International Labour Organization

Labour Market Intelligence:
Drafting Analytical Reports from SDMX Data Using Generative AI

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Labour Market Information System (LMIS)

ILO supports countries in developing robust LMIS

*A LMIS is a network of **institutions**, **persons** and **information** that have mutually recognized roles, agreements and functions with respect to the production, **storage**, dissemination and use of labour market related data and metadata.*

- Ensure timely and harmonized labour market data
- Data dissemination using the open-source .Stat Suite platform (SDMX compliant)
- Nearly 30 LMIS projects currently impacting over 50 countries
- Increasing volume of publicly available data presents both opportunities and analysis challenges

Examples of a LMIS Data Explorer

Time-Related Underemployment (TRU) by sex, strata and status in employment

The proportion of employed persons who worked less than a specified threshold of hours during the reference period in all their jobs and who were available and willing to work more hours. This indicator highlights the extent of underutilisation of labour among employed individuals.

Dimensions: Sex, Strata, Status in Employment, Time Period

Download

Unemployment Rate by sex and educational level

It is the proportion of the unemployed population to the Total Labour Force (Employed + Unemployed). It reflects the inability of an economy to generate employment for those who are available and actively seeking work. It is therefore seen as an indicator of the efficiency and effectiveness of an economy and the performance of the labour market.

Dimensions: Educational Level, Sex, Time Period

Download

Unemployment Rate by sex and strata

It is the proportion of the unemployed population to the Total Labour Force (Employed + Unemployed). It reflects the inability of an economy to generate employment for those who are available and actively seeking work. It is therefore seen as an indicator of the efficiency and effectiveness of an economy and the performance of the labour market.

Dimensions: Sex, Strata, Time Period

Download

Unemployment Rate by sex, strata and disability status

It is the proportion of the unemployed population to the Total Labour Force (Employed + Unemployed). It reflects the inability of an economy to generate employment for those who are available and actively seeking work. It is therefore seen as an indicator of the efficiency and effectiveness of an economy and the performance of the labour market.

Dimensions: Disability Status, Strata, Sex, Time Period

Download

Unemployment by sex and strata

The unemployed population are individuals who are not in employment, seeking work and are available to start working if a job opportunity arises.

Dimensions: Sex, Strata, Time Period

Download

Developer API query builder

The application programming interface (API) based on the SDMX standard allows a developer to programmatically access the data using simple RESTful URL and HTTP header options for various choices of response formats including JSON.
To get started check the API documentation. For any question contact us.

Data query

SDMX flavour: Flat | Time series

```
https://sdmx.lmis.hrdc.org.bw/rest/data/HRDC,DF_NEET_SEX_REF_AREA,1.0/all
?dimensionAtObservation=AllDimensions
```

Copy code

Structure query

```
https://sdmx.lmis.hrdc.org.bw/rest/dataflow/HRDC/DF_NEET_SEX_REF_AREA/1.0
?references=all
```

Copy code

The query filter is generated according to the current data selection. To change the data selection, use the filters on the left.

Youth Not in Employment Education or Training (NEET) (SDG 8.6.1) by sex and census district

Frequency: Quarterly ● *Indicator:* Youth Not in Employment Education or Training (NEET) (SDG 8.6.1)
Combined unit of measure: Rate, Units

Time Period		2019-Q4	2020-Q4	2021-Q4	2022-Q4	2023-Q3
Census District						
Sex: Total						
Total		36.1	37.5	39.5	38.5	39.9
GABORONE CITY		27.9	25.3	23.1	25.5	27.0
FRANCISTOWN CITY		29.8	26.6	33.6	35.5	35.9
LOBATSE		34.1	25.6	26.9	39.3	32.5
SELIBE PHIKWE		40.3	37.3	45.5	31.5	29.3
ORAPA		38.5	17.0	42.5	32.8	41.6
JWANENG		24.9	16.7	15.5	17.7	47.1
SOWA		27.1	14.6	16.7	24.0	38.5
NGWAKETSE / SOUTHERN		53.8	50.5	54.2	42.4	44.9
BAROLONG		50.2	41.8	50.9	42.5	40.7
NGWAKETSE WEST		46.9	37.3	39.7	48.8	45.9
SOUTH EAST		22.6	23.4	28.8	24.9	31.5

