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Advancing Statistical Quality Assurance with SDMX: A Metadata-Driven Approach from Consistency Checks to Smarter Dissemination in Bank Indonesia

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OUTLINE

1. Background
2. Business Process Reengineering
3. Pilot Project
4. Conclusion and Future Works

Background

Developments in Bank Indonesia's strategic environment are driving the demand for data that is more agile, comprehensive, granular, and collaborative, while ensuring sound governance to support the central bank's mandate

Changes in the Strategic Environment

The development of global domestic economic and geopolitical conditions requires pre-emptive policies based on high-quality data and information.

Technological developments are creating new opportunities for data collection, processing, and dissemination in central bank, while also introducing new risks.

Regulatory Reform

Law (UU) No 23/1999 - Bank Indonesia in conjunction with UU P2SK

BI Regulation: Bank Indonesia Policy Mix

Board of Governors Regulation: BI Information Management (PIBI)

BI Regulation: Data and Information (DIBI) Policy

Mandate of Article 14 of the BI Law.
Scope: formulation, implementation, reporting & oversight, coordination & synergy, and accountability & transparency of the DIBI policy.

Board of Governors Regulation: Public Information Disclosure (KIP)

Scope: public information disclosure at BI, pursuant to the fulfillment of the Public Information Disclosure Law

Board of Governors Regulation: Information Management for Policy and Institutions (MIKK)

Scope: collection, management, and utilization of data & information; infrastructure and capabilities; the role of organizational units.

Transformation Program

A CUTTING-EDGE DIGITAL BANK INDONESIA, POWERED BY INTEGRATED AND DIGITALIZED DATA AND INFORMATION

Strengthening the Transformation Program (IDCB PT#01)

DIGITALIZATION OF BI's POLICY MIX FORMULATION

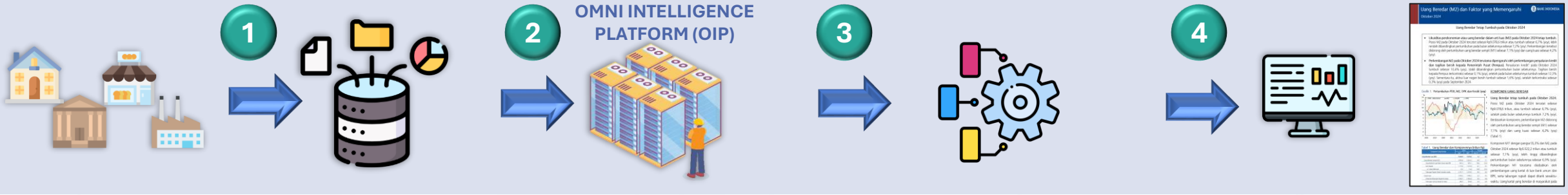
ICT 1.3.1.3. DIGITALIZATION OF THE STATISTICAL BUSINESS PROCESS

Business Process Reenginering

Transformation of Technology

Overview of BI Statistics Transformation

- **Statistical transformation is guided by the principles: supporting DIBI policy targets*, promoting one input–one process–multipurpose, and implementing end-to-end digitalization tailored to statistical characteristics and business processes.**
- **The transformation covers the entire statistical production process, from data collection to dissemination, along with supporting activities across technology, subject matter, and governance.**



1 Data Collection Modernization

Modernize external data collection mechanisms:

a. Capturing (online & metadata-based)
b. Information Exchange Application (IEA) / automated access for non-metadata-based sources.
c. Dynamic Suvey Application.

2 Input integration

Automated, standardized streaming of inputs from sources (capturing, IEA, survey apps, and BI internal systems) into the Omni Intelligence Platform.

3 Digitalization of Processes

a. End-to-end automation for statistics based on population-level inputs.
b. Add-on features and professional judgment for statistics based on non-population inputs.

End state: All processes centralized in the OIP.

4 Digitalization of Dissemination

a. Digitalization of analysis and report preparation (e.g., narratives, tables, charts)
b. End-to-end digital dissemination channels:
   i. Internal: Data Portal, *Analytics Platform* OIP
   ii. External: BIWEB, Data Portal, API, data exchange platform

5 Strengthening Overarching Activities and Substance

a. Revisit **statistical business process**
b. Strengthen **metadata** management
c. Digitalize data access management (input & output)
d. Strengthen data quality assurance (**QA**)
e. **Revisit the relevance of statistical products**
f. Revisit statistical methodologies (incl. new indicator)

*) The availability of high-quality data and information is essential to support policy formulation and implementation, fulfil national and international commitments, and provide data and information to the public

