Inno Mob
Supporting Mobility Innovation

INNO-MOB

Unlocking the potential of Mobility Innovation Ecosystems and Networks

D4.1 Stakeholder Chain Map Intelligent Platform (SCMIP) specifications

(Version 1.0)

DATE OF DELIVERY – 26/4/2023

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Funded by the European Union

This project has received funding from Horizon Europe Programme under Grant Agreement N° 101096746

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Document Track details

Project Acronym:	INNO-MOB
Project Title:	Unlocking the potential of Mobility Innovation Ecosystems and Networks
Start date of project:	01/02/2023
Duration of project:	24 Months
Call identifier:	HORIZON-EIE-2022-CONNECT-01-01
Type of Action:	Coordination and support action
Grant Agreement No:	101096746

Deliverable Information

Deliverable:	D4.1 Stakeholder Chain Map Intelligent Platform (SCMIP) specifications
Work Package:	WP4: Mobility Innovation Network
Due Date:	M3
Submission Date:	26/04/2023
Organisation Responsible of Deliverable:	ICMF/RS
Version:	2.0
Status:	Final
Author name(s):	Slobodan Mitrović, Marijana Petrović, Vladislav Maraš, Nenad Zrnić (ICMF)
Reviewer(s):	PPs
Nature:	☒ R – Report ☐ P – Prototype ☐ D – Demonstrator ☐ O - Other
Dissemination level:	☐ PU - Public ☒ CO - Confidential, only for members of the consortium (including the Commission) ☐ RE - Restricted to a group specified by the consortium (including the Commission Services)

Revision history			
Version	**Date**	**Modified by**	**Comments**
0.1	10/04/2023	ICMF	Draft
0.2	17/04/2023	ACCENT	Comments
0.3	17/04/2023	BOOSTER Labs.	Comments
0.4	21/04/2023	OKTHESS	Comments
0.5	21/04/2023	CUS	Comments
1.0	26/04/2023	ICMF	Final version

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Abbreviations

CIDDSM - Collective Innovation Deployment Development Support Model

DFA - Data-Feed Application

DIT - Database Initialisation Table

DSC - Decision support channels

EC-European Commission

KER - Key Exploitable Results

MIN – Mobility Innovation Network

SCMIP - Stakeholder Chain Map Intelligent Platform

ShD – Stakeholder Database

SIT - Special Index Table

SMEs – Small and Medium Enterprises

WP-Work Package

Executive Summary

Mobility innovation landscape is characterised by fragmentation and lack of synergies between various stakeholders and actors. Existing mobility networks, initiatives and clusters are restricted to the geographical boarders of one country or region while those that have moved to the “super-clusters” are dormant lately. INNO-MOB aims to re-mobilise the existing ‘super clusters’, enlarge the participation of more diverse actors and create interconnected innovation networks on mobility: Mobility Innovation Network (MIN). To support this, a specific platform labelled **Stakeholder Chain Map Intelligent Platform (SCMIP)** will be developed. It will facilitate mobility innovation networks, with a focus on the leveraging the inclusiveness of SMEs. The platform will bring together regional and national strategies and clusters, creating Pan-European clusters of diverse regions where stakeholders can identify opportunities for collaboration.

SCIMP will be a landing place for different types of data related to the various stakeholders (SMEs, investors, universities, government and others), which could be involved in collaborative activities within innovation eco-systems, in order to scale up the innovation mobility networks in Europe.

This report focuses on the technical specifications of the platform that support its functionality. The document comprises general technical descriptions of the four important SCMIP features: Stakeholder Database (SHD), Data collection, Visualisation Tools, as well as Decision support channels.

Disclaimer:

Please note that this report focuses on the technical specifications of the platform and is based on the information available at the time of writing. The process of developing the platform is ongoing, and certain aspects of the project, such as user requirements and supported services will be addressed in later deliverables. As such, the information presented in this report is subject to change, and we will update this specification as needed to reflect any new information or changes to the project scope.

1 Introduction

Mobility innovation networks have become increasingly important in recent years due to the rapidly changing landscape of transport and mobility sector. These networks consist of various stakeholders, including large corporations, start-ups, universities, and government agencies, who work together to develop and implement new technologies and business models. In particular, small and medium-sized enterprises (SMEs) play a vital role in these networks, as they bring unique perspectives, ideas, and solutions to the table. However, mobility innovation landscape is characterised by fragmentation and lack of synergies between various stakeholders and actors. Despite the potential benefits of these networks, small and medium-sized enterprises (SMEs) often face challenges in participating due to the dominance of larger players in the market. SMEs employ 55% of the European workforce in transport but due to rigid value chains they end up with short term contracts and lack of collective voice[1]. This can lead to a absence of diversity in innovation and a slower pace of progress. Moreover, the dominance of larger players can create barriers to entry for SMEs, which can limit their ability to participate and compete.

