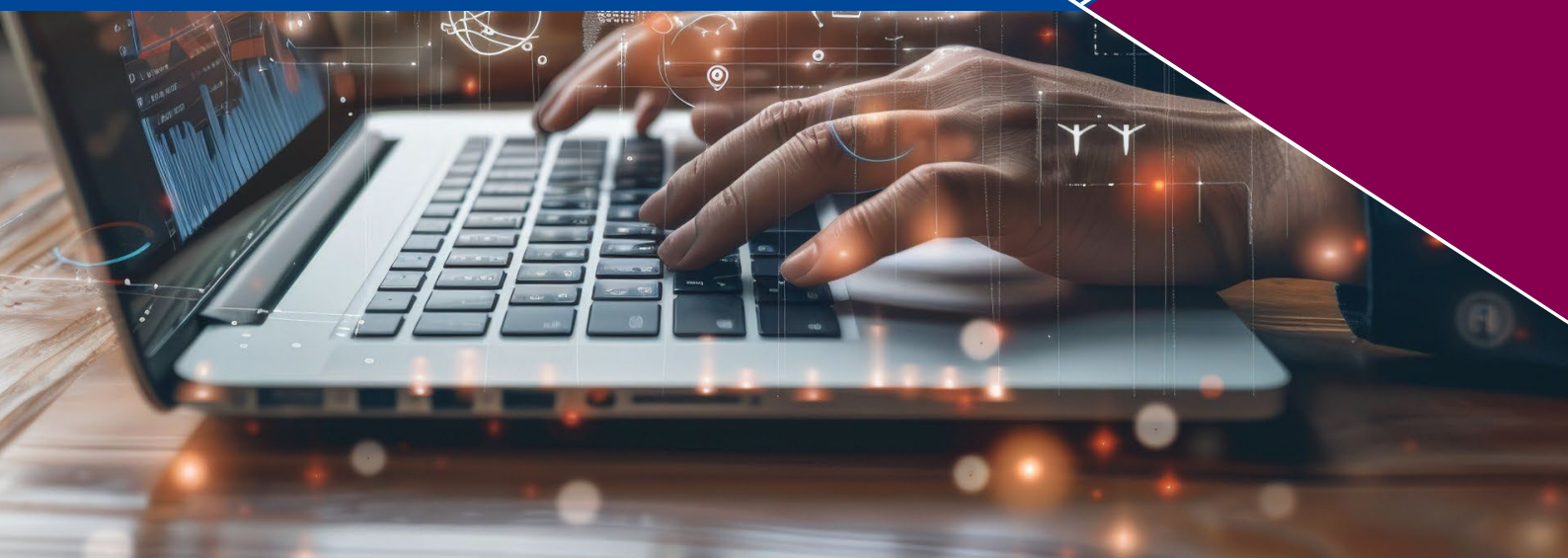




International
Labour
Organization

▶ LMIS

Brief Description and ILO Toolkit
(December 2023)





LMIS

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(December 2023)

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► Acronyms

API	Application Programmer's Interface
CSPA	Common Statistical Production Architecture
DDI	Data Documentation Initiative
DE	Data Explorer
DF	Dataflow
DLM	Data Lifecycle Manager
DSD	Data Structure Definition
DWI	Decent Work Indicators
DWT	Decent Work Team
EEO	European Employment Observatory
EES	European Employment Strategy
ENEI	Encuesta Nacional de Empleo e Ingreso
ETL	Extract, Transformation and Load
F.A.I.R.	Findable, Accessible, Interoperable, Reusable
GSBPM	Generic Statistical Business Process Model
GSIM	Generic Statistical Information Model
ICLS	International Conference of Labour Statisticians
ILO	International Labour Organization
IT	Information Technology
ITC	Information Technology and Communications
ITC-ILO	International Training Center of the ILO
LFS	Labour Force Survey
LMI	Labour market information
LMIS	Labour Market Information System
MoL	Ministry of Labour
MoU	Memorandum of Understanding
OECD	Organization for Economic Cooperation and Development
SDG	Sustainable Development Goals
SDMX	Statistical Data and Metadata eXchange
SIMEL	Sistema de Información del Mercado Laboral
SIS-CC	Statistical Information Systems – Collaboration Community

► Executive Summary

Since 2016, the Department of Statistics has been assisting countries in generating the capacities and incorporating the tools needed to implement a Labour Market Information System (LMIS). An LMIS is a network of institutions, people and information with mutually recognized roles, agreements and functions with respect to the production, storage, dissemination and use of labour market information and outcomes, in order to maximize the potential for the formulation and implementation of relevant policies and programmes.

The LMIS aims to systematically deliver timely labour market data essential for informed policymaking. The expanding engagement of countries and regional communities signifies the global momentum behind the LMIS, underlining its role in improving access to and management of labour market information.

This document provides a comprehensive overview of the LMIS, delving deep into its functionality, components, and the implementation framework developed by the Office for its development at a national or regional level. The integrated onsite and e-learning workshops combined with in-house developed tools underscores the Office's commitment to refining LMIS implementations tailored to diverse labour market context.

1. Introduction to Labour Market Information Systems

Market Information System (LMIS) The identification of labour market issues in both developed and developing economies critically rests on the availability of data, information and analysis. Labour market information (LMI) provides an essential basis for employment and labour policies, and informs the design, implementation, monitoring and evaluation of policies that are better focused and targeted. LMI also contributes to a reduction in the transaction costs of labour markets as it helps overcome incomplete information of labour market agents.

1.1. Functions of an LMIS

Three main functions of a Labour Market Information System (LMIS) can be distinguished:

- F1:** The LMIS is responsible for labour market analysis;
- F2:** The LMIS is responsible for monitoring and reporting on employment and labour policies;
- F3:** The LMIS system provides a mechanism to exchange information or coordinate different actors and institutions that produce and utilize labour market information and analysis.

The first function (**F1**) is purely analytical and as such is usually being undertaken, at least to some extent, by academic and research institutions, which may or may not have a focus on labour markets. However, the main purpose of LMIS that have been established outside academia is the production of information and analysis for policymakers and other labour market stakeholders. For example, the functions of the European Employment Observatory are stated as follows: “The European Employment Observatory (EEO) contributes to the development of the European Employment Strategy (EES) through the provision of information, comparative research and evaluation on employment policies and labour market trends in the countries covered by the EEO.”

Therefore, it is important that institutional arrangements are established to make the information and analysis widely available to the target group and to provide opportunities for labour market stakeholders to influence the agenda of the LMIS.

The LMIS can also be directly involved in monitoring and reporting on employment and labour policies (the second function, **F2**). If in addition to monitoring and reporting on policies the LMIS is used to conduct policy analysis and evaluations, the system would combine functions **F1** and **F2**. Both at the international and the national levels, the institutional role of the LMIS can be broadened to include a third function (**F3**), the exchange of information or coordination of the LMIS activities of labour market stakeholders, which include statistical agencies, research agencies and agencies involved in policy formulation and implementation including employers’ and workers’ organizations. This function may range from the dissemination of information on concepts, definitions and standards, to the allocation of resources regarding data collection or specific analytical activities (e.g. evaluations, econometric models).

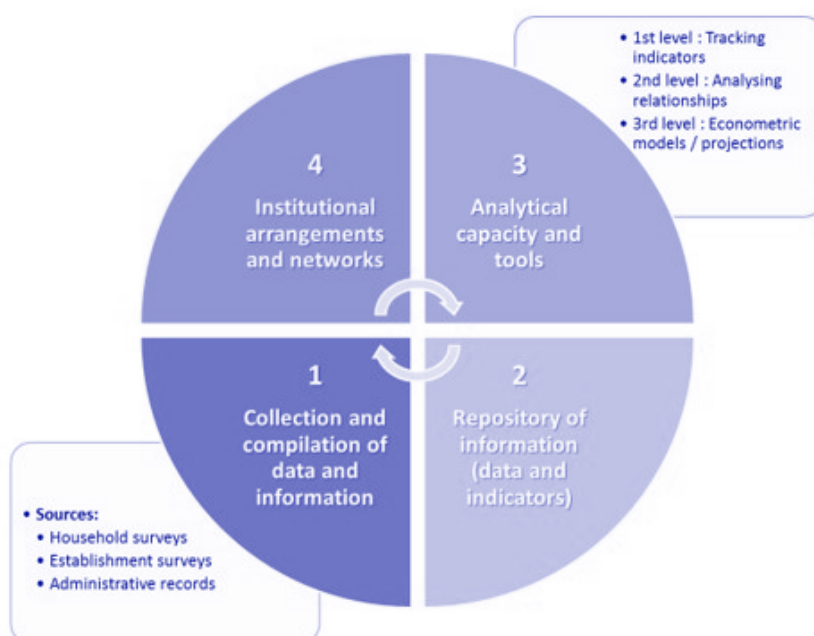
1.2. Components of an LMIS

► LMIS Components

LMIS consist of four main components:

- C1:** Collection and compilation of data and information.
- C2:** Repository of information.
- C3:** Analytical capacity and tools.
- C4:** Institutional arrangements and networks.