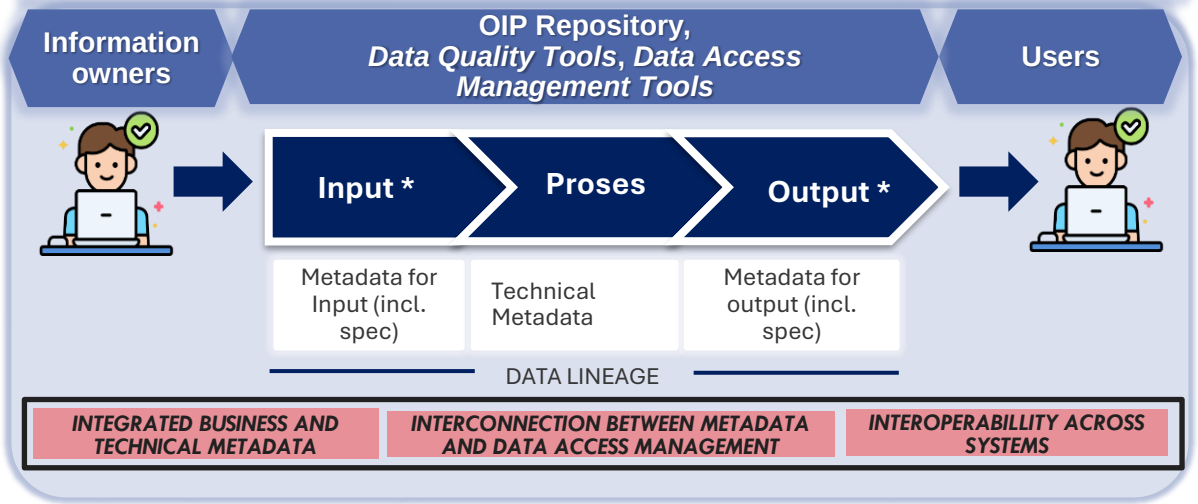
5) Strengthening Overarching Activities - *Metadata Management & Quality Assurance*

Strengthening metadata management is being advanced through three key principles: i) metadata-first, ii) comprehensive and standardized metadata, and iii) integrated metadata, to promote consistency, transparency, and more efficient management of data and metadata, thereby enhancing quality and usability

3 key principles

Metadata-first	Statistical development begins with the preparation of metadata, which serves both as a prerequisite and as documentation of the statistics to be produced.
Comprehensive & standardized metadata	Encompasses input and output metadata, with codification and consistent elements aligned to recognized standards (e.g., SDMX-like structures)
Integrated metadata	Metadata are embedded and linked with systems and applications supporting processes such as data processing, quality checks, search, and access control

End State



Current state

Standardization is not yet fully implemented, particularly for output metadata and data quality assurance, including codelists and concept scheme aligned with SDMX. Additional efforts are required to complete standardization and ensure interoperability across systems and applications

PILOT PROJECT

Adopting the SDMX-like standard to build metadata-driven quality assurance (QA)

Why do we need QA?

Macroeconomic Sectors				Payment System
Mon-Fin	Real	External	Fiscal	
> 50 Product , >1.100 Indicator				

e.g.:

Product	Table/ Indicator	Hits per month
Indonesian Economic and Financial Statistics (SEKI)*	108	> 30K
Regional Economic Financial Statistics (SEKDA)**	> 200	> 25K
Indonesia Financial System Statistics (SSKI)	25	> 3K
Payment System and Financial Market Infrastructure Statistics (SPIP)	36	> 10K

*) SEKI covers 9 chapters across 4 macroeconomic sectors.
**)SEKDA covers 5 chapters across 3 macroeconomic sectors for 34 provinces in Indonesia.

Pilot Project

Coverage: 42 Table for each province

Workflow: sdmx + python C

1. Preparation of **concept schema and code lists** based on SDMX, adjusted to our needs (SDMX-like).
2. Preparation of **QA rules referring to the code lists**:
   a. **Intra-table**: **vertical checks** (aggregate values with the sum of components), **horizontal checks** (monthly calculation with annual), and **before–after checks** (consistency with files from previous release periods).
   b. **Inter-table**.
3. Development of automated **QA programs in Python based** on QA rules, including **job scheduler** & **integration with power BI** for QA report.
4. **Running automated** QA using the job scheduler

PILOT PROJECT: Metadata-Driven Quality Assurance

The pilot project on metadata-driven QA (Python + SDMX) demonstrates ~93% faster processing, more consistent quality assurance, and strong interoperability potential > proving its effectiveness as a scalable solution for our statistics transformation initiative.