INNO-MOB will address this failure and focus on the opportunities that initiatives and networks offer to innovative and dynamic businesses through an inclusive mobility innovation European ecosystem business support framework. The INNO-MOB objective is to reduce innovation divide between strong and moderate innovators in European territories by increasing the inclusiveness of the existing networks and initiatives and their openness to SMEs and start-ups. Under this overall objective a specific one is to create interconnected innovation networks on mobility: Mobility Innovation Networks (MIN). Existing networks, initiatives and clusters are restricted to the geographical boarders of one country or region while those that have moved to the “super-clusters” are dormant lately. INNO-MOB aims to re-mobilise the existing ‘super clusters’ and enlarge the participation of more diverse actors. This objective will focus on developing links with regional /national strategies and clusters by bringing them together under the MIN that will be put together in the project in the form Pan-European clusters of heterogeneous regions where SMEs, investors, Universities and other stakeholders can identify opportunities for collaboration. Selected good practices and case studies will be also demonstrated on the digital portal where several online functions will support the knowledge transfer and communication between the actors.

This report focuses on the technical specifications of a platform that will be developed to facilitate the MIN and increase the inclusiveness of existing networks and initiatives. It is labelled **Stakeholder Chain Map Intelligent Platform (SCMIP)** and has several technical specifications to support its functionality. These include a user-friendly interface that allows stakeholders to easily connect and collaborate, a secure and reliable hosting infrastructure, structured database and compatibility with various devices and operating systems.

The purpose of this report is to set the technical bases of the SCMIP, including its architecture, programming languages, and database management system. Through detailed description of the platform's technical features and capabilities, we aim to provide technical basis for the establishment of Mobility Innovation Network that will support growth of SMEs, promote

[1] Brooks, R., Maher, S., Morris, D., Davalli, C., Adams, N., Pickering, C.: SMEs-acquiring new technology in different regions in Europe, Innovative Transport SME Action-INTRASME (2015)

innovation, and bridge the innovation divide between strong and moderate innovators in European territories.

The report is the structured around four main elements of the platform: Data collection, Stakeholder database, Visualization tools and Decision support channels, presented in separate sections after the introductory part of the report.

1.1 The deliverable in the frame of INNO-MOB work structure

INNO-MOB stations its operating principles on four main blocks of activities: i) Exploring the needs of the key innovation stakeholders, ii) Design, development and implementation of new schemes and collaborations, iii) Connect & learn, and iv) sustain. They are further associated with four Key Exploitable Results (KER): 1) Gaps vignette, 2) Strategy programme, 3) Mobility Innovation Networks and 4) Inclusive mobility innovation ecosystems blueprint (Fig. 1).

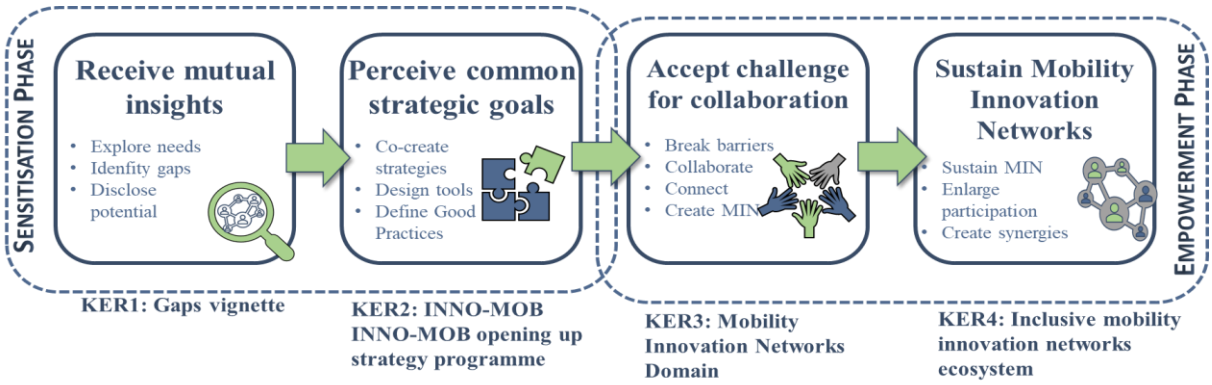


Figure 1 INNO-MOB work flow

One of important outcomes of INNO-MOB project activities is the Stakeholder Chain Map Intelligent Platform (SCMIP). This platform will be a part of Mobility Innovation Network (MIN) platform and it will be created with the aim to be a landing place for different types of data related to the various stakeholders (SMEs, investors, universities, government and others), which could be involved in collaborative activities within innovation eco-systems, in order to scale up the innovation mobility networks in Southern Europe.