► Components of an LMIS: Diagram



1.2.1. C1: Collection or Compilation of Data and Information

Considering that LMIS should provide analyses of labour markets in their economic context, component **(C1)** consists not only of data on labour markets, but also on the broader economy. For example, data on trade flows and remittances are indispensable for an analysis of the labour market effects on economic crises.

► Main Data Sources

The main data sources of labour statistics consist of:

- S1:** Household surveys and population censuses.
- S2:** Establishment surveys.
- S3:** Administrative records.

Labour force surveys (a particular type of household survey focusing on labour-related questions) can be designed to cover virtually the entire population of a country, all sectors of the economy and all categories of workers, including own-account workers, contributing family workers and persons engaged in casual work or marginal economic activity. For this reason, household-based labour force surveys offer a unique advantage to obtain information on the labour market of a country and its

structure. Other sources, such as population censuses, multi-purpose household surveys, establishment surveys, or administrative records (e.g. employment service records), differ in scope, coverage, units of measurement or methods of data collection.

Each source has advantages and limitations in terms of the cost, quality and type of information gained. For example, **establishment surveys** typically have poor coverage of very small or unregistered businesses but are a more reliable source on wages and earnings. Similarly, **administrative records** provide a low-cost source of labour market information, but this information is limited by the purpose of the registers, which may be different from the objective of an analyst or policymaker. Therefore, **effective LMIS draw on all sources**.

1.2.2. C2: Repository of Information

This information collected and/or derived from primary sources must be stored and made accessible to users by means of a software platform which will constitute the sole **repository of labour market information**. Inbound data flows of collected data should be verified in terms of both structural and logic consistency, transformed into new indicators as necessary and stored in the datawarehouse to be disseminated through several channels, including but not limited to graphical visualizations, statistical tables, bulk data download and application programming interfaces (API) for computer-to-computer interactions.

1.2.3. C3: Analytical Capacity

LMIS embody the **analytical capacity** to identify and interpret labour market developments and trends, and to relate these trends to policies or other factors influencing labour market outcomes. In terms of **analytical capacity**, LMIS can be developed at **three levels**. The **core or first-level LMIS consists of monitoring or tracking a set of indicators**. Activities that need to be undertaken to establish a core LMIS, such as the compilation of data, the establishment of appropriate repository, the production of regular labour market reports and the dissemination of information and analysis, can be carried out by an LMI unit in a government department, in collaboration with labour market stakeholders, statistical agencies and research institutions. The unit should be staffed by labour market analysts, statisticians and staff dealing with the processing of data and information technology. The monitoring of indicators not only results in signals on the state of the labour market, but also provides a starting point for a range of additional analytical activities and studies, focusing on **relationships in the labour market and between the labour market and the broader economy (second-level LMIS)**. The analysis of relationships involves the use of quantitative methods (e.g. regression analysis), but may also employ qualitative methods (e.g. stakeholder-driven forums). In all cases, analytical activities will draw on or will need to be complemented by a first-level LMIS tracking labour market indicators. The **third and most advanced level of LMIS involves the use of comprehensive econometric models**, building on second-level analysis. Econometric models represent an analytical approach that allows for the generation of economy-wide, detailed and consistent projections of labour market developments. Econometric models, however, are demanding in terms of all components of LMIS (C1, C2, C3 and C4) and are therefore costly to develop and maintain. In many cases, the development of models is undertaken by specialized research institutes, while LMI units may be involved in running existing models and/or use results from modelling exercises for policy development purposes.

1.2.4. C4: Institutional Arrangements and Networks

Institutional arrangements enable labour market actors to use information and analysis, and facilitate the creation of networks of users and producers, including government departments, employers' and

workers' organizations, statistical agencies and research organizations. These arrangements are needed for the LMIS to effectively perform its analytical function, for example by providing access to data (from statistical agencies, administrative bodies and other entities), but also to allow for the effective dissemination of information and analysis.

1.3. LMIS Indicators Framework

As discussed above, at a minimum, a first-level LMIS tracks a set of indicators, which constitute the basis for the development of more advanced systems. A widely used set of indicators are the **Decent Work Indicators** framework (DWI)¹. DWI covers not only access to full and productive employment, but also rights at work, social protection and social dialogue, as well as indicators of the economic and social context of decent work.

Amongst the more than 400 indicators and breakdowns in DWI, an initial group should be selected in order to:

1. Present a core set of labour market indicators; and
2. Improve the availability of the indicators to monitor new employment trends. This initial set of indicators is selected in consultation with national representatives from the Ministry of Labour, the National Statistical Office and other stakeholders, based on the following criteria:
 - a. conceptual relevance;
 - b. data availability; and
 - c. relative comparability across countries and regions.

Following this initial set, new indicators will be progressively added based on demand and data availability.

¹ https://www.ilo.org/wcmsp5/groups/public/---dgreports/---integration/documents/publication/wcms_229374.pdf

2. Implementation Framework for a National LMIS

The Office has introduced a comprehensive methodological framework to guide member states in the execution of LMIS projects. This refined framework presents a structured roadmap highlighting specific activities and elaborates on stakeholder engagement, identifying the principal leading agency and emphasizing the roles of other requisite agencies.

The **general objective** of the project is to develop a network of institutions, people and information with mutually recognized roles, agreements and functions with respect to the production, storage, dissemination and use of labour market information and outcomes, in order to maximize the potential for the formulation and implementation of relevant policies and programmes.

The ILO provides technical assistance to constituents willing to implement an LMIS in order to:

1. Improve and modernize the collection, processing, systematization and harmonization of information on labour, from different internal and external sources. Standardize statistical information on key market indicators to facilitate the reporting and management of labour market statistics in the country.
2. Provide labour market information that is relevant, accurate and timely at the highest level to decision makers.
3. Establish a suitable governance structure to make the System operate in an efficient and sustainable way with the participation of all the stakeholders in the production and use of LMI.
4. Identify the sources of information for the Labour Market Indicators, collect reference metadata and harmonize the definitions of the indicators and classifications used in all of them.
5. Build capacities in the technical personnel, in their different profiles, in the administration and use of the tools to implement the LMIS, including training in data modelling and SDMX.
6. Train analysts and decision makers in the interpretation of labour market indicators.
7. Make the LMIS.Stat platform available to the public.

The **main activities** carried out after an official request from the Government has been received, in order to build capacities in the required personnel and make the LMIS available to the public, are the following:

1. Assessment of the viability for an LMIS in the country, based on the data availability and institutional situation.
2. Signature of a Memorandum of Understanding and Project Document between the Government (represented by the lead agency implementing the LMIS) and the ILO (represented by the Country/Regional office)
3. Establish governance structure and appoint operational roles
4. Define system architecture
5. Deployment of data warehouse platform (LMIS.Stat)
6. Identify the sources of information for the Labour Market Indicators, make provision agreements with the data providers, collect reference metadata and harmonize the definitions of the indicators and classifications used in all of them.
7. If necessary, carry out a consultancy following the methodology developed for leveraging the use of administrative records as statistical data sources.
8. Define initial set of indicators (variables and classifications) to be implemented in the LMIS.Stat platform
9. Define a harmonized concepts scheme common to all indicators.
10. Publish the LMIS Master Plan and the Governance Manual by the implementing agency
11. Perform knowledge transfer for the configuration and administration of the LMIS.Stat platform by IT staff

12. Conduct a training workshop oriented to Data Production aimed at statistical staff, economists and data and metadata managers.
13. Carry out an SDMX and Data Modelling workshop, aimed at data and metadata managers of all the data providers for the LMIS.
14. Train data managers and producers in data preparation and ETL to the platform
15. Train analysts and decision-makers in LMI interpretation
16. Configure LMIS.Stat tool for live production, including the design of statistical themes (indicator clustering through Categorisation), user interface design (what needs to be customized), logos (specifications of logo files, images, icons, etc.), localization of text labels and translations, etc..

