4) seems to be the most promising approach.

However, depending on weighting of the twelve difference criteria, a given NSI might arrive at different conclusions. For instance, if legal and privacy aspects outweigh all other aspects and impose a blocker criterion, then this NSI will always have to adopt a NSI-specific development (scenario 1, 2 or 3).

Looking at the experiences within the SSI project it is clear that developing services together is beneficial but also challenging. There was a lot of knowledge and experience in the project, resulting in two generic services with sound methodology. The partners that were using the smart platform (scenario 4) had the advantage that the services and functionalities developed could be used without spending much additional effort, allowing to concentrate on designing and setting up the survey.

Based on these experiences, the recommended way forward seems to be to setup a consortium to jointly provide a central smart solution (scenario 4). This however is easier said than done. The roles and responsibilities and legal and privacy aspects require much more attention. And the NSIs that currently have their own solutions must be prepared to let them go in order to join this consortium.

Regardless the choice, the role of Eurostat is very important to promote and support smart surveys. Investments in smart services remain essential as technology continues to evolve at a rapid pace. To fully harness these opportunities, collaboration between NSIs and other research partners is crucial. By sharing expertise, data standards, and best practices, NSIs can improve data quality, enhance efficiency, and address privacy concerns more effectively. Joint efforts will ensure that statistics keep pace with technological advancements, providing reliable insights for policymakers and the public.

Part 3: Project coordination

1. Introduction

Work package 1 (WP1) covers the general and financial management, coordination and administration of the Smart Survey Implementation (SSI) project, in addition to communication and dissemination. This deliverable is the smart baseline stage report for the project as a whole. The report covers both the outputs of the project so far and the inputs (resources) used in the project. For both, the grant agreement is the main reference, but where there have been changes in the deliverables and milestones foreseen, or in the associated resources, this will be specified in this report.

To manage the project there are three steering levels for monitoring issues, risks, realization of the budget and the progress of the project and the fourth level is to keep everybody informed:

- Steering level one are the operational meetings per work package organized by the project leader of the work package.
- Steering level two is the overall project management meeting, which includes the WP leaders, the project officer, and the liaison officer of Eurostat. The meeting is organized by the Project Coordinator.
- Steering level three is the core team meeting, which includes representatives from all partners, and is organized by the Project Coordinator.
- The fourth level is to keep everybody informed on what happens in the project and the work packages and is organized by the Project Coordinator.

Besides the more formal meetings, also several meetings were organised and conferences attended to promote the work of the SSI project internally and externally.

Concerning the inputs (resources) of the project used so far, the report gives information on what has been spent by each WP and organisation involved, in order to be able to assess whether this is reasonable compared to the progress made so far. The resources spent should neither be too high nor too low, given the current stage of the project.

The structure of this report is simple. The next chapter (chapter two) describes the organisation of the project. Chapter three describes the realization of the deliverables of the project so far, including changes that were deemed necessary after the start of the project. In addition to the deliverables, milestones are also briefly looked at. Chapter four describes the resources spent so far and our collaborations.

2. Organisation

Project structure

The SSI project consists of five work packages:

- Work package 1: Coordination and integration
- Work package 2: Methodology
- Work package 3: Developing micro services
- Work package 4: Logistics
- Work package 5: Legal

Each work package has a work package leader, who is responsible for managing the work package. This involves managing the participants of the work package and ensuring that the products and deliverables are created and delivered on time. The goal of the operational meetings of the work package is to discuss, plan, review and manage the progress.

Work package 1 takes care of the overall coordination and is responsible for the resources, budget and the overall communication. Also the cross-national perceptions survey belongs to this work package.

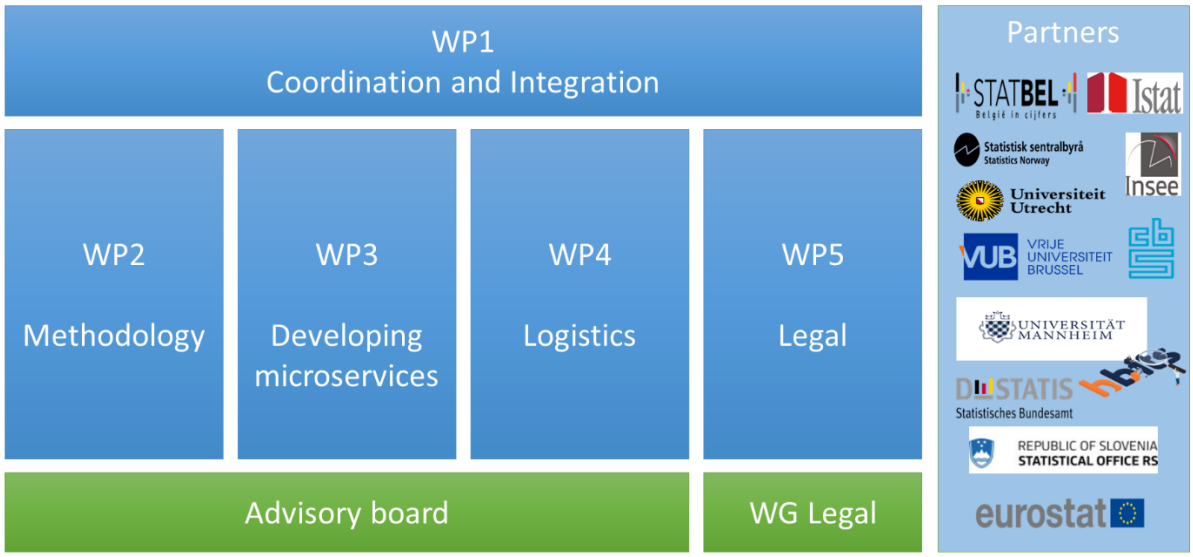

Figure 6: SSI project organisation

The project structure can be depicted as shown above. The people mentioned form together the project management team, which consists of the work package leaders, the overall smart survey expert, the overall project manager, and the project officer. Also the liaison officer of Eurostat is invited to the monthly meeting. The goal of the project management meeting is to monitor the progress of the work to check whether we are still on time (deliverables) and within budget, to monitor dependencies between the work packages and to resolve issues (risks), and detect issues that should be discussed in a broader audience or elsewhere.