1.2 The INNO-MOB work structure

INNO-MOB block of activities (Fig. 1) mirrors in the WPs of the project. It is given in Fig. 2.

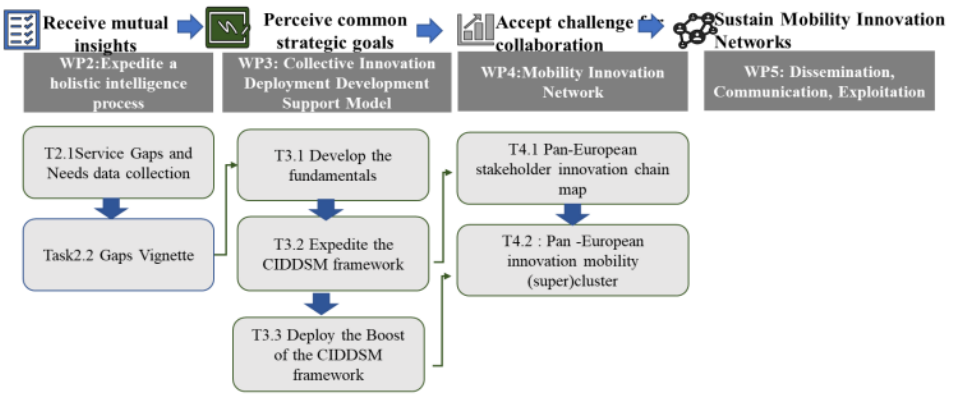


Figure 2 INNO-MOB work flow: WPs and tasks

To receive mutual insights a holistic intelligence process (WP2) will be conducted with the aim to investigate the gaps in the services provided by the networks/initiatives along with specific needs of key innovation stakeholders (including Tier 2 SMEs, as well as the participating countries and/or regions). On the basis of gap analysis missing elements and features for customization of the provided services by the network/initiative (gap vignette) will be identified.

This will further serve as a base for perceiving common goals and developing strategy programme - Collective Innovation Deployment Development Support Model (CIDDSM) developed within WP3. The activities will be built around the identification and deployment of a set of mobility innovation services that will meet identified gaps and further support Collective Innovation Deployment Development in Europe.

Boosting collaboration through mapping, analysing and engaging relevant actors will be supported by the dedicated platform developed within WP4. The platform will provide a holistic picture of the networks, initiatives and their offer and thus, scaling up the innovation mobility networks. The Stakeholder Chain Map Intelligent Platform (SCMIP) developed within WP4, will set a base for scaling up the innovation mobility networks at various level by analysing Pan-European stakeholder chain map (T4.1) and building a plan for improving participation of mapped actors (T4.2), as well.

1.3 Task 4.1

This task is about creating a Stakeholder Chain Map Intelligent Platform (SCMIP). SCMIP will gather data from various sources and store it in a central repository, which will use a specific data model. The repository will include important data related to EU countries and other associated countries. SCMIP will offer customizable visualization options for exploring and interpreting the data, as well as a decision support feature to assist decision makers. The process will involve two primary methods and two visualization tools to help project partners analyse stakeholder potential and relationships.

SCMIP will be a platform that will:

a) collect information from resources, such as innovation centres, etc.,
b) gather all collected data within incorporated Stakeholder Database (SHD)
c) provide SHD datasets visualisations
d) provide data channels in order to enable decision support

SCMIP will continuously gather all the appropriate data from several resources. To achieve these goals, the SCMIP must contain functions for collaboration, networking, information provision and opportunity scanning. In this way, it could help external stakeholders to be informed about important outcomes, using visualised interface on the platform frontend, or/and help potential decision engines of other collaborative platforms/systems through Decision Support Channels (Fig. 3).