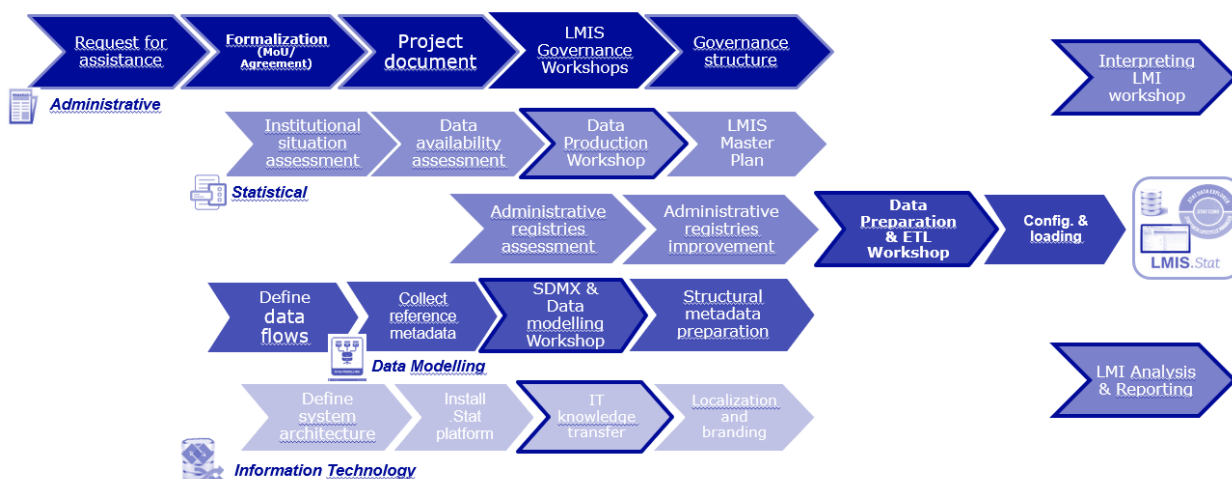
► **Box 1. Implementation Checklist for a National LMIS**

Checklist for the implementing agency

- Submit an official request to ILO
- Conduct an assessment of data availability and institutional readiness
- Sign a Memorandum of Understanding (MoU) with ILO
- Formulate a governance structure and allocate specific operational roles
- Initiate a data warehouse platform
- Organize targeted workshops for data managers and IT focal points to enhance understanding of data production, modelling, preparation, and platform integration
- Compile, prepare, and upload existing data to the platform
- Tailor and configure the LMIS platform for live production

As shown in the implementation roadmap in Figure 1, there are four lines of action (or “tracks”) which are developed mostly in parallel, with few dependencies to observe among them:

► **Figure 1. Implementing Roadmap for a LMIS**



Administrative Track

It begins with the official request from the Government to the ILO requesting for assistance to implement a LMIS. Right after its reception, a MoU between the ILO and the leading Agency has to be signed, and the Agency must prepare the Project document. After the “Governance” workshop a manual describing the governance structure should be published.

Statistical Track

After the signature of the MoU, the “Data availability and institutional situation” assessment is carried out, typically spanning 3-4 days in-country. This process aims to sensitize and align objectives of the primary stakeholders of the LMIS, and to generate the inputs for the “Data Production” workshop. During this phase, meetings with the IT team, responsible for the .Stat Suite application hosting, are also conducted.

The “Data Production” workshop usually takes 4 or 5 full days and organized for all the “incumbents”, i.e., data providers, data analysts and data users, from the leading Agency and the main stakeholders. During this activity, the indicators framework(s) are defined, and all the compilation and calculation methods are discussed. The harmonized list of disaggregation criteria must be initiated in this workshop. The main outcome of this workshop is the “LMIS Master Plan” to be produced by the leading agency.

Data Modelling Track

Once the Data Production workshop concludes and a draft Master Plan detailing data flows, disaggregation criteria, and reference metadata is in place, the “SDMX and Data Modelling” workshop which congregates during 3 to 5 days is organized for data-related stakeholders, in particular the data manager(s). IT focal point(s) are also welcome and should participate for them to get a better understanding of the “statistical business”.

Information Technology Track

Simultaneously, post-MoU, this track focuses on setting up and customizing the .Stat Suite platform.

It is vital that these tracks conclude around the same timeframe, as the last activity of the assistance, the “Data Preparation and ETL” workshop requires prior completion of the tracks ensuring an established governance, a published Master Plan, the SDMX and Data modelling training, and the readiness of the .Stat Suite platform for data and metadata upload. This workshop takes 3-5 days and is oriented to data managers and IT focal points.

After this workshop there will be a follow-up virtual activity providing remote assistance to the configuration and upload of the system, on demand.

Two optional activities, “Administrative registries” assessment and a workshop on “Interpreting labour market indicators” can be carried out at any moment, as needed.

► Box 2. Implementation Milestone for a National LMIS

LMIS Milestones		
► M1	Project presentation	Administrative Track
► M2	Data availability assessment	Statistical Track
► M3	MoU Signature	Administrative Track
► M4	Publish LMIS governance manual	Administrative Track

► M5	Nomination of data manager	Administrative Track
► M6	Nomination of IT focal point	Administrative Track
► M7	Data production workshop	Statistical Track
► M8	Publish LMIS Master Plan	Statistical Track
► M9	Data analysis capacities development	Statistical Track
► M10	SDMX & Data modeling workshop	Data Modeling Track
► M12	Define structural metadata	Data Modeling Track
► M13	Setup LMIS infrastructure	IT Track
► M14	IT knowledge transfer	IT Track
► M15	Data preparation & ETL workshop	Data Modeling Track
► M16	Upload indicators' data	Statistical Track
► M17	Upload indicators' metadata	Statistical Track
► M18	LMIS in production	

2.1. Assessment of Data Availability and Institutional Situation

Data is a *sine qua non* resource for an LMIS. Without labour market information it is not possible to establish an LMIS.

Its availability depends on two aspects: 1) existence of an operation that generates or compile data from which labour market indicators can be calculated; and 2) the producer/owner of this data is keen on sharing the information with the LMIS.

Prior to initiate the LMIS project it is necessary to confirm that these two requirements are met in the country. The regional statistician of the ILO quite often knows what happens in this regards in the countries under their responsibility, but sometimes it is necessary to conduct a short mission to verify the situation on site. The mission must identify the available sources of information for the Labour Market Indicators, ensure the availability of reference metadata for the different datasets and suggest the establishment of provision agreements with the data providers willing to share their data. The occasion is also an opportunity to meet with those data producers who are unwilling to share their data and try to raise their awareness of the importance of LMIS.

2.2. Signing of Memorandum of Understanding (MoU)

The first step in the LMIS implementation project is the signature of a Memorandum of Understanding (MoU) between the ILO, represented by the Country Office, DWT or Regional Office director, and the leading Agency representative, in order to formalize the project execution. The MoU describes the nature of the project and establishes the legal framework under which it will take place.

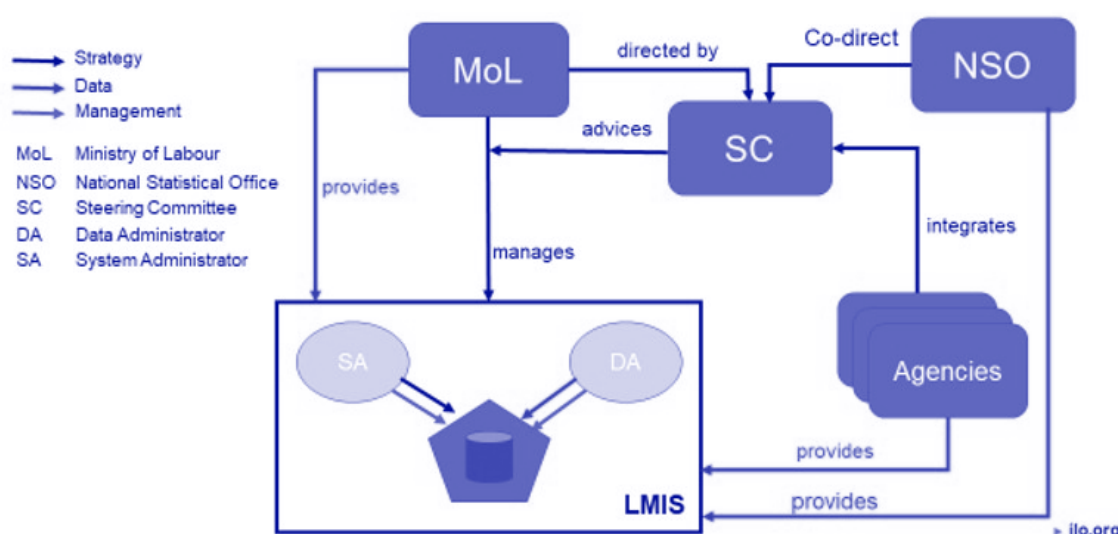
Besides, the Agency team must prepare the Project Document (ProDoc) which describes the project from a technical point of view, including a description of current situation, overall goal of the project, specific goals, overall and specific expected benefits, definition and scope of requirements, technological infrastructure, and training activities.