Source: Labour Market Observatory, Botswana

Feasibility check

Data

- LMIS database
- Aggregated data, no micro-level disclosure
- Well structured and harmonized
- SDMX handles both data and metadata via API
- Indicator typically with demographic breakdowns

AI tools

- Any existing AI tools to achieve this by direct prompts?

  Not yet fully achievable
- Powerful LLMs, paid access via API: OpenAI
- Require dedicated AI-driven workflow and structured prompting

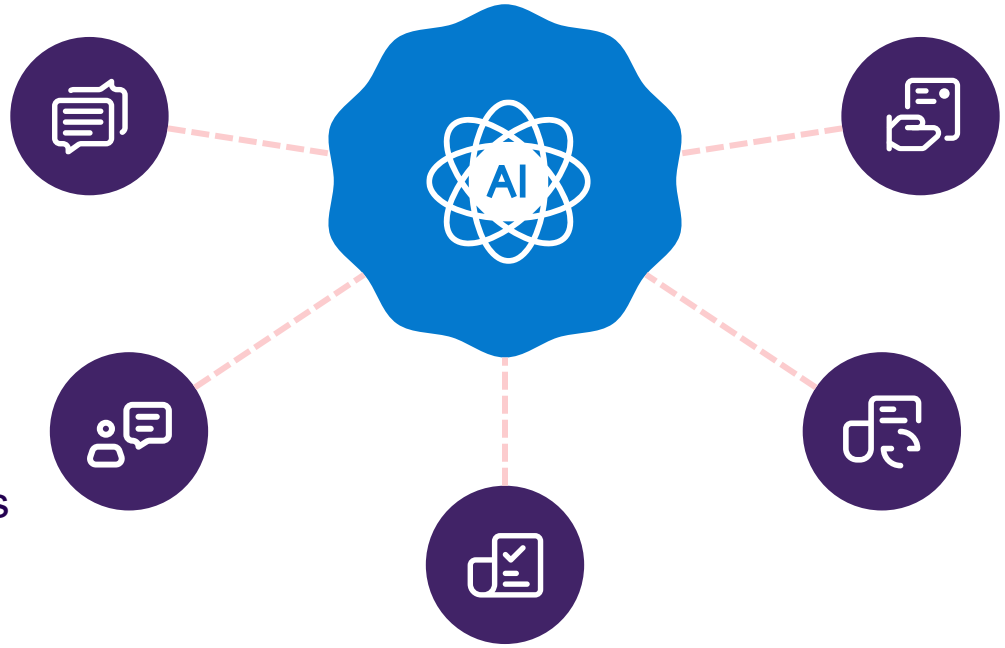
Desired solution

- Affordable
- “Zero-hallucination”
- Meaningful insights
- Draft - not final, not replacing
- Minimized configuration
- Centralized deployment & LLM management preferred
- User login with credit allocation
- Python-based web application

GENERATIVE AI

Support **multilingual**

When handling data from different countries, language will not be an issue.



Reproduce effortlessly

The analysis of one table can be generalized to conduct similarly for others; however, exact same results may not be guaranteed.

Learn knowledge & report sytles

Integrate expert knowledge and the report's tone, style, and interpretation methods into the model by selecting either a brief, summary, or full report format.