Participants from eleven partners participate in the project and work packages. The core team consists of representatives of all partners and the project management team. Bi-monthly the core team meets and the goal of the meeting is to discuss and decide on issues that may affect partners, for example budget, capacity, risks, etc.

The project is supported by external advisors (see advisory board).

Project meetings

To manage the project there are three steering levels for monitoring issues, risks, realization of the budget and the progress of the project and the fourth level is to keep everybody informed:

- Steering level one are the operational meetings per work package organized by the project leader of the work package.
- Steering level two is the overall project management meeting, which includes the WP leaders, the project officer, and the liaison officer of Eurostat. The meeting is organized by the Project Coordinator.
- Steering level three is the core team meeting, which includes representatives from all partners, and is organized by the Project Coordinator.
- The fourth level is to keep everybody informed on what happens in the project and the work packages and is organized by the Project Coordinator.

For the monthly project management meetings and the bi-monthly core team meetings minutes are created, reviewed, approved and circulated to all project members and parties interested.

At the start of the project, a kick-off meeting has been organised on May 22nd and 23rd, 2023 in Brussels with representatives from all partners and parties interested. During this meeting the objectives of the project and each work package were presented and discussed in more detail. All presentations given and the minutes of the kick-off meeting (26 pages) are available and were circulated.

Besides the more formal meetings, also several meetings were organised and conferences attended to promote the work of the SSI project internally and externally.

Advisory board

In order to advice the work packages and review their deliverables, two independent external advisors are contracted per work package for the work packages Methodology (WP2) and Developing micro services (WP3) and three for the work package Logistics (WP4). Together they form the advisory board. Note that the work package Legal is supported by the working group Legal.

Consortium agreement

In the Grant Agreement (GA) it is stated in the data sheet that for this project a Consortium Agreement (CA) is required. From the start of the project, it took almost nine months to create a CA that was acceptable to all parties and their legal departments. Finally, on February 13th, 2024, the CA was signed by all parties.

Project amendment

Late 2024 it became clear that some activities could not be completed within the project timelines. After discussing the situation with Eurostat and all partners, an amendment was submitted on February 13th, 2025. The reason for the amendment was that we concluded that it was no longer feasible to conduct the (HBS) field test by CBS in The Netherlands nor the (TUS) field test by ISTAT in Italy within the current timelines of the project. We considered extending the project by 6 months, but due to the financial implications (cashflow) for some of the partners, this was not an option.

The delay of the field test by CBS was mainly caused by the internal systems. A few years ago, a successful field test was conducted with the @HBS app. This field test was performed outside the production environment. For legal and policy reasons, the SSI field test had to be performed within the production environment. This required that the collection platform had to be extended with an app channel. Furthermore, the receipt scanning service had to be deployed in the new Kubernetes cloud environment. These unforeseen activities took so much time that the deadlines to be able to perform the field test within the SSI timelines were no longer met.

Please note that CBS still plans to perform the field test in 2025 (outside the project) and that the results will be shared with Eurostat and the SSI partners.

The delay of the field test by ISTAT was mainly caused by unforeseen legal requirements. The national authority in Italy mandated that the field test had to be approved by them. This approval process is very difficult, precise and time-consuming. The submission and processing of such a request has a lead time of two to three months. In addition, the tendency to receive very detailed information (DPIA) was very time-consuming. Although the required information has been collected and the request can be initiated, it would take two/three months before the field test can start. As a result, the field test could not be completed, let alone analysed, within the current timelines of the project.

Please note that the pipeline for the (TUS) field test is installed, configured, tested and almost ready for use. During this process a lot of experience and knowledge has been gained. ISTAT still desires to perform the field test in 2025 (outside the project) and are investigating the possibilities.

Resources and budget

The project spent much more resources (especially capacity) than anticipated. This is not surprising, because development activities and field tests are generally difficult to plan and depend on many other internal departments and resources (such as interview capacity). From the beginning, the planning was tight and all small delays together meant that there was actually not enough time at the end of the project and we had to decide to cancel the field tests in Italy and The Netherlands. Note that both ISTAT and CBS are still planning to perform these field tests, but only after the project has finished.

3. Project results

Project deliverables

At the time of writing this document, the SSI project is almost finished. This report describes the progress of the project so far, by summarizing the results achieved, relating these results to what was required and specified in the grant agreement. Concerning the deliverables, as a rule, the deliverables of the SSI project are sent for review to all WP leaders and applicable advisors, before they are delivered in their final form. All deliverables of the smart baseline stage have been delivered on time.

Project milestones

There are only five project milestones defined across the work packages for the entire project:

- Kick-off meeting in May 2023
- End of review stage in October 2023
- End of smart baseline stage in June 2024
- End of smart advance stage in April 2025
- Final closing workshop in April 2025

On May 22nd and 23rd, 2023, a kick off meeting was held in Brussels with representatives from all partners and Eurostat's liaison officer. During the meeting, the overall project planning, the project organization and each of the five work packages were presented and discussed, which gave everybody a good overview of the project. The presentations and meeting minutes were circulated and are available upon request.