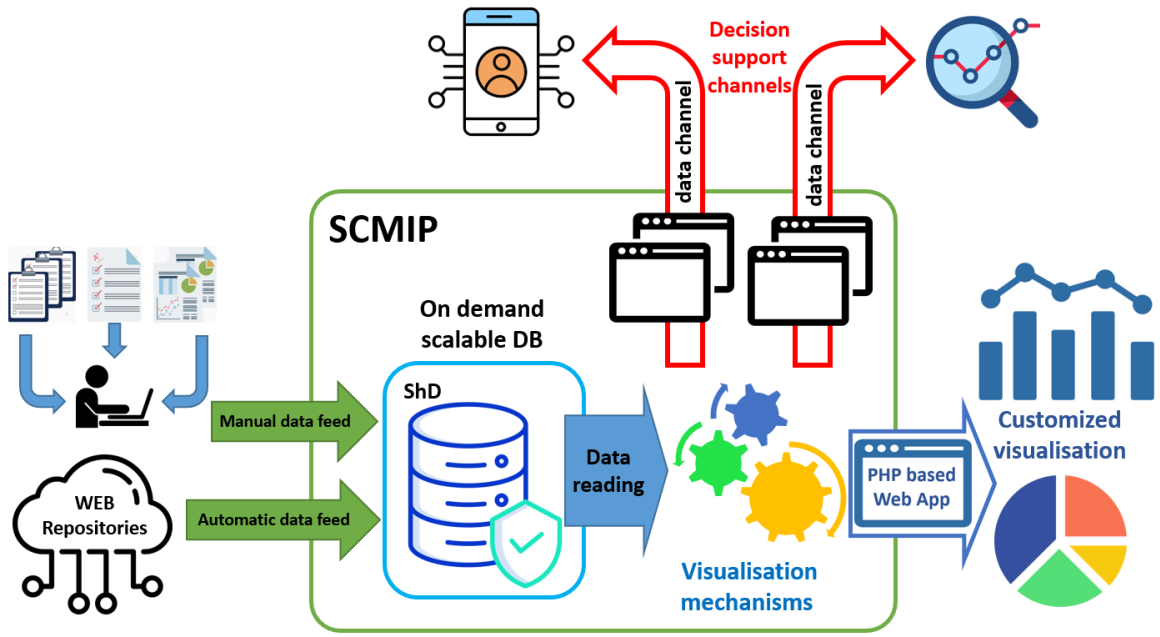


Figure 3 SCMIP structure

Four important SCMIP features: Stakeholder Database (SHD), Data collection, Visualisation Tools, as well as DSC channels are presented in the separate sections of this report.

1.4 Interrelations of Task 4.1 with other tasks of the project

Full operational of SCMIP is dependent on the of strategic framework developed in the second block of activities and aimed at perceiving common strategic goals. Collective Innovation Deployment Development Support Model (CIDDSM) developed within the WP3 will provide a framework for further enrichment of SCMIP features and its facilitation to the MIN (Fig. 2). SCIMP will support basic services developed within CIDDSM by acting as a work space for mapping, analysing and engaging relevant actors. In this way it will contribute to connecting growth stage actors and stakeholders and matchmaking between corporates and scaling start-ups and SMEs such as those of Tier 2.

The end-user needs will define the contents and focus of the platform, so that we can provide something focused and tailored to documented needs. The process of developing the platform is ongoing, and certain aspects of the project, such as user requirements and supported services will be addressed in later deliverables. SCMIP will be a living form, constantly evolving and improving based on the inputs received from other work packages. In particular, two key areas of focus will tailor the platform functionality: mapping gaps in services and identifying new services that will help overcome these gaps. These inputs will be used to tailor the functionality of the platform to meet the specific needs and provide maximum value to its users. This continuous improvement process will ensure that the platform remains relevant and effective throughout the project, and beyond.

2 Stakeholder Database (ShD)

2.1 Operation principles

The main role of the Stakeholder Database is to be a data-hub for all information about existing innovation mobility networks including SMEs, industry, investors, innovation centres, government, and other stakeholders, as well as levels of mutual cooperation, involvement and characteristics of vertical and horizontal supply chain network and other important information.

It is expected that ShD should meet various data-feed demands from various data-sources, different demands for data management, as well as possibility to be modified, scaled up and dynamically adapted to the different needs during project lifetime. This means that ShD database could consist variable number of tables where each table could have variable structure. By following the SCMIP activity level, such a database structure could be significantly increased. In order to meet such a demand, the special design technique, developed by the ICMF, will be applied to ensure the ShD structure scalability. The technique principles are based on the management of two ShD tables: the Database Initialisation Table (DIT), as well as the Special Index Table (SIT) that is used to describe all other ShD tables. In other words, the ShD is consisted on the following tables: USERS, SESSIONS, DIT, SIT, T1, T2, ... , T*n*.