Draft analytical reports

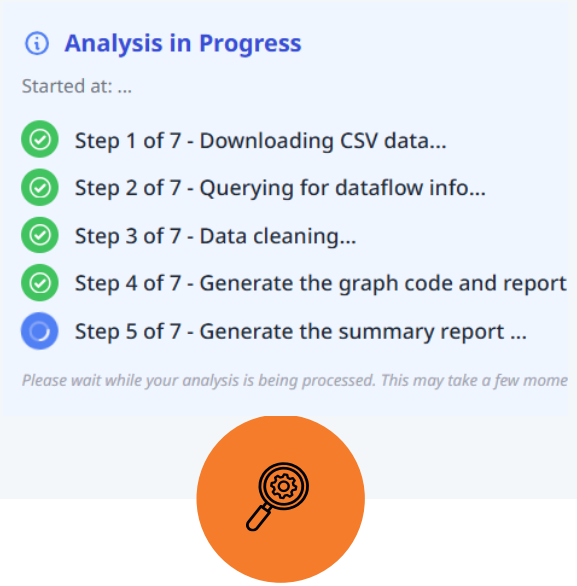
Produce analytical reports and offer insights based on the provided SDMX data.

Create **code** for graph plotting

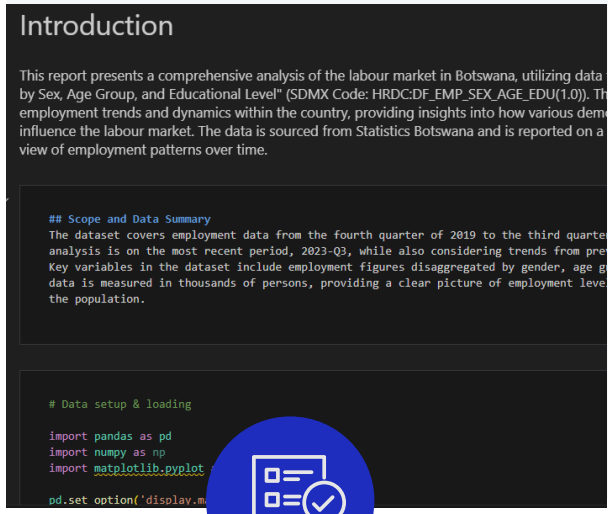
Allow the model to select the graph types and data slides for presentation by generating Python code to create the charts.