2.3. Establishment of Governance Structure and Appoint Operational Roles.

2.3.1. Organizational Structure

An example of a straightforward institutional arrangement is the establishment of an LMIS Advisory Panel (or a Steering Committee) joining policymakers, the statistical agency and workers' and employers' organizations.

► Example of LMIS Governance Structure



A strong role of the LMIS with regard to policies (F2) and coordination (F3) necessitates institutional linkages between the system and the process of formulating and monitoring national socio-economic plans, including national employment policies, poverty reduction strategies and other development plans. This may also involve the selection of a set of indicators that are monitored to track progress in the achievement of labour market objectives, or the setting of targets for certain indicators. Institutional arrangements could also encompass institutions involved in the implementation of policies.

At the core of LMIS operation, two roles are fundamental for a successful operationalization: the "Data administrator" and "IT focal point". These roles can be assigned to individuals, although small teams of at least two people are advisable to be safe in case of any of them leaving.

2.3.2. Data Administrator

Main tasks:

1. Actively participate in training workshops and, in particular, in the definition of the data model during the Data Preparation Workshop.
2. Manage structural metadata for the entire LMIS platform.
3. Manage the reception of data and metadata from the different suppliers, internal and external to MoL
4. Ensure the quality of the datasets and metadata received, and that they are in the correct format for uploading.
5. Compile indicators derived from micro-data or aggregated data for down-loading
6. Configure "default" views for dataflow queries

7. Configuring and maintaining dataflow categories and categorisations
8. Perform indexing of dataflows and maintenance of search engine
9. In general, provide all data and metadata management tasks for LMIS.
10. Act as a first line of support for data users and providers, and as a focal point for escalating issues to ILO specialists.

Dedication:

Full time since the beginning of the project.

Profile:

Experienced and with a "taste" for working with data, they could be a statistician, economist or sociologist who is used to processing data. Advanced undergraduates in these fields can fill the role perfectly well. It can also be a computer scientist who understands the "statistical business". In general, computer scientists are the quickest to "learn" and adapt to the role, but they must have a "taste" for working with data. A developer is probably not suitable for this role, nor is an infrastructure specialist.

2.3.3. IT Focal Point

Main tasks:

In the first 2 to 3 weeks, during the implementation of the system:

1. Define the architecture of the .Stat platform together with the ILO specialist.
2. Prepare the infrastructure to host the .Stat Suite platform (2 servers), including installation of the base software, DBMS and configuration of the network infrastructure and domain names for the microservices.
3. Install and configure .Stat database (MS SQL Server)
4. Participate in the installation and configuration of the .Stat application in conjunction with the ILO specialist.
5. Carry out the localisation and branding of the platform, with the support of the ILO specialist.
6. Configure authentication service (list of users and their login credentials)

During the development of the project:

7. Participate in the "Data Production", "SDMX and Data Modelling" and "Data Preparation and ETL" workshops (preferably).

Once the platform is up and running:

8. Be the IT focal point for the support of the .Stat platform.
9. Maintain the platform infrastructure
10. Install and configure .Stat system upgrades, with support from the ILO specialist whenever necessary.
11. Managing the authentication system (users and access credentials)
12. Administering the .Stat database server
13. In general, configure and maintain all aspects of LMIS' central infrastructure.
14. Act as the first line of IT support for users and the data manager, and as a focal point for escalating problems to the ILO specialist.

During the first weeks full time commitment is not required, but at least this project should be their main task, being able to participate in the workshops. Once the platform is up and running the dedication is partial and on demand.

2.4. Defining System Architecture and Deploying .Stat Suite

This activity normally starts with an introduction to .Stat Suite architecture followed by a demonstration. Participants required in this activity are key IT focal point including normally system and network administrators, database admin, and application developers. During this initial introduction, we focus on a high level system architecture and infrastructure requirements. We also collect information from the participants about their preferences on the type of systems, technologies, and use cases in general.

After this kick-off meeting, we will present a draft system design with minimum requirements for the organization to prepare their infrastructure. Once it's ready, we start the assessment and deployment process either through remote assistance or on-site if resources permit.

During the deployment, we work closely with the IT focal point, providing detailed explanation on all the components of .Stat Suite. In general, local IT staffs are gaining hands on experience on the deployment routine with instructions from ILO experts, and sometimes even with the support from the SIS-CC community. At the end of the deployment, not only a running .Stat system is installed and configured according to a local environment, but also all necessary knowledge to maintain and manage the system and users are transferred to the IT staffs in the organization, in order to achieve and form a self-sufficient and autonomous technical support team locally.

After .Stat Suite is deployed, we continue to support users and IT team while data managers start using the system to upload data and metadata. We also support the organization where customization and localization are necessary. Over the period of data preparation, we regularly provide technical support and assistance for troubleshooting system or data issues. Very often, fine tuning the configuration and some minor adjustment to the system are expected during testing and data preparation.

When .Stat is populated with data and metadata, prior to production release, we will conduct a final assessment of the system, ensuring the system is up-to-date, secured, and properly configured. Any network and accessibility issue should be solved and verified so that both internal data managers and external users have sufficient and proper access to the LMIS system.

Through the entire LMIS system design and deployment process, ILO is closely engaged with IT focal point to ensure a well configured and secured system is ready for production.

2.5. Conducting a Data Production Workshop

After identifying the available data sources, the Data production workshop is the instance where all the different criteria around the LMI must be unified.

It will include an analysis of the available data sources (according to the results of the *Assessment of data availability and institutional situation*, considering the LMI that can be obtained from each of them, as well as its strengths and limitations.

After the data sources analysis, the work will be focused on defining the set of indicators (variables and classifications) to be included in the LMIS.

► Main Data Sources Strengths and Limitations

	Strengths	Limitations
Population census	➤ Comprehensive enumeration, coverage of the whole population ➤ Allows for the production of reliable information on small groups	➤ Very costly ➤ Short questionnaires prevent collection of detailed info on specific topics
Household surveys	➤ Comprehensive coverage of population ➤ Detailed questioning permits precise measurement of statistical concepts for short reference periods	➤ Sampling prevents reliable estimates for small groups ➤ Lower quality of data on income, "sensitive" and employer-related topics ➤ Cannot provide estimates of vacancies, training needs, etc
Establishment surveys	➤ Comprehensive coverage of larger businesses ➤ Payroll records provide consistent and reliable data for income and employment by industry ➤ Only source for data on vacancies, training needs, etc	➤ Typically poor coverage of very small and unregistered businesses ➤ Requires constant updating of registers (births and deaths) ➤ Difficult identification of small or informal units ➤ High non-response rates ➤ Sampling prevents reliable estimates for small groups ➤ Data items are limited by the information in establishment's registers
Administrative records	➤ Total count allows maximum detail ➤ Inexpensive to compile statistics	➤ Purpose? ➤ Coverage? ➤ Data quality?

In some cases, especially when dealing with administrative registries, it might be necessary to carry out a consultancy (following the methodology developed by the LMIS team) with the aim of leveraging the use of administrative records as statistical data sources.

During the workshop, the participants will learn how the selected indicators are to be calculated following the international recommendations and best practices, in particular those emerging from the International Conference of Labour Statisticians (ICLS).

Usually, the main set of LMI will be part of the Decent Work Indicators framework, which comprises ten substantive elements (and an additional one on the economic and social context) corresponding to the four strategic pillars of the Decent Work Agenda.

► Strategic Pillars of the Decent Work Agenda

The four strategic pillars of the Decent Work Agenda are:

1. Full and productive employment
2. Rights at work
3. Social protection
4. Promotion of social dialogue.

The Decent Work Agenda includes a cross-cutting objective of gender equality. Thus, the Decent Work Indicators will be disaggregated by sex, whenever possible.

► Decent Work Indicators Framework

SUBSTANTIVE ELEMENTS OF DECENT WORK	
1. Employment opportunities	2. Adequate earnings and productive work
3. Decent working time	4. Combining work, family and personal life
5. Work that should be abolished	6. Stability and security of work

7. Equal opportunity and treatment in employment	8. Safe work environment
9. Social security	10. Social dialogue, employers' and workers' representation
Economic and social context of decent work	

Other reference frameworks, like the SDGs, or Labour Migration indicators, are also taken into account during the workshop, as well as any indicators suggested by the LMIS stakeholders.