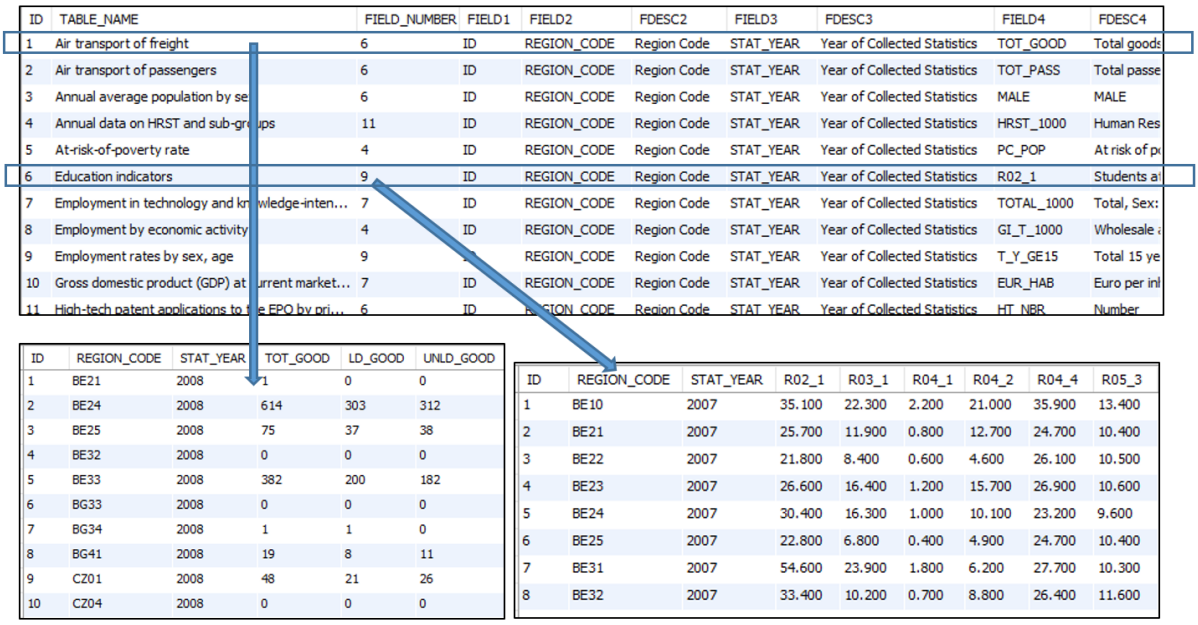
Each ShD T*n* table is defined by SIT record. Each SIT record is generally consisted of the following fields:

- ID
- TABLE_NAME
- FIELD_NUMBER
- FIELD1
- FDESC1
- FTYPE 1
- FVAR1

  …

- FIELD_*n*
- FDESC_*n*
- FTYPE_n,
- FVAR_n

where the *n* represents the number of field description sets (groups of FIELD_*n*, FDESK_ *n*, FTYPE_*n* FVAR_*n* fields) for the related T*n* (ShD managed) table. The relation of SIT and other ShD managed tables is shown Figure 5 (within the example of EUROSTAT derived database).



ID	TABLE_NAME	FIELD_NUMBER	FIELD1	FIELD2	FDESC2	FIELD3	FDESC3	FIELD4	FDESC4
1	Air transport of freight	6	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	TOT_GOOD	Total goods
2	Air transport of passengers	6	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	TOT_PASS	Total passe
3	Annual average population by se	6	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	MALE	MALE
4	Annual data on HRST and sub-gr ups	11	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	HRST_1000	Human Res
5	At-risk-of-poverty rate	4	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	PC_POP	At risk of p
6	Education indicators	9	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	R02_1	Students at
7	Employment in technology and kn wledge-inten...	7	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	TOTAL_1000	Total, Sex:
8	Employment by economic activity	4	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	GI_T_1000	Wholesale
9	Employment rates by sex, age	9	I	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	T_Y_GE15	Total 15 ye
10	Gross domestic product (GDP) at urrent market...	7	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	EUR_HAB	Euro per inl
11	High-tech patent applications to e EPO by pri...	6	ID	REGION_CODE	Region Code	STAT_YEAR	Year of Collected Statistics	HT_NBR	Number

ID	REGION_CODE	STAT_YEAR	TOT_GOOD	LD_GOOD	UNLD_GOOD
1	BE21	2008	1	0	0
2	BE24	2008	614	303	312
3	BE25	2008	75	37	38
4	BE32	2008	0	0	0
5	BE33	2008	382	200	182
6	BG33	2008	0	0	0
7	BG34	2008	1	1	0
8	BG41	2008	19	8	11
9	CZ01	2008	48	21	26
10	CZ04	2008	0	0	0