Closing workshop

On 3 and 4 April 2025, the closing conference and workshop took place in Heerlen, The Netherlands. The workshop was attended by 45 participants from various countries. In the first part of this document, more information on this event is provided and in the appendix the minutes and pictures of the results of the SSI conference are included.

Dissemination via informational meetings and project site

During the project several meetings were organised to promote the work of the SSI project, both internally and externally. Important to mention are the five informational meetings held on October 20th, 2023, March 22nd, July 5th, November 22nd, 2024, and February 21st, 2025. During these sessions, presentations and demos were given to update the audience on the status of the project. All sessions were well-visited by interested parties within and outside the consortium, including participants from Austria, Finland, Latvia, Luxembourg, Sweden and the UK.

In March 2024, a dedicated project site was published on the new Eurostat CROS[12] portal. Besides general information, also the final deliverables and the presentations and demos of the informational meetings and final conference and the are available.

Early February 2025, the factsheet describing Trusted Smart Survey was published on CROS as part of the ESS Innovation Agenda portfolio: https://cros.ec.europa.eu/book-page/trusted-smart-surveys. This factsheet was made by Eurostat with input from the SSI project.

Dissemination via conferences

During the project, the SSI project results were presented at several conferences:

- LIX SIEDS (Italian Society of Economy, Demography and Statistics) Annual Scientific Meeting, 25-26 May, 2023 in Naples. One paper where the methodological and data collection issues related to smart surveys are discussed and how Istat is supporting the SSI project;
- ESRA 2023 (European Survey Research Association) conference from 17-21 July, 2023 in Milan, Italy. During this event several SSI presentations were given, including an invited talk at plenary on the future of survey research post-pandemic.
- ODISSEI conference on November 2nd, 2023 in Utrecht. A one-day large event where two papers were presented. One paper on where smart survey maturity was presented and discussed. One paper where preliminary results from the SSI perceptions survey from NL were presented.
- 2nd Workshop on Methodologies in Official Statistics, 6-7 December, 2023 in Rome. One paper on methodological issues and challenges of smart survey and the involvement of Istat in the SSI project.
- European Master in Official Statistics. Webinar given on smart surveys on 14 February, 2024. See https://www.emos-events.com/webinar-peterlugtig.
- MASS 2024 workshop, March 6th and 7th, 2024 in Washington DC, USA. Mobile Apps and Sensor Surveys workshop, where the first results of the SSI perception survey were discussed.
- Q 2024 conference from 4-7 June, 2024 in Estoril, Portugal. There was a dedicated speed talk session on the SSI project. Furthermore, there was session on smart surveys, where five presentations were given by project members on the SSI project.
- 15th CNS (National Conference of Statistics), 3-5 July, 2024 in Rome. A presentation was given on smart surveys, methodological issues and challenges, as well as the involvement of Istat in the SSI project. And a poster was presented about the SSI project and some results from the Italian perception surveys.
- 46th International Association for Time Use Research Conference from , 7-9 October, 2024, in Corfu, Greece. A presentation was given with the title "Leveraging Modernization of Legacy Surveys - Insights on Onboarding and Modes from an Experimental Time Use Survey with MOTUS by Statistics Belgium."

[12] https://cros.ec.europa.eu/dashboard/trusted-smart-surveys

- Online panels and mixed mode surveys workshop on October 16th, 2024 in Ljubljana, Slovenia. The SSI project and the results of the national SSI perceptions survey were presented and discussed.
- 13th colloque francophone sur les sondages (French-speaking conference on surveys), on 5-8 November, 2024 in Esch-Belval, Luxembourg.
- NTTS 2025 conference from 11-13 March, 2025 in Brussels, Belgium. There was a dedicated session to present the results of the SSI project.
- DAGSTAT conference on 'smart surveys', from 24-28 March, 2025 in Berlin, Germany. An invited talk was given.

Even after the project officially has ended (April 30th, 2025), the results will be presented at various conferences. For some conferences the proposal are already accepted, for others these are in the process of being submitted:

- ESRA 2025 conference from 14-18 July, 2025 in Utrecht, The Netherlands. Our proposal has not been submitted yet.
- ISI WSC 2025 conference on 5-9 October, 2025 in The Hague, The Netherlands. Our proposal for a dedicated session on smart surveys and results from the SSI project has been accepted.
- Journées de méthodologie statistique (JMS) on 25-27 November, 2025 in Paris, France. INSEE plans to presents the results of the SSI project.

Appendix: Minutes SSI final conference

Opening 3 April 2025

Welcome

The SSI conference was opened by Joost Huurman, Deputy Director-General at Statistics Netherlands.

Joost welcomes all participants and emphasizes the importance of innovation and the collaboration between academia, NSIs and in this project even a commercial partner.

Research and innovation are needed not only for new resources, methods but is also important to maintain and enrich the quality of (some) statistics.

Research and innovation on using smart features is complex, difficult and expensive. It is also very hard to determine what the added value is for an NSIs or statistics in general but we are getting more towards that point.

About the last ten years Statistics Netherlands invested much and continues to do so in future to get more clarity within this field.

Joost wishes everyone a pleasant and fruitful conference.

Agenda and goals of this workshop

Remco also welcomes all participants (45) and gives a summary of the agenda and the expectations of this conference.

Perception survey

Results perception survey presentation by Janelle

The main question is:

How does the general population think about smart features?

The survey was done to find out if respondents are willingly to adept smart features, find clues for strategies and get background information for legal and ethical matters.

The perception survey was held in three countries, Italy, Slovenia and The Netherlands in a two-step survey.