2.6. Publication of the LMIS Master Plan

After the Data production workshop, it is necessary to set out the content of the LMIS in a comprehensive document, including all the details of the data and metadata to be integrated in the datawarehouse.

► Content of an LMIS Master Plan

I.	INTRODUCTION
II.	LMIS COMPONENTS
III.	GENERAL MAPPING OF INFORMATION SOURCES
IV.	PHASES AND CRITERIA FOR THE INCORPORATION OF INDICATORS
V.	THEMATIC AREAS
VI.	INDICATORS
	a. PHASE I INDICATORS
	b. PHASE II INDICATORS
	c. ...
	<i>(For each indicator it should include the definition, preferred and alternate data sources, calculation method, interpretation guidelines and disaggregation criteria)</i>
VII.	CLASSIFICATIONS & OTHER DISAGGREGATION CRITERIA
	<i>(For each concept to be used as a breakdown for the indicators it should include the definition and the categories with codes, names and descriptions. All variants used, i.e. different age bands or classification's versions, must be listed in this section)</i>
VIII.	RECOMMENDATIONS AND REMAINING CHALLENGES
IX.	REFERENCES
Annex 1	STATISTICAL TABLES
	<i>(For each indicator it should include the valid combinations of breakdowns, e.g. Labour force participation rate by sex and age, Labour force participation rate by sex and education level, Labour force participation rate by sex and economic activity, etc.)</i>
Annex 2	DATA VISUALIZATIONS AND DASHBOARDS

The two initial sections are meant to provide a context to the document in the framework of the LMIS project.

All data sources to be used should be described in Section III, highlighting their strengths and weaknesses. In case phases for the loading of indicators have been defined, these should be made explicit, with a timeline as clear as possible and explaining the reasons why it is set up in that way.

The thematic areas and which indicators belong to each of them constitute an important input for the design of the data access paths in the data model. They are to be described in Section V.

The core of the Master Plan is the list of indicators in Section VI, with a comprehensive description including, but not limited to, its definition, preferred and alternate data sources, calculation method, interpretation guidelines and disaggregation criteria.

Section VII is a cross-referenced list of all the classifications and disaggregation criteria mentioned along the indicators' descriptions in the previous section. This is an essential resource for the data harmonization process since will be the input to define the unique Concept Scheme for the system. It should include the concept definition and the categories with codes, names and descriptions (i.e., code lists). All variants used, i.e., different age bands or classification's versions, must be listed in this section as well. This information must be available for the SDMX and Data production workshop.

Section VIII should list the remaining challenges at the moment of writing the Master Plan, as well as any recommendations for the data modelers or data producers following the specifications in the Plan.

Annex 1, the list of statistical tables, is also a mandatory resource for the data modelling work. This list establishes which are the "valid" combinations of indicators (measures) and breakdowns (disaggregation), thus defining the valid "data cubes". This is an essential input for the forthcoming SDMX and Data Modelling workshop.

Annex 2 is optional, but it is quite useful to have it in the document if the visualizations have already been defined by the time the Master Plan is being edited.

2.7. Workshop on SDMX and Data Modelling

This workshop is designed to equip data managers and analysts from all key data stakeholders with the skills necessary to model labour market indicators effectively. Participants will practice the creation of a harmonized single concept scheme, learn the consolidation of code lists from varied sources, and acquire proficiency in modeling data tables within the SDMX framework. The duration typically ranges between 3-5 days, depends on participants' prior familiarity with SDMX.

Before starting the workshop, it's imperative that the LMIS Master Plan is available. On-site training is highly recommended, as a substantial portion of the training involves hands-on exercises. By the end of the workshop, participants will have crafted all essential structural metadata artifacts in SDMX, including concepts, code lists, data structural definitions, and data flows based on their country's LMIS context.

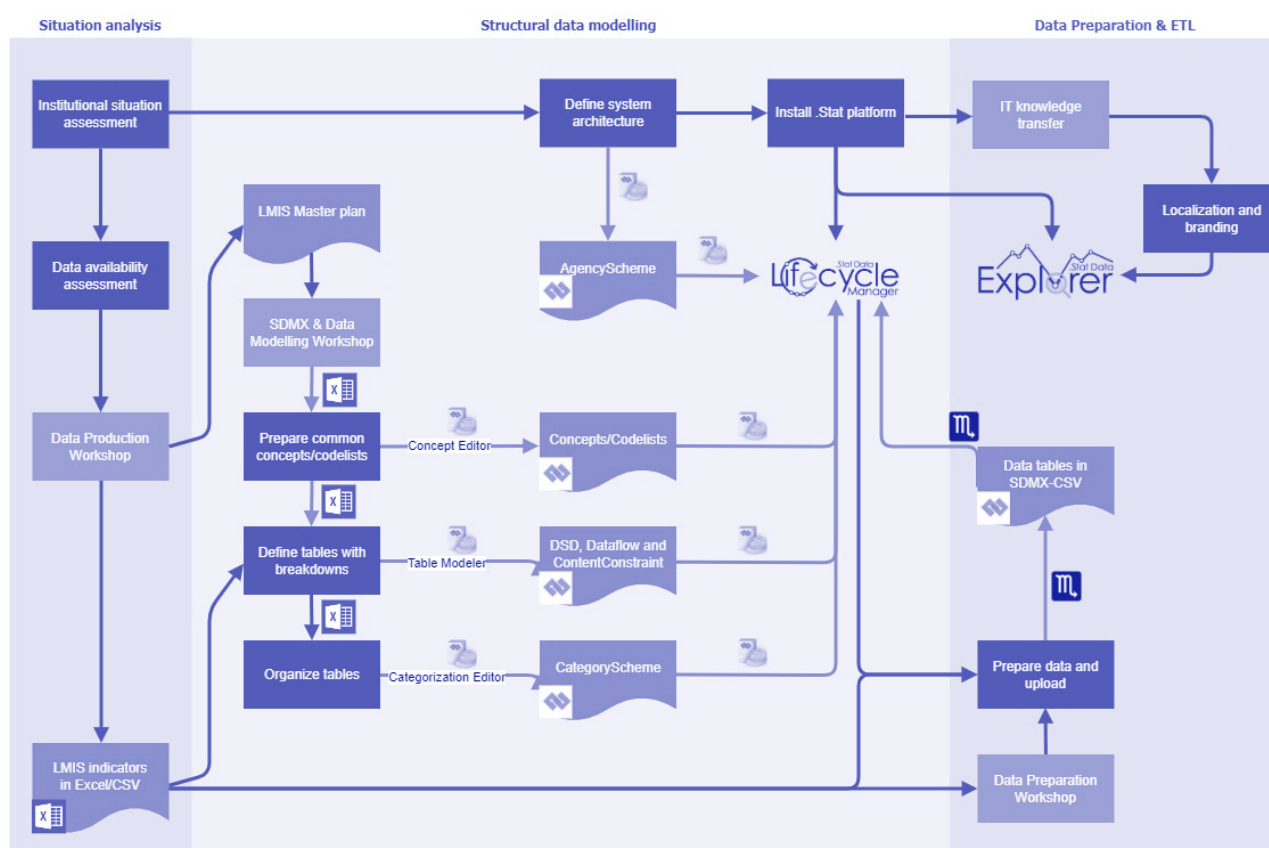
The "Statistical Data and Metadata Exchange" (SDMX) is promoted as the data modeling standard for LMIS due to its efficacy in harmonizing diverse data sets. At its core, SDMX allows to use a single concept scheme and shared code lists, which are crucial for achieving data harmonization across various data sources. Defining the data model based on the SDMX information model, it ensures that labour market indicators, regardless of their origin from different data sources, are consistent and comparable.

Beyond data harmonization, SDMX brings additional advantages. It enhances data accessibility, paving the way for stakeholders to seamlessly share and exchange labour market information. SDMX allows to define F.A.I.R. (Findable, Accessible, Interoperable, Reusable) vocabularies, a crucial aspect for interoperability and enabling computer-to-computer operations. By embedding standardized structural metadata and reference points, SDMX also enhances data interpretability, ensuring that users can

effortlessly comprehend and employ the data. Additionally, its foundation on open-source principles translates to reduced IT developmental costs. Through its comprehensive framework, SDMX not only ensures data coherence but also streamlines operations, making it an indispensable tool for global labour statistics management.