Solution

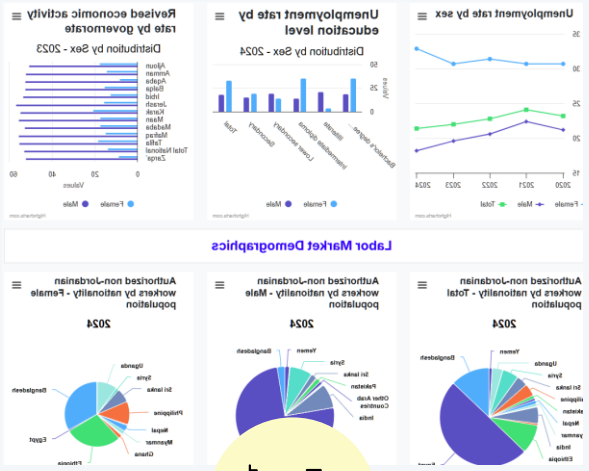
Single Table Analysis



Overall Market Report



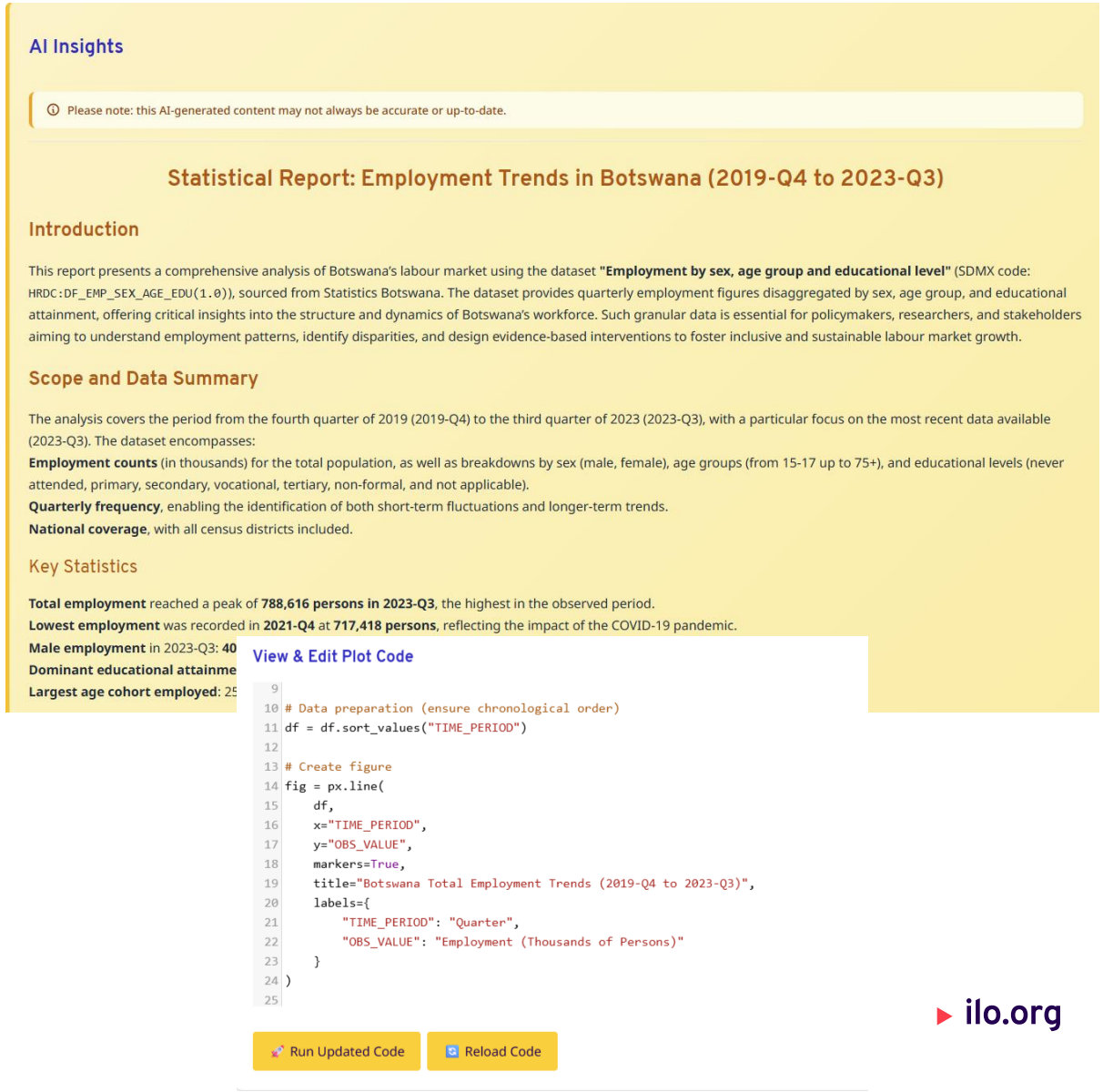
Dashboard Template



Workflow & Methodology – Phase I

Single table analysis

- **Data Retrieval**: API calls to SDMX entry point
- **Data processing**:
  - Reshape data for context
  - Slice historical data series and recent periods
- **AI analysis**: Call LLM via API to generate narrative reports and Python code for graphs.
- **Consolidation**



Workflow & Methodology – Phase II (Ongoing)