ID	REGION_CODE	STAT_YEAR	R02_1	R03_1	R04_1	R04_2	R04_4	R05_3
1	BE10	2007	35.100	22.300	2.200	21.000	35.900	13.400
2	BE21	2007	25.700	11.900	0.800	12.700	24.700	10.400
3	BE22	2007	21.800	8.400	0.600	4.600	26.100	10.500
4	BE23	2007	26.600	16.400	1.200	15.700	26.900	10.600
5	BE24	2007	30.400	16.300	1.000	10.100	23.200	9.600
6	BE25	2007	22.800	6.800	0.400	4.900	24.700	10.400
7	BE31	2007	54.600	23.900	1.800	6.200	27.700	10.300
8	BE32	2007	33.400	10.200	0.700	8.800	26.400	11.600

Figure 4 The SIT Role: The functional relations between SIT and tables T01 and T06 (an example)

The *n* number is stored in DIT and SIT (for backup and some operations purposes) at the FIELD_NUMBER(T*n*) field and refers the maximal number of field sets in the SIT record per T*n* table. In this way SIT is used as a reference table in order to create, define, include/exclude and modify any other T*n* table. Also, data search is possible on both, the primary and the secondary level. The primary level search include all terms defined in Special Index table (SIT), within scope of each fieldname, description, fieldtype or fieldtype variable. Afterwards (secondary level) search is executed in those tables, which are related to index values defined in SIT, resulting with data polled from identified table positions.

2.2 The SCMIP ShD initial structure

With regards to previous chapter, the SCMIP ShD should include a number of tables, where each table should be related to a SCMIP entity (or group of entities), which share the common data features:

1) Stakeholders,
2) Stakeholder relationships
3) Stakeholder Initiatives
4) Stakeholder Activity Outputs
5) ….

The Stakeholders table contains following fields: Record_ID, Stakeholder Group, Stakeholder Name, Stakeholder Type, Stakeholder Short Description, Stakeholder Email, Region, Country, Address, Postal Code, City, Website, Contact person, Contact person email, Contact Phone, Technology Sector, Cluster member, Comment.
Stakeholder relationships table comprise following fields: ID, Stakeholder1ID, Stakeholder2ID, Relation_Type, Relation_Description, Permanent (Y/N), Start_Date, End_Date, Comments.
Stakeholder Initiatives table comprise following fields: ID, Initiative_title, startdate, startperiod, funding_program, Area_Type, Comments.
Stakeholder Activity Outputs comprise following fields: id, activity_acronym, title, project,

programme, activity_area, timeframe, main_topics, recommendations, measures_and_actions, planned_actions, contact_info, web_address, Comments.

Other tables will be created during project activity period.

2.3 Technical notes & recommendations

- The ShD is conceptually designed with the aim to operate with MySQL–based queries, regardless of the particular MySQL or MariaDB environment.
- ShD database should use UTF-8mb4 encoding.
- All fields default values should be NULL. NULL value should remain for those field type without length limitation, as well.
- Each field that refers to some description for which there is no details about text length, should be defined as MEDIUMTEXT type undefined, which means that it will use maximal capacity (16,777,215 characters and 3 bytes of required overhead storage), otherwise it should be defined by other appropriate type (TYNYTEXT, TEXT or LONGTEXT).
- All DATE fields should be defined as VARCHAR(min 20) for different compatibility issues.
- All contact info fields should be defined as VARCHAR(700), while website/webaddress fields should be defined as VARCHAR(500) for different compatibility issues, as well.
- It is recommended that Comments filed should be formatted as TEXT, without limitations.

3 SCMIP Data collection

Data collection will be realized in two different ways: manually – by the partners and (optionally) by stakeholders, as well as automatically – by harvesting data from web repositories and/or feeds, where available.

3.1 Manual data collection

Manual data collection will be available to project partners and (optionally) to some stakeholders, which could be recognized as valuable and reliable sources of data. All data collection will be realized by PHP data-feed application (DFA), directly connected to the ShD. Data-feed application allow two working modes:

- individual data feed, using the DFA web form,
- data upload, using the DFA upload page.

Data feed could be realized using existing or new ShD tables, so the existing data could be updated/appended or the new data could be loaded. Tables are identified by their names stored in TABLE_NAME field in the table corresponding SIT record.

Data collection permissions are defined by role – project partners can add new tables and/or conduct the data feed (individual or by upload). On the other hand, stakeholders can only conduct the individual data feed. However, if they need new ShD table, the corresponding project partner can create demanded table for them, in accordance to supplied table structure.

Data upload could be realized by using CSV files. These files must be UTF8 encoded, with semicolon delimiter and double-quote text qualifier. The value order must meet field order, defined in SIT for particular table.

3.2 Automatic data collection

Automatic data collection will be realized by ICMF or other project partner capable for such an activity, according to supplied technical information. Automatic data collection is realized as a web scraping process that targets given web URL location and extracts data using predefined rules. Extracted data is then structured in predefined CSV format, which file is further used for upload to ShD. Output CSV files have to meet abovementioned CSV demands, as well (Fig 6).