After this workshop is completed, the team will be able to complete the data model, and create all the structural metadata and upload it to the .Stat Suite platform.

► **Figure 2. LMIS Information Flow**



► **Table 2. Modeling Template for a Single Concept Scheme**

ID	Name	Codelist Representation	Role
REF_AREA	Reference area	CL_AREA	Core Dimension
FREQ	Frequency	CL_FREQ	Core Dimension
INDICATOR	Indicator	CL_INDICATOR	Core Dimension
SEX	Sex	CL_SEX	Breakdown
AGE	Age groups	CL_AGE	Breakdown
EDU	Highest level of education completed	CL_EDU	Breakdown
ECO	Economic activity (ISIC 1-digit)	CL_ECO	Breakdown
OCU	Occupation (1-digit)	CL_OCU	Breakdown

SIE	Status in employment	CL_SIE	Breakdown
DIS	Disability status	CL_DIS	Breakdown
GEO	Geographical area	CL_GEO	Breakdown
TIME_PERIOD	Time period		TIME
OBS_VALUE	Observation value		MEASURE
UNIT_MEASURE	Unit of measure	CL_UNIT_MEASURE	Core Attributes
UNIT_MULT	Unit multiplier	CL_MULT	Core Attributes
DECIMALS	Decimals	CL_DECIMALS	Core Attributes
OBS_STATUS	Observation status	CL_OBS_STATUS	Attributes
NOTES	Table footnotes		Attributes

2.8. Data Preparation and ETL Workshop

This workshop is designed to provide data managers, .Stat system administrators, and data providers from various stakeholders, the required skills to prepare their data in SDMX format and upload it to the central data warehouse. Given the diverse origins of data, the training emphasizes harmonizing formats, reconciling inconsistent attribute coding/naming, and preparing for regular data updates. The ideal duration for this workshop is 5 days, including at least 3 days of hands-on exercises. Furthermore, given the practical nature of the training, an on-site format is highly recommended.

By the end of this workshop, participants should be adept at navigating and exercising the data preparation process for the LMIS platform, ensuring seamless data uploads.

The data preparation for LMIS platform has the typical three phase ETL (Extract, Transformation and Load) process:

2.8.1. Extraction

Data sourced from diverse origins undergoes the initial extraction process. The procedure involves: Retrieving data, which may span various formats, and subsequently staging it. Some of this data might be derived. Collaborative engagement between data managers and providers to ensure alignment of indicators with the master plan. Upon alignment, the next step is to finalize a consistent data format with the required breakdowns. In the absence of alignment, the recommendation is to resort to a flat CSV approach, leveraging codelists for data extraction.

2.8.2. Transformation

At this phase, data finds its way to a centralized staging area, ensuring that naming conventions are uniformly understood by all stakeholders. The SMART tool can be very useful here as it transforms incoming data into the SDMX-CSV format as well as recodes the records towards the defined reporting attribute. And the mapping files, once created for recoding, are archived for future re-use. For automation, the SMART.cmd tool can be deployed to create batch applications, streamlining the transformation process.

2.8.3. Loading

The final ETL process is the loading phase, characterized by channeling the transformed data to the .Stat platform, with a preference for batch loads facilitated by APIs. And ideally, this API-driven transfers from the outbound stage to the platform happening concurrently with the transformation phase.

It is also recommended to institute a scheduler synchronizing with the reporting frequency, which ensures that new data sets trigger the batch application for processing and relocation to an outbound folder.

To maintain informed over upload processes, monitoring tools, especially email alerts from .Stat Suite are important to follow.

3. LMIS Toolkit

As it has been mentioned, a LMIS aims to the production, storage, dissemination and use of labour market related information and results. Those constitute the core phases of a statistical process, as defined by the Generic Statistical Business Process Model (GSBPM).

Therefore, the implementation of a LMIS will require processes and tools, mainly for data collection and processing, and for storage, management and dissemination of both data and related metadata, but should not be difficult to integrate in any statistical production environment. A set of open source and free to use tools are provided and supported by the ILO for the implementation of the different components.

LMIS' indicators are to be produced from different data sources (). Depending on the level of integration with the production system, some transformations may be required in this source data, either to compute the indicators from microdata or to transcode some of them to match the coding scheme of the repository. For both functionalities, **ILOSTAT SMART** (Statistical Metadata-driven Analysis and Reporting Tool) is provided by the ILO at no cost.

For reference metadata management and exchange, the standard DDI template provided by IHSN and the associated Metadata Management Toolkit, also available at no cost, are suggested. It is also possible to define an ad-hoc metadata template for the LMIS using .

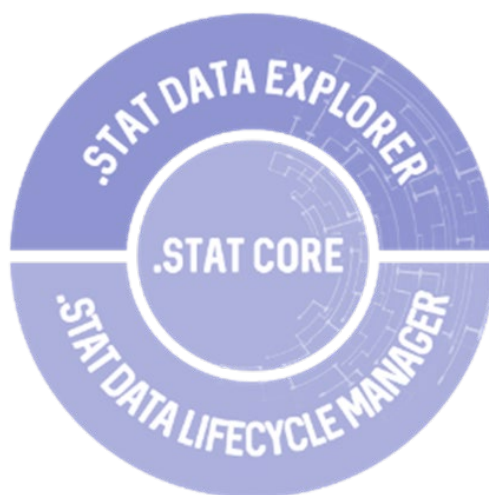
3.1. Repository of Indicators

The tool recommended for storage and dissemination of LMIS indicators is **.Stat Suite**. This powerful platform is available for those countries implementing LMIS through an agreement between ILO and OECD and the Statistical Information Systems – Collaboration Community (SIS-CC).

Amongst many **reasons** why .Stat has been selected as the tool for implementing a LMIS, it worth mentioning:

1. **High quality product:** .Stat is one of the most advanced statistical information systems' platform currently used in the official statistics community. Its architectural design and development process follows the recommendations and best practices in application lifecycle management to obtain a robust and reliable product.
2. **Affordable investment:** Under the "umbrella" of ILO's membership to the SIS-CC, a country implementing a LMIS can use the product and receive first level support and free upgrades. The only investment required to the country are the expenses associated to the deployment of the platform and training on .Stat administration and data/metadata management.
3. **Community values:** The SIS-CC promotes a series of values that are aligned with ILO principles, like Partnership (Collaboration rather than a vendor/client relationship), Transparency (Information openly and transparently shared among members), Commitment (To respecting the coordinated work plans put in place), Industrialisation (Outputs developed according to best practices in application lifecycle management), and Standards (Foster and promote internationally defined standards, such as [SDMX](#), [GSBPM](#), [GSIM](#), and [CSPA](#)).
4. **Sustainability:** The collaborative approach for development, and the number of institutions using the software minimize the risk of support or further development being interrupted, an inconvenient situation that unfortunately is quite common when contracting external developers.

► .Stat Suite main modules



► .Stat Suite Modular Architecture

The architecture of .Stat Suite is composed by three modules:

1. **.Stat Core:** In the centre of the architecture, includes the functions related to data and metadata storage, configuration and the SDMX, Share and Search web services.
2. **.Stat Data Lifecycle Manager (DLM):** As already mentioned, the DLM is the “backoffice” interface for data and metadata management.
3. **.Stat Data Explorer (DE):** The DE, entirely composed by Reusable Components for the Web (RCW), is the user’s interface to search, visualize (in several formats) and share LMIS data.

.Stat provides four main functions:

1. **Data Upload:** The Data Lifecycle Manager (DLM) is a front-end application to load and process data into the Data Warehouse. Data can be in csv, Excel or sdmx format.
2. **Data Storage:** Based on Microsoft SQL server and a standard star schema data warehouse technology.
3. **Data Exit:** A single exit point serves all outputs from the Data Warehouse exposing the data to several dissemination tools through a set of Web Services to Search data, Visualize and Share results. SDMX based web services allows interfacing with a number of re-usable web components for data visualization and reporting.
4. **Data Analysis:** .Stat allows for the extracting of data to various analytical tools for further data analysis.

The interaction between both DLM/DE and .Stat Core is 100% based on **SDMX** standard web service, ensuring interoperability for data integration to/from other systems implementing such standard.