First a paper questionnaire on digital skills, willingness towards smart data collection and second followed by an online 'smart' survey including four smart tasks; share location, share step count, share receipt and share meter reading of water, electricity and gas.

Conclusions and next steps

Conclusions (not limited)

- While participation in the general survey varied across the three countries, the participation rate in the smart survey was very similar, namely around 20%.
- Both hypothetical and actual willingness vary across the countries and are not always consistent (Note that survey was experimental by nature and surveys design not fully comparable).
- Willingness to do smart tasks depends on the context and logic of the request.
- Strongest hesitations come from concerns about data security and (consequently) privacy.

Next steps
Next to review and revise interview tactics, recruitment materials and in-survey help options also inform legal officers.

Q and A
Question
What is the definition of the participation rate?
Answer
It is about the response rate of the willingness between the hypothetical tasks in the paper questionnaire versus the smart questionnaire.

Question
Could this apply that we have to choose our battles as there is more reluctancy in different NSIs?
Answer
It is not really choosing your battles, the characteristics are quite similar but there is some bias in the results, a group willing versus not willing to go smart. We have to alter our tactics in how to convince them to go smart, to understand why respondents not going smart and there also the aspect of privacy.

SSI overall findings per WP

Methodology results WP2 by Peter, Theun, Florian, Claudia and Danielle
Various presentations on the overall results including the field tests and usability tests so far. There are four subtasks within this work package:

- How do we recruit respondents successfully for smart surveys?
- How should we use Machine Learning to use smart data successfully?
- Issues of User Experience & User Interaction. How do we let respondents interact with smart data?
- How do we combine data from smart surveys with traditional data (web or paper dairies)?

To get answers to these questions small- and large scale tests are done in different countries, smart data collected is reviewed and models are (re)trained.

Subtask 1: How do we recruit respondents successfully for smart surveys?
Recruitment experiments were carried out in Belgium, Germany and Norway as part of large field tests with smart surveys on HBS (Germany, Norway) and TUS (Belgium). In Belgium and Germany the MOTUS app was used and Norway used their own smart app.
Because of the different studies in different countries the results were sometimes hard to compare.

Conclusions (not limited)

- Huge differences between countries.
- Hesitation at respondents to go smart, different perception, privacy.
- There is a more positive effect when interviewers are used.
- Influence of bias.

Subtask 2: How should we use Machine Learning to use smart data successfully?
The use of Machine Learning (ML) and algorithm for smart data processing is a time consuming activity. Next to methodological research the acquisition of (smart) training data and testing takes a lot of effort. The importance of training and testing must not be underestimated.
In this project a pipeline is developed from input of smart data, process using ML models or unsupervised algorithms leading to output tentative or committed data (simplified).

Conclusions (not limited)
- Models can be improved when you train and test them more.
- The quality of the input data is important.
- There is a need for country specific models.

Subtask 3: Issues of User Experience & User Interaction. How do we let respondents interact with smart data?
Studies on usability tests in different countries (Belgium, Germany, Norway, France , Italy and The Netherlands) concerning Receipt Scanning microservice and the Geo-service microservice are done with the use of the MOTUS platform or with the developed apps at the NSI.
Respondents got a think aloud test, a harmonised task list/sample (receipt scanning), a TUS/mobility survey, a harmonised post-use interview/sample.
In principle respondents are used to smart features when you think about banking, using apps for taking a picture to upload your license for instance. So they also have expectations about a smart feature like a fast processing time, accuracy, easy to use, not too many notifications, it must be supportive not controlling (privacy).
Conclusions (not limited)
- Take notice of what respondents expect or not expect.
- Train the microservice.
- Communicate with the respondents.
- Offer alternatives for paper receipts.
- Add and train classification algorithms.
- Smart microservices also needs to be clever.
- Smart microservices lower respondent burden but not the complexity of survey.

Subtask 4: How do we combine data from smart surveys with traditional data (web or paper diaries)?
Looking at the TUS survey in different modes, by paper or by web tells us that the differences are large. Also a distinction is made in age, education and employment.

Conclusions (not limited)
- There are significant differences in overall response rates across key variables.
- There are significant differences in mode-specific response rates.
- There are no-significant differences in mode-specific response rate across key variables.
- The differences are likely a combination of causes.

Q and A
Question
Might stressing the effort be positive?
Answer
Probably but it is not the data collection but about the people (respondents) who need to deliver.

Question
Looking at the response rate, can the browser be of influence to increase this?
Answer
Different participants answered that the response rate will increase with the use of interviewers and also with the onboarding.

IT/services results WP3 by Joeri
The goal in this project is the development and integration of microservices for smart end-to-end surveys.
There are four tasks; General Microservice Architecture, Integration Microservice(s), Specific solution 1: HBS and Specific solution 2: TUS.
For the 3 developments, receipt scanning, geo-service and energy service the architecture is reusable and shareable.
The road to production is paved with many challenges, innovation and different roles, as there are:

- Citizens: role as active contributors and stakeholders.
- Institutions: role as data collectors, funders and stakeholders.
- End-to-end solutions: integration of online methods and modes + smart data collection solutions (design – collect - smart data).
- Trustworthiness: guaranteeing strong privacy and security safeguards.

It is inevitable that research and taking the development to production are also important. Together with legal and ethics this is the supply chain to success of using smart features in surveys.
Therefore every code developed is free of use, open source and available on Github.

The microservice architecture and the integration to (any) data collection platform(s) is visualised in the presentation (sheet 8).
There is an independency towards microservices and platforms itself, information that is being processed in a microservice does not interrupt another. In the architecture is a complete end-to-end solution.
There are four deployment strategies, production domain, namespace, containers and native platforms. At production domain and namespace overall control management, updates and support lies more at hbits, for containers and native platforms this is more external at the client. The client has their own control over privacy and security and less support.