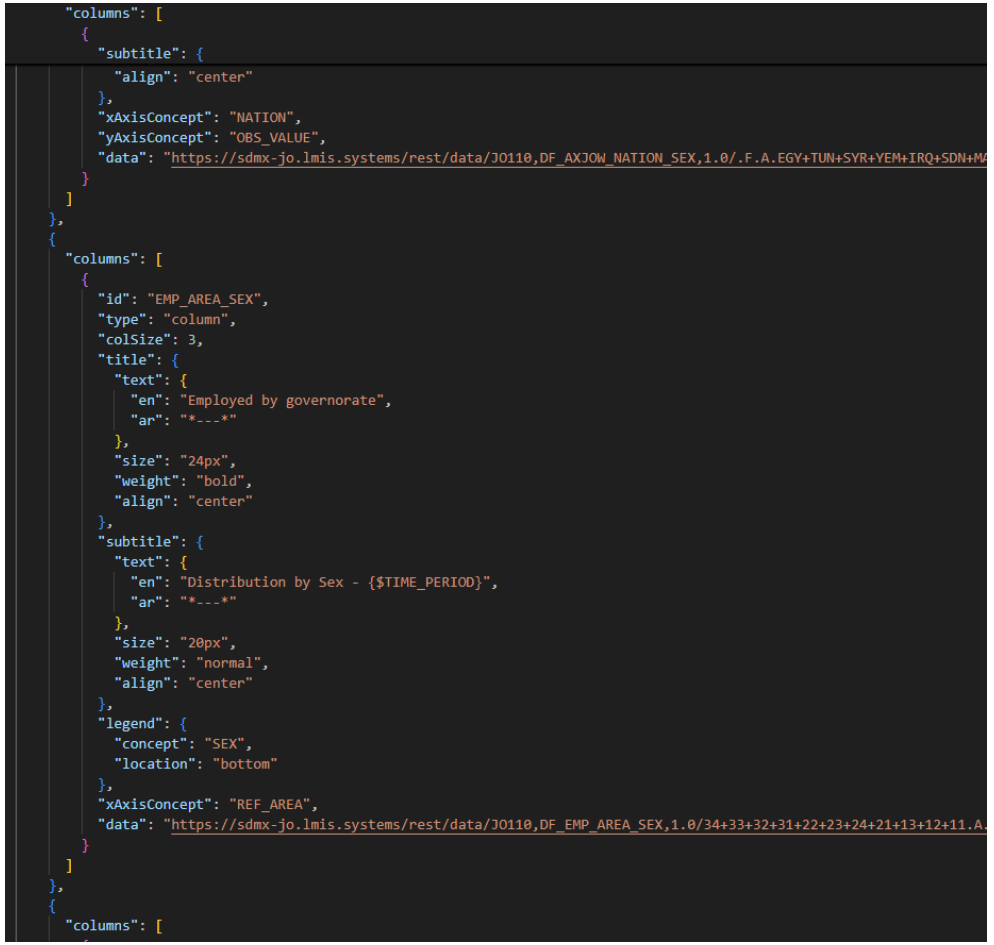
Overall market report

- **Roll-out**: Execute single-table analysis for all tables.
- **Knowledge-base generation**:
  - Provide historical labour market report (e.g., LFS releases) to LLM
  - Derive insights on report layouts, tone, preferred charts, and causal analysis
- **Consolidation**: Combine individual report outputs and learned report templates to generate final report drafts in Jupyter Notebook.

Workflow & Methodology – Phase II (Ongoing)

Dashboard template

- **LLM as in overall market report**
- **Dashboard Generator**: Existing open-source tool using SDMX data query in JSON (2023 SDMX GC Hackathon Winner)
- **LLM Learning**: Consume existing dashboard JSON to learn about output template
- **Template generation**



SDMX Empowering AI

Data complexity?

Data integrated from different agencies in various formats

Dynamic data access?