In this regard, a smooth migration path from Version 7 to .Stat Suite is possible by adding to .Stat v. 7 a new web service which implements a fully compliant SDMX 2.1 API (already available) and connecting through this interface the new .Stat Data Explorer. This makes possible all the new features in terms of data visualization that are delivered by the DE, while not having to change the production process.²

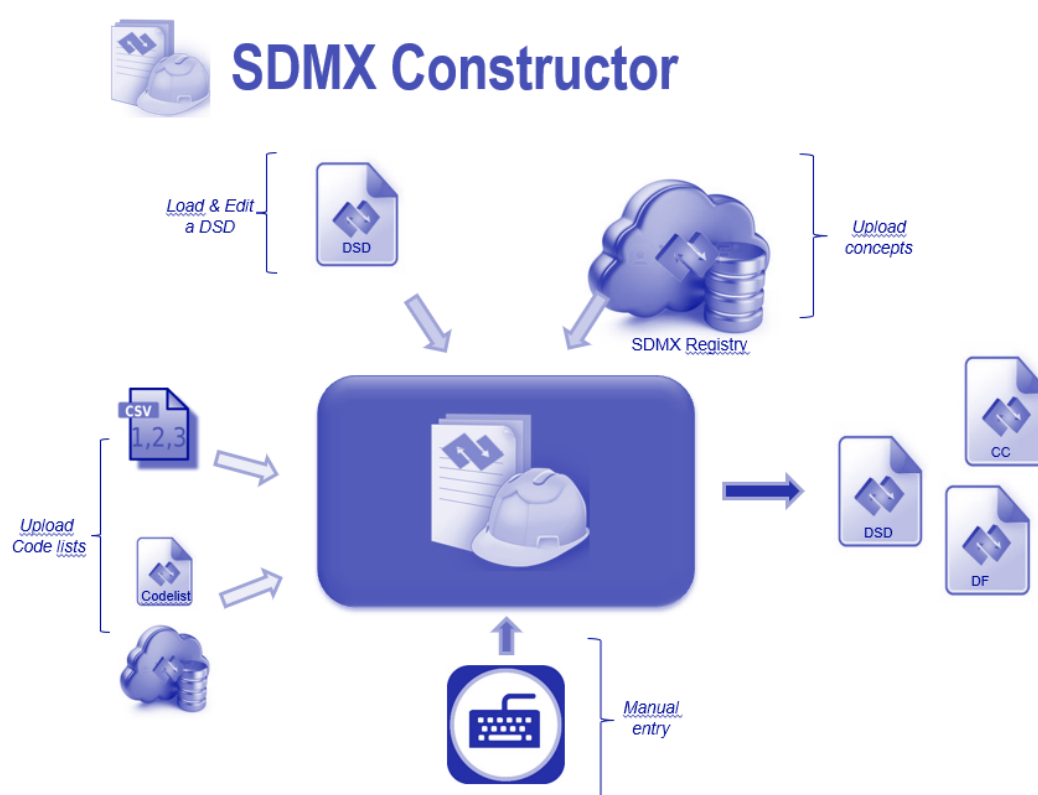
² The actual possibility of this interoperation depends on data modelling aspects of the v.7 database.

3.2. Structural metadata preparation

The **SDMX Constructor** allows the creation and edition of the main SDMX structural metadata artefacts (DSD, Codelist, Dataflow, etc) according to the data model defined.

It operates at the structural data modeling and preparation phase, acting as a backend interface for direct interoperability with the .Stat DLM through its SDMX API entry-point. Within this system, existing artifacts in the DLM can be fetched for both review and modification, while freshly designed or modified artifacts can be effortlessly uploaded through the API.

► SDMX Constructor

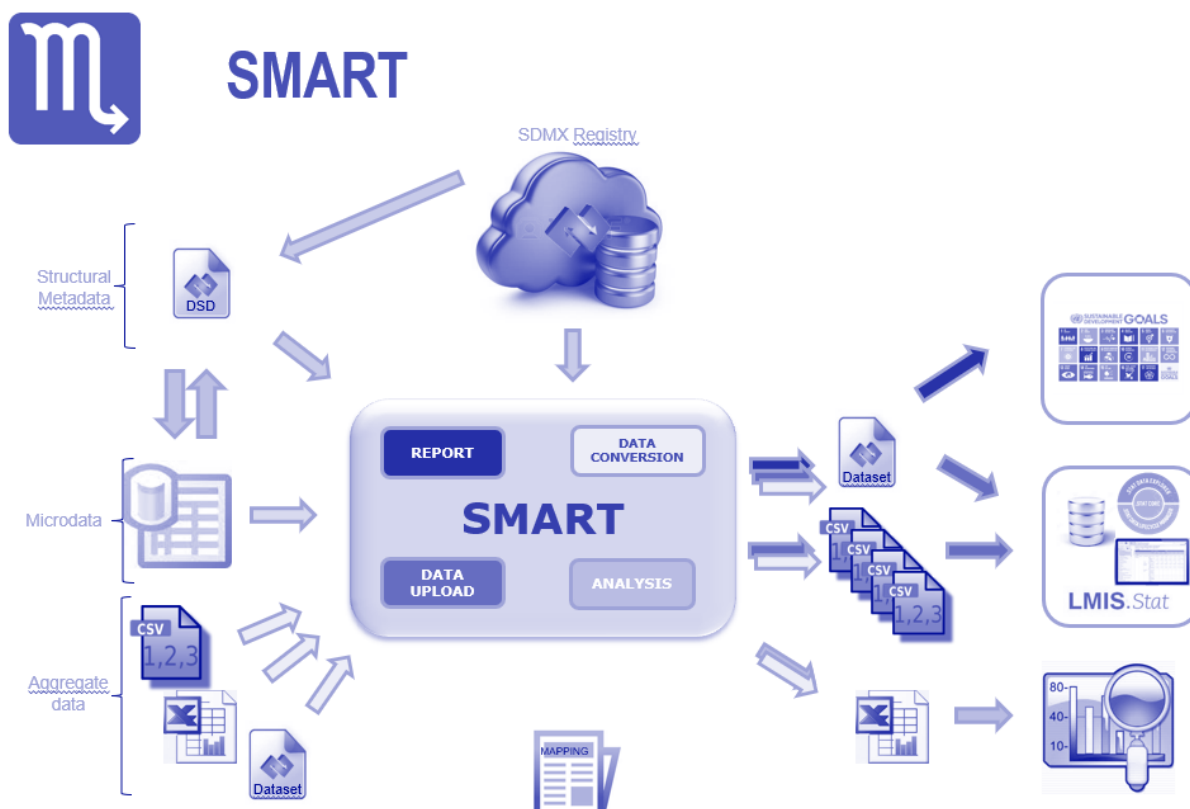


As indicated in the diagram, the conceptual design and data modeling falls predominantly on statisticians and data managers. They initiate the process in Excel Worksheets with the modeling template, preparing common concepts/code lists, defining indicators with their respective breakdowns, and assorting indicators based on thematic topics. Subsequently, system administrators or data engineers are responsible to craft the corresponding SDMX artifacts using the SDMX Constructor. This transition is streamlined: items for concepts and code lists can be transferred directly from the Excel inputs via simple copy-paste operations. The newly integrated Editor – Table Modeler further simplifies this by allowing the creation of DSD, data flow, and content constraints for tables through intuitive drag-and-drop actions. Additionally, with the CategoryScheme Editor, hierarchical categorizations can be established, mirroring the grouping principles outlined in Excel.

3.3. Data collection and formatting

ILOSTAT SMART, the multipurpose statistical processor and transcoder developed by ILO, is compatible with current and future versions of .Stat, serving the purpose of data and metadata preparation for uploading to .Stat.

► SMART



Using SMART, the definitions of the indicators are downloaded from the Repository using SDMX or are received in a SDMX-ML file. Based on such definitions, the user creates the mapping of each concept in the tables with the variables in the input file, which can be either microdata or aggregate data.

In case of multi-dimensional Excel tables, SMART is able to “flatten” the structure and load the data just by signalling the table columns and rows headers by painting the corresponding cells.

Once the mapping has been established and the basic aggregation rules defined, SMART will generate the output in the right format required to update an LMIS.Stat system, or to report to ILOSTAT or the SDG collection agency. This mapping can be saved for future re-use.

It can also generate Excel reports for pre-analysis of the outputs, for example to decide which variant of a classification to use based on cases coverage.

SMART provides direct upload of datasets to the .Stat Suite datawarehouse to facilitate the data production of indicators, not only for the LMIS, but other reporting needs as well.

SMART takes the dataflow (and its associated DSD) to define the output data structure, and also the LMIS table directly from Excel as the data input. After applying the mappings between the input data and the output structure, it converts the data into SDMX-csv, which can then be directly pushed to DLM via transfer API.