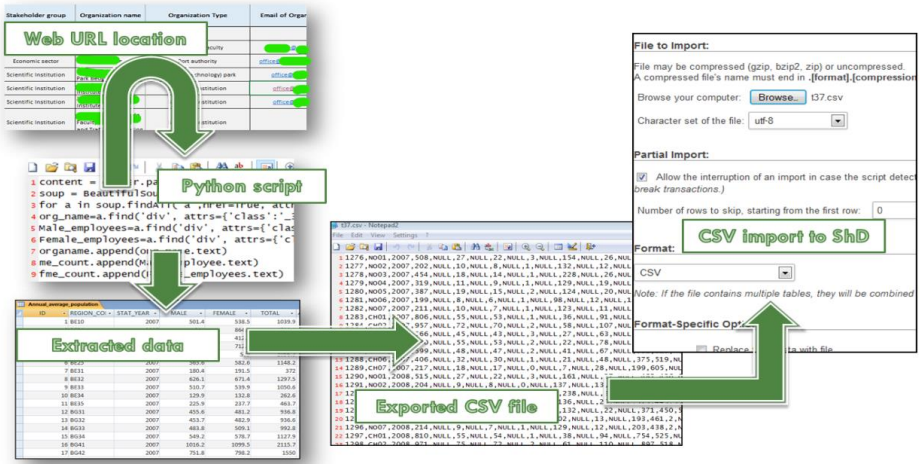


Figure 5 Automatic data collection - web scraping process example

In most cases, web scraping will be realised using a specially designed script written in Python (or other appropriate language) and adapted specially for given URL location.

Web Scraping should be realized ONLY when such an activity meet all legal and other technical demands upon web location, which URL is permitted for targeting by its owner.

It must be noted that web scraping could be successful only when it is technically allowed by particular web location i.e. web location owner have to give permission and allow data extraction by editing the contents of its "robots.txt" file, as well.

4 Visualization Tools

Creation of Stakeholder database initiates a new phase of activities related to the collected data analysis. This phase comprises different processes like:

- identification and analysis of relationships between various actors (how they are connected, and how they interact with each other);
- identification of areas where stakeholders can work together to achieve shared goals;
- creation of a Stakeholder Chain Map, which will connect them to show their relationships.

In order to complete these processes, various mapping tools will be used, such as: Interest and Influence table, Actor-linkage table, Interest and Influence matrix, Chain map script, etc. Usage of these tools implies the usage of software components for data visualisation in order to make data analysis efficient. Also, visualisation components could be also used later, to help in developing strategies for engaging with stakeholders and addressing their concerns;

There are three different tools, which are developed for visualisation purposes:

- numerical and/or statistical visualisation tools,
- interest and influence matrix visualisation tool, and
- stakeholder chain map visualisation tool.

The number of these tools are not limited to abovementioned and could be developed in accordance to further demands. However, these tools are not used on collected data in "as-is" manner. There is visualisation process that operates upon data that should be visualised. The process is consisted of three phases (Fig 7.):

1) Data consistency check phase - in order to prevent possible data nature heterogeneity, the used datasets should be pre-checked for data consistency: for this purposes, a special data consistency check tool, developed in Python by ICMF will be used. If the pre-check result show data inconsistency, a warning message is generated and sent back to PHP application to be shown to user, asking to use different dataset for visualisation od to exclude problematic data.
2) Data pre-processing phase - all data should be prepared and reorganized (in other words – pre-processed) in order to meet their specific nature; in this phase, PHP application sends the visualisation type trigger to the preprocessing PHP module, initiating needed data operations. It must be noticed that the pre-processed data could be also sent back to the temporary ShD table in case of activating communication through DSC.

3) Data visualisation phase – data is used for visualisation purposes: after pre-processing phase, datasets will be loaded to HTML5/PHP based web application, designed for visualisation purposes.