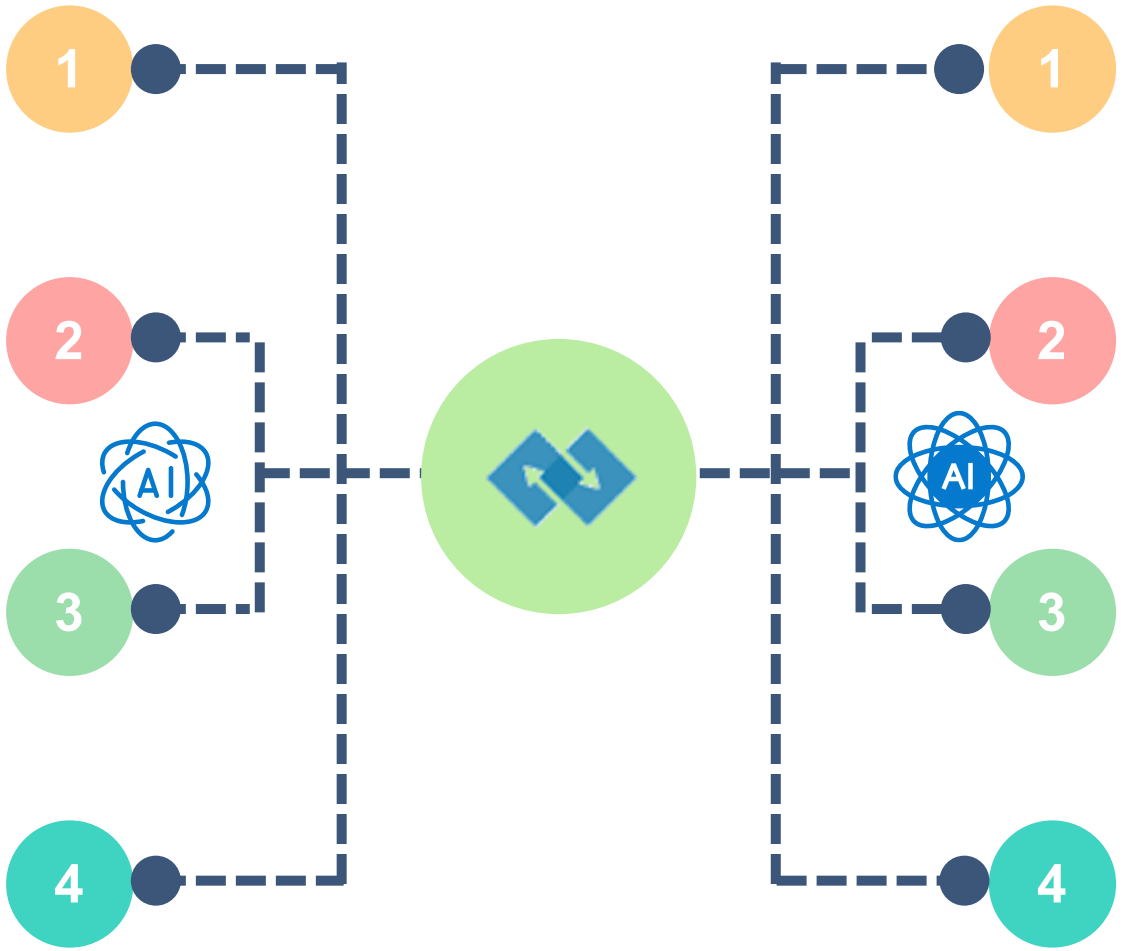
Always up-to-date data retrieval

Data semantics?

LLMs need to understand the data context, identify indicators, and interpret code accurately.

Tools?

Any available packages and tools?



Structured & harmonized

Data have been standardized using common codelists and definitions.

API

via SDMX restful API

Rich metadata

Structural and reference metadata traveling together with data

Community ecosystem

SDMX dashboard generator, Pysdmx, …

Points for reflection

- **SDMX** naturally facilitates automation and AI integration.
- Simply offering products in multiple languages can be costly – AI makes it seamless.
- “Zero-hallucination” remains questioned, expected to have further insights from our field-testing.
- AI vs predetermined programming trade-off: More AI, richer insights but increased error risk (e.g., autogenerated Python code).
- Would it be possible to generalize the AI analytical core beyond the labour context?

Thank you!

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