Business process building blocks WP4 by Marc
The aim is to provide guidelines that will help NSIs to extend their business process to adopt smart solutions in their surveys. NSIs can than model their business process and identify the capabilities and roles needed.

The description of the process building blocks is a kind of library with business activities which are relevant for smart surveys. These can be divided in different phases such as specify needs, design, build, process. A (sub)process can exist of more process activities, we described 63.

The scope of the library consists two types of process activities; a. new or non-existing for non-smart surveys (e.g. develop app) and b. not specific as such for a smart survey (e.g. train helpdesk employees). Further there are different types of smart solution, those which are not specific so activities that are general usable/applicable and those which are specific in this project HBS, TUS and Energy usage meters.

There are examples of processes which gives NSIs an idea how to use building blocks.
This description is not the best practice and the structure of the building blocks process is not a prescriptive process. It can help NSIs a lot in a supportive way. NSIs has their own needs and should therefore develop its own process.

Legal framework WP5 by Lino
The work package started with reading the DPIAs (Data Protection Impact Assessment) from different countries of which just a few are related to smart survey.
We take into account some needs and constraints:

- DPIA for smart surveys should be considered mandatory.
- Regulation and guidelines to be followed.
- A relatively new field for several NSIs.
- Involves different actors and different professions.

How to handle with DPIA when you want to go smart in your surveys?
You have to know which key elements needs to be analysed and then propose a modular strategy to extract the ethical legal issues related to the use of smart features.
A decision tree is developed which can support NSIs in this, you can see this as a building block for DPIA. Together with interviews, guidelines and documentation it should be possible to set up a DPIA in cooperation with your legal department.
It is also useful to check whether existing DPIAs should be revised.

Conclusions and next steps

- A modular strategy has been elaborated based on the smart features classification, user tests, pilots and field tests and discussions.
- To test the modular strategy, we applied it to HBS, TUS and Energy data donation.
- It is time to use the modular strategy, checking strengths and weaknesses in the field, populating the different sub-modules and analyses and to share them.

Q and A
Question
Is there a public DPIA document available?
Answer
Not as such, there is no generic DPIA but you can use the model, analyse and consider how to convert the DPIA.

Question
Are there alternative solutions for OCR, smaller building blocks perhaps?
Answer
As far as known there are no alternatives.

Questions
What does that mean "follow the data"?
Answer
It is a method to discover, in the flow of personal data during statistical process, where data are stored, who are the actors involved, where risks concerning personal data may arise. So, it is a useful method in your analyses for setting out a DPIA to mitigate risks .

Question
A lot of data is collected by others (e.g. Google) when you use a smart phone. Do you consider them as a joint actor?
Answer
In general it is the problem of the user of the smart phone. When third parties are involved in the survey's process, this can be a problem unless you have a contract with them. To discover these situations it would be useful consider the concept of "follow the data".

Question
How does this all relate to trust?
Answer
Usually respondents find NSIs trustworthy but as NSI you have also an accountability to be so. Janelle adds that in the perception survey a question about trust was included and information about the results will be in the deliverable.

Receipt scanning service and HBS

Specific presentations on HBS by Joeri and others
The configuration on the MOTUS application and the development of the HBS app is presented and how it works when receipts are scanned.
In principle you can develop whatever you want but you need tot train it, not once but many, many times for improvement.
You have to create good training data which can be done by collecting tickets and digitalize them also different experts are needed for instance COICOP experts.
The OCR microservice is integrated, it starts with some general information than the respondent can choose between receipt scanning or add manual information (instructions are based on the usability test) and at the end the respondent checks OCR and document for understanding the results.

Usability testing Receipt Scanning (small sample) by Theun
When we look at the different context the results are:

- Complex diary studies; respondents understand the purpose and responsibility. There is no history or perspective.
- Microservice linked to UI/UX; no one size fits all but there are general points of attention.

- Smart solution; respondents expect smart solutions but the expectations are higher than we think.
- Clever solution; yes and no, tentative versus committed. Not clear (yet).
- Trustworthy solution; positive if the purpose is clear and also if the institute is trustful.

Workshop on HBS
The participants are divided in groups and give answer(s) to the assigned question.

Can you design the HBS process using the process building blocks?
From a business perspective it was a good discussion and for NSIs it is recommended to do this yourself by using the process building blocks. It can also be used as a checklist and when you encounter issues, difficulties take a decision.
The group designed a process as example:
- Download the app.
- Ask for consent (when?)
- Upload ticket.
- Active learning, make use of the respondent; available products in the store but not in the model and use these products as input for updating the model.
- OCR in-house or at a third party?
- Feedback classification (COICOP) back to the respondent?

Legal: apply the legal framework to HBS?
The perspective is to look at the data, what we do with it and how we want to protect it, in other words “follow the data”.
Simplified there is an app and receipts are scanned so the data is in the app but probably also on the phone to be used in the app (in the gallery).
In the journey data is taken from the phone, this can be different versions of the data (tentative, aggregated) and also stored in different cases/boxes. You must be aware that if there is a breach what the impact might be, low or high?
Looking at the actors in the end-to-end process, the respondent (data subject), the data collectors (data controller and the statisticians (data processors), you must ask yourself which security (legal, ethical) must be taken when they come across.

When is our smart HBS also clever?
Smart features from NSIs/universities will become common features but are they clever enough for respondents. Therefore we need to understand the respondent, what the respondent has to know and able to and is willingly to do what we ask through the app.
Smart features needs to be fast otherwise respondents will drop out, the performance (technical) is also important, less or even better no errors.
We have to manage the expectations, communication towards respondents is very important perhaps the availability of in-app communication and the possibility to give feedback through the app (e.g. text messages).