	Aspect	Excel Macro	Python + SDMX
1.	**Processing Time**	~3 days for SEKDA (42 tables × 34 provinces). Slower as data size/complexity increases.	~5 hours for SEKDA (42 tables × 34 provinces). Consistent execution regardless of scale.
2.	**Efficiency Process**	• Efficiency declines as data/complexity grows; • manual triggers required.	• High efficiency, • Automated execution with job scheduler • Stable performance at scale
3.	**Flexibility & Customization**	Limited flexibility; difficult to implement complex or conditional QA rules.	Highly flexible; supports advanced QA logic, metadata-driven checks, and cross-table rules.
4.	**Standardization**	Hard to enforce standards across multiple files/users	• follow SDMX standards, • standardized QA rules application
5.	**Scalability, Integration & Interoperability**	• Limited to Excel file size; • basic integration	• Scales easily across databases. • Integrates with Power BI dashboards, APIs, and SDMX-based systems. • High potential for interoperability.

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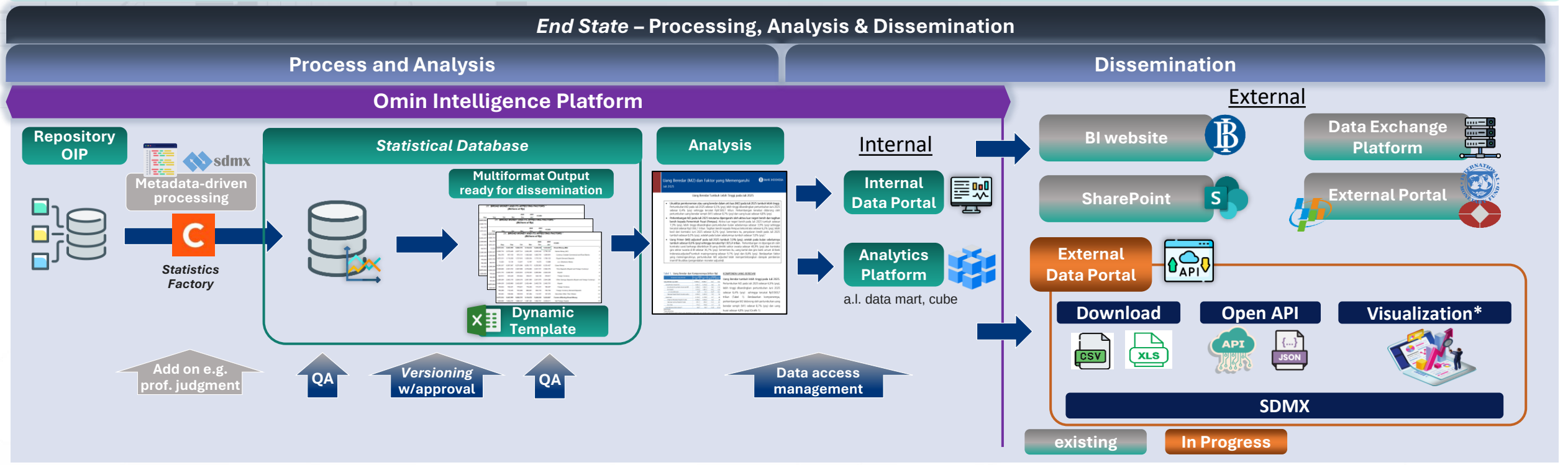
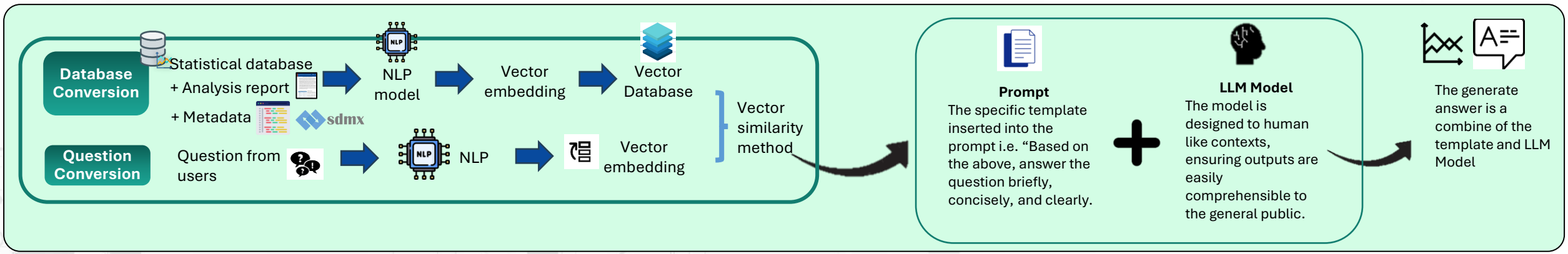
What's Next?