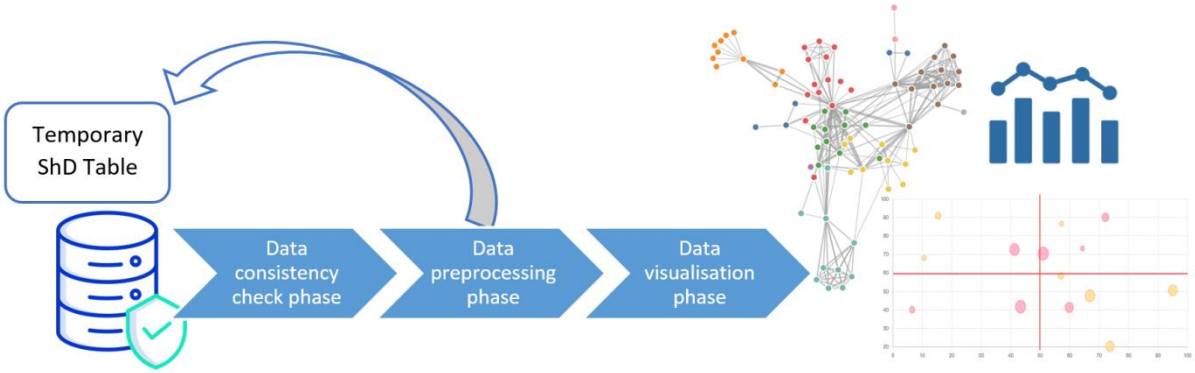


Figure 6 Data visualisation process

Visualisation solution is consisted of set of scripts, written in PHP7/PHP8 and JavaScript in order to enable chart customization features. For each visualisation type, different JavaScript module is used:

5 Decision support channels

Decision support channels (DSC) are used for decision support processes initiated by the third-parties in order to give a plan for increasing the engagement of under-represented actors within Pan-European landscape. Third-parties, upon given permission by Consortia, could use raw ShD data from allowed tables (in order to conduct own decision support process), or they could use already pre-processed data (prepared for SCMIP visualisation tools usage and stored in abovementioned temporary ShD table). Demanded raw ShD data will be inspected for inconsistency, before opening DSC.

Third-party demand is initiated by opening DSC-INIT PHP application (DSC-INIT) that uses XML files based on Document Object Model (DOM) in communication. Third-party user should be logged-in through init-XML file, before introducing any demand. After login, DSC-INIT responses with “OK” tag and waits for the new XML file with data specification demand (“SIT-request” or “TST-request” tag). TST-request stands for Temporary ShD Table request.

- If “SIT-request” is detected, then DSC-INIT responses with SIT table content, waiting for the new XML file that contains demand specification, with the set of table IDs and corresponding field-set lists. DSC-INIT will activate Data consistency check phase and Data pre-processing phase (already described in previous chapter). In case of data inconsistency DSC-INIT will respond with “case99” code and will wait for the new XML file. In case that new XML file contain “QUIT” tag, DSC channel will be closed, otherwise new data specification is expected. If new demand passes Data consistency check phase, then DSC-INIT will initiate Data pre-processing phase in order to generate XML content as new response.
- If “TST-request” is detected, then DSC-INIT will directly initiate Data pre-processing phase in order to generate XML content based on Temporary ShD Table records, as new response.

After this operation DSC-INIT will close DSC channel.

Additional Notice

- SCMIP application will be hosted on Apache based webserver (2.4.6 version or newer).
- Virtual host will have its own fully-qualified-domain-name (fqdn) and it will be secured with corresponding SSL certificate.
- Hosting server will create regular backups of the Virtual host and corresponding MySQL database, via dedicated CRON record.
- Copy of created backups will be stored on separate backup server, as well.

6 Concluding remarks

INNO-MOB aims to re-mobilise the existing 'super clusters', enlarge the participation of more diverse actors and create interconnected innovation networks on mobility: Mobility Innovation Network (MIN). To support this, a specific platform labelled **Stakeholder Chain Map Intelligent Platform (SCMIP)** will be developed. It will facilitate mobility innovation networks, with a focus on the leveraging the inclusiveness of SMEs. The platform will bring together regional and national strategies and clusters, creating Pan-European clusters of diverse regions where stakeholders can identify opportunities for collaboration. Technical baseline of SCMIP outlined in this report lay a foundation for this support. It offers detailed description of four main building blocks of SCMIP:

- ShD (Stakeholder Database) - data-hub containing all relevant information about existing innovation mobility networks: their actors, activities and linkages.
- Data collection by means of manual and automatic data feed to ensure that ShD is regularly updated.
- Visualization tools – tailored designed visualisation options based on well-known stakeholder mapping tools (like Interest and Influence table, Actor-linkage table, Interest and Influence matrix)
- Decision support channels –access to the collected data for further analyses aimed at scaling up the engagement of MIN actors.

SCMIP will continuously improve its functionality based on the inputs received from other blocks of activities within the project. By tailoring the functionality of the platform to meet the specific needs of its users, the platform will be able to effectively address the gaps in mobility innovation services and ensure that it remains a valuable tool throughout the project's lifespan and beyond.

"Funded by the European Union. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or the European Innovation Council and SMEs Executive Agency (EISMEA). Neither the European Union nor the granting authority can be held responsible for them."