Role of HBS training data?
Is there the possibility to generalize because every country annotates, OCR is tested. Maybe we can generalize in the future with the use of LLM (Long Language Models). A lot of

tickets/receipts are not yet defined. Looking at supermarkets, scanned ticket must first be recognized as a ticket from the supermarket.
There is need of COICOP classification for country specific data.
Retraining with data will detect changes in receipts and repetitive errors. You have to know what is on the receipts and link them to COICOP.
How do we retrain? There is product change and receipts lay out can change.
Training data is important to improve models, classification, decrease errors, etc.

How do we better recruit for smart surveys?
Of course each country is different and the impact of issues such as privacy, motivation, digital or technical differs also.
There are many reasons why respondents drop out or not even begin with the survey. You must think of privacy reasons, distrust in using an app, not a mature app, poorly rated app, country/NSI specific limits, to burdensome, the respondent does not see the benefits of participating etc.
Possible solution suggested are (not limited:

- Make concessions.
- Ask less.
- Make use of interviewers (explanations, trust, help).
- Feedback in the app.
- Incentives.
- Short and transparent invitation letter.
- Less complex.

Geo-service and TUS

Specific presentations on TUS by Joeri and others
The Geo-service on TUS is shown how it looks like in the app. In different you can see the information about the time-line, measured data, detailed view, adding context and map visualisation.
All the geo activity is being recorded and there is the possibility to make changes, add information, save geo-points.
You can also see the recorded information back. The source data keeps completely in tact. If the connection for example was lost, you can add a time block manually.

For the first model to define stops and tracks and to define the mode of transport a decision tree was made and a sample code and test data sets were used to predict the mode of transport with an algorithm.
The results of a CBS test set (non-domain) shows that the performance varies widely across classes. For car, bike, walking and train the performance is good but for bus, metro, tram and other the performance is poor.
The results of a open geo-data test set (non-domain) shows that the performance for walking and train are relatively good, for bike the performance is moderate and for the rest bus, tram, metro this is poor. The balanced accuracy is less at the geo-data in comparison with the CBS test set (32% versus 46%).

The HETUS classification pipeline (domain) uses points of interests (POI) to predict the activity done by the respondent with an algorithm. The POI are points, at stops, on the map with information such as a bank, shop or theatre.
When we look at Google places and open street maps (OSM) we can conclude that:

- The algorithm works well when the auxiliary information is available.
- If there are no POI's, the prediction is not obtainable.
- The prediction improves when more than one activity is selected.
- OSM is a lower quality auxiliary source then Google places as it contains fewer POI's and this affects the activity prediction.

Usability testing Geolocation by Theun
When we look at the different context the results are:

- Difference between microservices; not single task-oriented, versatile microservice.
- Microservice linked to UI/UX; no one size fits all but there are general points of attention. Some respondents it was confusing to use it as they did not know in which diary the were.
- Smart solution; if you only register your movement (mobility) this works well but it is limited for TUS. For home specific activities or more activities on the same location it is not very useful.
- Clever solution; there is not much consensus about this. It is in the details.
- Trustworthy solution; for supportive reasons respondents find it trustful but for controlling respondents are more negative for example switch of at home.

Workshop on TUS
The participants are divided in groups and give answers to the assigned question.

Can you design the TUS process using the process building blocks?
For this workshop Henna came up with a use case from Statistics Finland and some building blocks from work package 4 were used to form a work flow and this worked well.
Activities in the process noted were for example; edit geolocations, integrate data, train helpdesk employees, edit classification by respondent.
The workflow formed was: deploy the microservice -> collect geolocation points -> derive motions and stops -> edit motion and stops -> classify automatically/manually.

Legal: apply the legal framework to TUS?
There is friction if we try to compare HBS with TUS. TUS is more domain specific and there is continuous and much richer data than what we (NSI) need.
A legal basis is important and also who is accountable, the respondent or the NSI. The respondent can choose between different apps that are available.
For NSIs communications towards respondents is important.

When is our smart TUS also clever?
The discussion in the group was very interesting and focussed on four questions items, when, when not, how and why?
When to use smart TUS, when traveling, shopping at HBS, recording activities and not when activities or location are sensitive, perceived third party risk.

On the how (what) question you can think of a toggle switch, continuous interaction, communication and for why it can be supportive of diary, the versatility.

Role of TUS training data?
Impressions and experiences were shared. Input should be tailored to be used (better detailed) so that travel prediction is better. The quality of sensors across countries can be different.
Respondents use different smart phones, like iPhones and Android.
A data set should be available as a benchmark with high quality of the travel mode even specific travel modes.

What do we when algorithms fails?
If the threshold to algorithm is not fulfilled what do we communicate to the respondent and how to deal with it? There are two options where the burden lies, at the NSI or at the respondent?
Concerning the NSI do we have alternatives like fall back to another mode, is the data received enough to make use of it, do we have classification in house.
Concerning the respondent try to keep them in the survey, make use of a sub-sample, more incentives, communicate that there was something going wrong (manage the expectations).

Second day 4 April 2025

Energy service

Energy service and usability test by Jeldrik
The context of the research is to learn how to build, test and evaluate a smart energy survey while considering methodology, IT, logistics and legal aspects. The motivation to do this is the declining of response rates, the burdensome of the traditional surveys and requirements and desires for information increases.
The respondents (13) for the usability test started with a questionnaire, collected data and filled in a evaluation questionnaire in the end. The data was collected for 8 days with a dongle installed in the smart electricity meter.
In this way we did not have to develop ourselves, the dongle and app were available. Further comparison of behavior was measured and we got information about data quality, assess feasibility and use experience.