Next Pilot Project: Leveraging SDMX with AI-driven Visualization

A conceptual framework to combine SDMX with AI-driven visualization, making data accessible, interactive and actionable.



*) Workflow of an AI-driven Chatbot



Conclusion

1. **Implementation of the three principles** of metadata management: **metadata-first, comprehensive and standardized metadata, and integrated metadata,** has **strengthened Bank Indonesia's statistical business process to ensure consistency, transparency, and more efficient use of data and metadata**. Combined with metadata-driven QA and visualization, these principles provide the foundation for more effective and innovative statistical dissemination channels.
2. By **adopting an SDMX-like standard to build metadata-driven QA tools**, Bank Indonesia has **reduced processing time from three working days to less than five hours**. This significant efficiency gain not only accelerates dissemination but also reinforces confidence in the quality and coherence of statistical outputs across publications.
3. The development of **AI-driven visualization platforms supported by SDMX's** structured metadata and interoperability features **has the potential to enhance the accessibility, interactivity, and contextual relevance of statistics. Envisioned as communication platforms,** these tools **could transform consistent data into actionable insights for policymakers, stakeholders, and the public**.

Future Works

1. **Further development of data quality assurance** to include plausibilty checks, such as utilizing machine learning techniques for anomaly or outlier detection.
2. **Extending output metadata standardization and developing QA rules** directly aligned with metadata structures **for other statistical publications**, thereby strengthening cross-publication interoperability.
3. **Developing AI & SDMX-based chatbot** built upon standardized metadata publications to provide interactive access, enabling users to visualize and navigate statistical outputs more intuitively.

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THANK YOU
Terima Kasih

Intra-table: vertical checks

II.3 OUTSTANDING OF PRIVATE DEPOSITS IN RUPIAH AND FOREIGN CURRENCY OF COMMERCIAL AND RURAL BANKS BY OWNERSHIP IN PROVINCE OF … (Million of Rp)

Group of Ownership	2025 Jan
Rupiah	650,141,216
Other Financial Corporations:	21,801,158
Public Owned	4,566,627
Insurance Company	2,581,113
Financial Institutions	399,460
Securities and Mutual Fund Companies	422,607
Others	1,163,447
Private Owned	17,234,531
Insurance Company	2,238,443
Financing Company	579,226
Venture Capital	210,072
Pension Funds	7,028,526
Securities Companies	556,441
Mutual Funds	2,226,907
Others	4,394,917
State and Local Governments	11,402,472
Provinces	2,527,398
Municipalities	8,875,075
Non-Financial State-Owned Enterprises	22,936,250
State-owned enterprises	21,251,762
Regional owned enterprises	1,684,488
Privately Owned Non-Financial Enterprises	150,014,535
Other Private Sectors	443,986,801
Social Foundations	21,553,713
Cooperatives	1,405,039
Individuals	421,018,803
Others	9,245

= 650,141,216 fx:SUM

= 4,566,627 fx:SUM

Inter-table

II.2 OUTSTANDING OF PRIVATE DEPOSITS IN RUPIAH AND FOREIGN CURRENCY OF COMMERCIAL AND RURAL BANKS BY GROUP OF BANKS AND BANK OFFICES FUND LOCATION IN PROVINCE OF … (Millions of Rp)

Group of Banks and Type of Deposit		2025 Jan
Rupiah		650,141,216
1. State Bank		331,392,519
Demand Deposit	: Nominal	70,516,736
	: Account (number)	244,026
Saving Deposit	: Nominal	173,486,082
	: Account (number)	44,049,991
Time Deposit	: Nominal	87,389,701
	: Account (number)	296,417
2. Private National Banks		305,112,128
Demand Deposit	: Nominal	50,770,665
	: Account (number)	189,092
Saving Deposit	: Nominal	141,179,813
	: Account (number)	14,579,734
Time Deposit	: Nominal	113,161,650
	: Account(number)	281,667
3. Branch Offices of Foreign Banks [2]		494,852
Demand Deposit	: Nominal	41,159
	: Account (number)	39
Saving Deposit	: Nominal	285,997
	: Account (number)	2,488
Time Deposit	: Nominal	167,696
	: Account (number)	54
4. Rural Banks		13,141,717
Saving Deposit	: Nominal	4,297,543
	: Account (number)	1,657,685
Time Deposit	: Nominal	8,844,174
	: Account (number)	62,580