4. Regular LMIS training

From 2020 to 2023, the International Training Centre of the International Labour Organization (ITC-ILO) in Turin, in collaboration with the ILO Department of Statistics, has been offering the course "Institutional Capacity Building for Effective Labour Market Information Systems (LMIS)." Over the years, this course has evolved to meet the dynamic demands of constituents in relation to labour market information systems. The course has consistently aimed to equip participants with a solid understanding of LMIS functions, components, and applications. It emphasizes that an efficiently functioning LMIS is crucial for designing, implementing, monitoring, and evaluating evidence-based employment and labour market policies.

More specifically, the course has maintained specific learning objectives:

1. Understanding LMIS Components: Participants gain insights into key LMIS components, including data collection, information repositories, analytical tools, and institutional arrangements.

2. Understanding LMIS Functions: The course fosters an understanding of critical LMIS functions, such as labour market analysis, policy monitoring and reporting, and coordination among actors and institutions involved in labour market information.

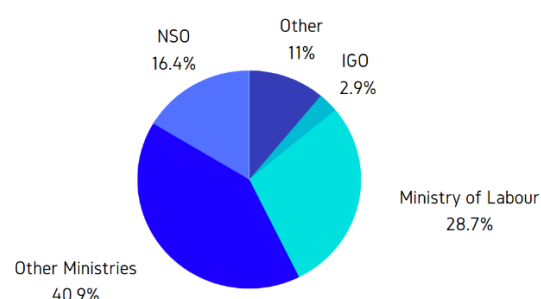
► Participant Diversity in LMIS Capacity Building

The participant diversity in LMIS capacity building can be seen across three pillars:

1. Gender Equality
2. Multifaceted Professional Backgrounds
3. Global Distribution

The gender distribution of participants in the program reveals an almost equal representation of both females and males, with **186 female participants and 222 male participants, totaling 408 individuals**. This balanced participation is a testament to the program's commitment to inclusivity and diversity, fostering an environment where individuals from all backgrounds and genders can come together to enhance their understanding of Labour Market Information Systems (LMIS).

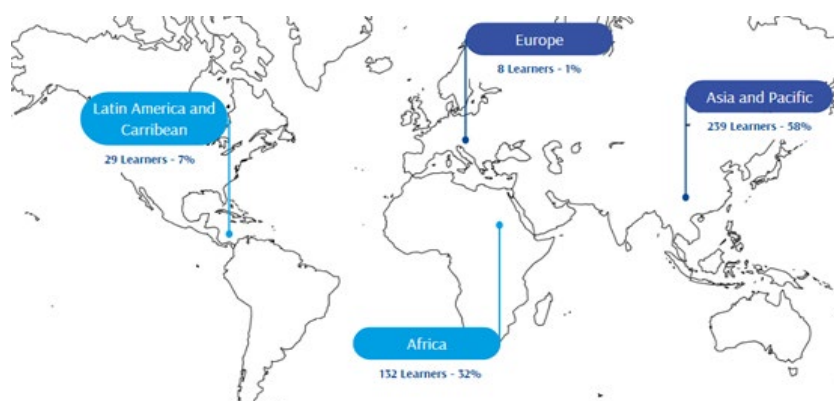
► Participants by sector



Source: ITC-ILO

Participants in the course are a dynamic blend of professionals representing various sectors. From Ministries of Labour, National statistical offices (NSO), and other ministries to International Organizations (IGO) and beyond, this diverse group of learners forms a powerful mosaic of knowledge and expertise.

► Participants by geographic region



The course's ability to draw participants from across the world underscores its relevance and importance in enhancing labour market information systems on a global scale. It also fosters a rich and varied learning environment where participants can share insights and best practices from their respective regions.

Source: ITC-ILO

► LMIS Support From the ILO Team

The Office offers multiple layers of support for the development and implementation of LMIS from both the STATISTICS team at headquarters and regional advisers. While the specifics can vary based on individual country or regional needs and the evolving priorities of the ILO, the general support structure includes:

1. **Technical assistance.** The ILO dedicated team provides expertise in designing, developing and rolling out LMIS. This covers all the main activities in the LMIS implementation, including system architecture, data platform solutions, data availability assessment, data modelling and preparation, and other technical tasks.
2. **Capacity building.** Essentially, at least 4 workshops and training sessions are provided to strengthen the capabilities of the involved stakeholders on data production, SDMX & data modeling, Data preparation and ETL, and IT knowledge.
3. **Methodological framework.** Standardized framework has been developed to guide countries in their LMIS implementation process and harmonize their data with international standards like SDMX. This ensures consistency, comparability, and best practices are adhered to.
4. **Collaborative tools and platforms.** Specific data toolkits and software solutions have been developed inhouse or shared by other international communities, which aid in various aspects of data collection, formatting, uploading, and analysis.
5. **Stakeholder engagement.** The ILO team also assists countries in identifying and engaging with essential stakeholders, ensuring that all relevant parties are involved in the LMIS project. This can involve setting up governance structures, operational roles, and more.

5. Conclusion

The growth in the number of countries requesting assistance from the Office for the implementation of Labour Market Information Systems has been sustained over the last 5 years, even in times of the COVID-19 pandemic. This confirms that governments consider timely and accurate labour market information as a necessity for the formulation and monitoring of public policies.

The implementation roadmap has been structured to focus on capacity building to ensure the sustainability of the project, rather than on obtaining short-term results through processes that fail to be replicated locally once the assistance project comes to an end.

Likewise, the tools provided, in particular .Stat Suite, are open source and supported by a community of official statistics producing institutions (SIS-CC) that is growing in number and importance of its members. This also ensures sustainability, as there is no risk of the LMIS being threatened by lack of support for the application that provides the information storage and dissemination services, something that could happen if it relies on its own budget or even worse, on a service provided by commercial for-profit companies.

It is also worth highlighting the data modelling methodology developed in the Knowledge Management Solutions Unit with the objective of taking advantage of SDMX features to facilitate data harmonization. The elaboration of a Master Plan that consolidates all the necessary information for the definition of the structural metadata; the shared work on the modelling templates that allows to define in a very simple way a unique "ConceptScheme", unified codelists and the detail of the statistical tables that the system will contain; and the functionalities of the SDMX Constructor that use this information, constitute a very straightforward path from the conceptualization of the LMIS content in the Master Plan to the structural artefacts loaded in the .Stat Suite repository.

However, some steps in the implementation process are still perfectible. The Master Plan, a fundamental input for the data modelling workshop, is not always delivered on time with required information. More time should be planned towards Data Production Workshop so that participants could fully understand the relevance of this document.

In the structural metadata preparation, the rigid SDMX information model, a feature from which the methodology benefits, generates setbacks due to integrity rules that prevent modifying artefacts referenced by other artefacts. Very often a small error in the data model, for example the attachment level of an attribute in a DSD, is extremely difficult to correct as it implies changing the version of the DSD and therefore the references in all the dataflows that use it, which can be dozens; these in turn are referenced by the ContentConstraints, which must also be modified. The upgrade of the tools to SDMX 3.0 will allow the application of semantic versioning, which includes wildcarded references, making this type of minor changes possible without affecting the reference chain.

The compilation and preparation of referential metadata needs also to be improved. More time will be allocated to this topic in the workshops, and the SDMX Constructor is going to incorporate new feature to facilitate the production of this important information. Besides, a new metadata authoring tool is planned to be integrated to the toolkit.

The possibility of automating data updates is also a common need once the LMIS is in production. The new "action" codes for data maintenance in SDMX 3.0, combined with some of the features of SMARTcmd, the batch utility for data transformation and upload, will provide such capabilities in the near future.

It is also quite obvious that LMIS requires the implementation of a portal to present the information in a more user-friendly way than those default visualizations offered by the Data Explorer. Dashboards and infographics allow information to be conveyed in a much clearer and understandable way for non-technical users. While using Power BI to produce graphs and dashboards is an alternative thanks to the existence of an SDMX connector, it is sometimes complicated to use for beginners, and the publication of the graphs in a controlled environment (not public access) requires licensing. It is the intention of the Office to incorporate into the LMIS toolkit a dynamic dashboard generator based on SDMX to produce graphs easy to embed in any web portal.

Last but not least, a closed-loop follow-up and review exercise would be very welcome and valuable not only for our constituents, but also for ILO teams to continuously improve the LMIS project implementation and methodology. Therefore, making LMIS a strong and sustainable platform to benefit all of us.

In summary, it is envisaged that LMIS implementation projects will continue to grow in the coming years, while the Office will continue working to improve the methodology and tools with the aim of making it easier for the constituents implementing the systems, as well as improving their end-users' experience, and ultimately enable evidence-based labour policies to be defined and favour transparency.

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