Results
The installation was very easy except for one person, there were no technical issues, only one person needed an extra USB-C cable.
One person found the test burdensome, on the other hand almost all participants became more aware of their usage and 3 adjusted their behaviour.
Instead of 15-minute data one participant provided daily data instead.
Half of the participants raised concerns about privacy.

Lessons learned
Positive is that once installed passive collection is feasible and the burden is low. Further the real-time insight is valuable to participants.
But we must take into account that this was a very small pilot, the 15 minute data was not detailed enough to identify devices automatically so diaries are still needed for the context.

Help might be needed for both installation and sending data back.

Future outlook
Some ideas are:

- Develop secure microservice for data retrieval.
- Consider energy panel for gas, electricity and water.
- The need of better onboarding strategy.
- Devices as incentive, but think about the costs.

Q and A
Question
You got feedback about changing behaviour from 3 participants, do you think this will increase?
Answer
Participants that started with the pilot are more aware in the beginning but if they participate for a longer period they might fall back in their old behaviour.

Question
What about the privacy at a single household? What someone is doing or leaving the house or is on holiday can be detected.
Answer
Agreed, we can say something about (some part of your) behaviour so we have to explain, communicate that we are not interested in what people are doing.

Question
What are the costs of the dongle equipment?
Answer
About 25 euro's, which is a cheap option.

Question
How about the landscape of smart meters in Europe?
Answer
Concerning smart meters for energy The Netherlands are far ahead, for smart water meters we just started.

Question
Were there any technical complications, e.g. first or second floor?
Answer
There was one drop out because this person lives in an apartment and the energy meter was for the whole block.

Question
What about the influence of a solar panels?
Answer
That is a big problem, in real time you can not see how much energy is going in and out. You have to estimate, storing energy during the day might help.

Question
If the time slot of 15 minutes is not enough to detect devices, why don't we try ways to get more detailed information?
Answer
That depends who is asking (e.g. Ministry) that is not up to us as NSI. On the other hand the more you have can be better but the amounts of data are so huge that the internet probably cannot handle it.

Governance and maturity

Maturity model by Marc
The maturity model is developed for NSIs to give insight how mature they are and how to become more mature. Before using a smart feature, NSIs must be mature enough, if not failure is not unlikely.
We used existing models as an inspiration to come to a model focussed on smart surveys.

The framework of the model consists of 5 focus areas namely; organization, methodology, business process, IT and legal. For each of these areas there different levels of maturity; awareness (e.g. ideas), pilot (e.g. first trials), production (e.g. implementation), managed (in control), optimized (continuous improvement). It is obvious that levels are getting more mature from awareness to optimized.

The maturity model can be used as an assessment for the NSI as a whole or for specific surveys like HBS. The best outcome is if there is no imbalance, that all areas are on the same level.
In this project we will provide a manual how to use the model for doing the assessment in your organization.

From research to production by Jerome
To call a hold on declining participation rates and increase data quality Eurostat and NSIs decided to develop and implement new data collection modes.
It started about 7 years ago in Germany with the question "Can it work?".
It was and still is not an easy task to do, the research and so called preparation phase of developing "an App" took 3 years. When we were convinced that it can work, the next phase started with the question "Will it work?" which took almost another year. Now, within this project we reached the stages of "working" and the next aim is the implementation of going smart with the HBS survey in 2026.
Foundational work had to be done, choices to be made, issues to be taken into account:

- Basics or called so; legal, data privacy and data security aspects, IT-infrastructure and server performance.
- Functional adaptions; transforming a third-party app to meet specific national demands.
- Mode strategy; online only, or online first or free choice?
- Measurement equivalence.

Survey managers have to learn a new role, more service oriented to the subject-matter and efficient service platforms are designed.
During this (long) process it is very important to test, train, evaluate, analyse, rethink, retrain etc. over and over again in order to do more, no what the issues are, how to solve them and

to understand not only how the developed tool, methods or platform works from end-to-end but also what to expect from the respondents and how they might react.

Lessons learned
Many lessons are learned concerning costs which, hopefully in the long run will not only effect the new way of working but are more efficient as well. But on the short term investments are huge.
Lessons learned related to IT, project management, methodology, service attitude, quality control and change management are for example (not limited):

- IT personnel interested not only in IT but also in statistics and methodologist also in IT.
- Involved staff, shared vision, accept certain risk levels.
- Take a deep dive into online survey methods.
- NSIs must take on a service mentality.
- Automation and trust.
- Do not neglect change management.

Future
In the future Destatis will strive to further development towards digitalising and share practices with others with the aim to develop tools which make the burdensome for respondents easier and increase efficiency of the production process.

Question
Resources like money and human capital are critical and how was the organization coping with this?
Answer
These resources are important but it is more important that there is also backing from management.

Question
Did you find any persistence in your organization?
Answer
Yes, a lot. The question was will it work and we had our own technical process and forgot to take others with us and we have to regain their trust. We did this by talking to people, holding workshops, showing changes. This took us two years.

Governance scenarios by Remco and Menno
An exploration on Smart Survey Infrastructure governance models for the future.
Components that are in scope are, the app (front-end), collection platform, services (back-end), methods and knowledge.
We got input from other NSIs, added some more (literature) information and combined it and we came up with four scenarios:

- NSI completely supports itself: full control, on-premise hosting, minimal central governance.
- Joint component building: code sharing, best effort support, flexible collaboration.
- Joint service building: individual platform decisions, shared service development, coordinated integration, formalized agreements.

- Central smart solution: joint end-to-end solution, platform utilization, clear division of responsibilities.

The approach with a consortium has some benefits like shared expertise and experiences and lower operational costs but also challenges like complexity of roles and responsibilities, legal, privacy and IPR issues.
The recommended way forward is to invest continually, have the support of Eurostat, have a clear governance framework which will lead to a consortium for central smart solution.

Thoughts about the future by Jean-Marc and Eniel (Eurostat)
A decade ago were the first thoughts of the future which resulted in Trusted Smart Survey (TSS). Think about development of the first concepts of smart surveys, shared infrastructure, internet of things (IoT), new data sources like MNO.
Innovation was first more focussed on architecture that could be shareable, reusable to where we are now a combination of two approaches both architecture and business and going a step further with proof of concepts with end-to-end solutions for complex smart surveys (e.g. HBS) together with smart devices and respondents and take into account their privacy (DPIA).
Success factors are the cooperation between NSIs, Universities and a private company, a win-win combination with a multi facet approach, mature technology, user centricity.
But there are also challenges significant investments are done and being done but these are not completely mature yet. We probably save money in the end but still funding is needed.
Smart surveys are not the sole solution, it is a shift in burden for respondents and has impact on NSIs both operational and organisational.

The way forward … there is no future plan yet in the programme at Eurostat so we need to be creative with the lack of subsidies. Promote the success stories, communicate on different levels, share with other NSIs not only the forward stepping ones but also the others, focus on key use cases and create cooperation structures in order to keep the innovation running.

Workshop on governance and maturity
The participants are divided in groups and give answer(s) to the assigned question.

Generic approach to smart surveys?
Keep working together towards a promising and new smart survey, share information and share results and discuss opportunities and challenges.
Combine HBS and TUS, do not ask more but smarter, more clever and deal loosely with the privacy issue.

Community after the project?
Why?
Because collaboration makes friends/organisations better, you can share experiences and develop on European level.
How?
We need more formalization and structured governed for which we look at Eurostat to take the lead. We need also be targeted and the involvement of universities and commercial partners.

What?
Share knowledge (e.g. methodological, IT), develop new use cases, access to (new) data sources, alternative funding are some of the issues to think about.

Governance?
Group members scored the criteria which they find important/relevant comparing the different governance scenario's. The criteria that scored 3 and more are:

- Managing smart solution.
- Legal and privacy aspects.
- Roles and responsibilities.
- Initial costs.
- Operational costs.

Further there is a big shift in thinking at NSIs as they are working together as partners in this project and Eurostat should take the lead. One of the risks is that the responsibility is not clear.

Maturity: apply the maturity model to one or more NSIs?
An assessment can be done on a organisational level or on a specific level for instance methodology. Take into account a set of criteria and measure your NSI.

Marc makes a statement about how he experiences how the maturity model is handled, not only today but also in the project. The focus in the project is on methodology and IT to lead the way.
Not many are interested in the maturity model while the model will give insight from an organisational point of view on which level of maturity the organisation stands, so you know how to act or know what the major risks are.

How should countries prepare for a smart survey?
The goal is a working app. The group brainstormed and came up with lots of ideas and these were clustered to 5 essential topics.

- Resources (e.g. funding, preparing interviewers for app skills, help/support desk).
- Organisational (e.g. management commitment, shared vision, realistic expectations).
- IT (e.g. plan to maintain the app, enough IT-developers, meet the high expectations of respondents).
- Population (e.g. willing to use our app, easy to handle, well managed by the NSI, offer alternatives/mixed mode).
- Methodology (e.g. adapt/improve monitoring and evaluation of data collection).

Legal measures all clusters and is therefore not a topic on its own. Legal is underestimated (high risk).

Our recommendation

Having heard all the presentations and discussions, what are your recommendations? The recommendations can be to Eurostat, NSIs in general, methodology departments etc. on various themes.
The recommendations collected and discussed about among the participants lead to the following results (random and not prioritized):

- Innovate and take risks.

- Exchange should be facilitated by Eurostat and NSIs should actively share experiences.
- Involve all stakeholders during the whole process -> Interoperability.
- Put yourself in the position of the sample (target group).
- To Eurostat: maintain and support the SSI community and chosen governance model.
- Regular exchange (weekly) for specific projects (field test) with all participants.
- Eurostat must take more responsibility.
- Embrace change and remain open to possibilities.
- To NSIs: run parallel smart/non-smart tracks as long as is possible.
- Be smart by asking input.
- Don't use tool just because it is in the toolbox.
- To NSIs: use the business model to launch smart survey.
- Motivate the entire organization and don't forget to look at the impact on business process.
- To NSIs: involve Top-management in a common vision on smart survey.
- Collaborate and don't try to do everything on your own.
- Define terms and goals at the start.

Wrap-up and closure of the conference

Reflection by Jean-Marc

The conference was a perfect opportunity for an overview of the project. It was very inclusive and full of energy. Within the project much is achieved and there are still challenges ahead. Eurostat will take notice of the deliverables of course and will look internally how to go further on the path of innovation.

But we all have to spread the information and experiences from this project by giving presentations to different audiences, at discussions about innovation (working groups, task forces), keep on experimenting with universities.

Building a community is not that straight forward, maybe we have to merge different communities and structure this and take into account governance. It won't be easy but is necessary as we don't want to loose the momentum.

Closure

Before closure of the conference Remco remarks that the conference was energetic, with beautiful presentations, serious but also with time for socializing and fun.

He learned a lot in the past two years, the project was not easy, wish we could have done more. There was a lot of expertise in the project on business, legal, it, methodology. Unfortunately the future is uncertain.

Peter takes the opportunity to thank Remco for his excellent role not only at the conference but in the whole project as well.