



**«Government Financial Management  
Information System» Conceptual model**

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## Abbreviations

<b>RA</b>	Republic of Armenia
<b>MoF</b>	Ministry of Finance
<b>CPV</b>	Common Procurement Vocabulary
<b>CBA</b>	Central Bank of Armenia
<b>GFMIS</b>	Government Financial Management Information System
<b>SRC</b>	State Revenue Committee
<b>SRLE</b>	State Register of Legal Entities
<b>SPR</b>	State Population Register
<b>CES</b>	Compulsory Enforcement Service
<b>IMF</b>	International Monetary Fund

## Documents

1. GFMIS Conceptual Model
2. GFMIS Conceptual Model: Budgeting Module
3. GFMIS Conceptual Model: Treasury Module
4. GFMIS Conceptual Model: Procurement Module
5. GFMIS Conceptual Model: Public Debt and Obligations to Budget modules
6. GFMIS Conceptual Model: Public Sector Accounting Module
7. GFMIS Conceptual Model: Internal Audit Module
8. How to Design a Financial Management Information System, A Modular Approach, ©2019 International Monetary Fund

## Introduction

This document describes the implementation model of the Government Financial Management Information System (GFMIS), developed based on the study of the functions of the GFMIS structure.

The document has the following structure.

- **Chapter 1.** provides a summary of the results of studying the functions of the entire GFMIS structure and a conclusion.
- **Chapter 2.** The structure of the GFMIS model presents the components (modules and external systems) and their relationship.
- **Chapter 3.** Analytical Reporting Module description
- **Chapter 4.** User Management module description
- **Chapter 5.** Testing module description
- **Chapter 6.** Training module description

In addition to the chapters presented, this document includes additional documents (a list is given in the Documents section) that describe individual GFMIS components. Links to them are provided in the relevant parts of the document.

# Chapter 1. Summary of the study of existing procedures

This chapter provides a summary of the results of the study of the functions of the GFMIS structure and the conclusion based on them.

## 1.1 Summary

In the previous stage, the functions of the GFMIS structure, which are implemented in the Ministry of Finance of the Republic of Armenia and other state bodies, were studied.

At this stage, the studied functions were analyzed, and non-optimal processes, unclear connections between functions, insufficient data processed in functions, etc., were highlighted. Based on the analysis, meetings/discussions were organized with specialists and industry experts involved in the functions. New options for functions needing optimization have been proposed and developed, allowing for achieving the expected result from these functions more systematically and optimally. Function variables representing processes and the data connection between them were modeled.

The problems identified as a result of the analysis of functions can be divided into several groups.

- Non-electronic functions
- Electronic inconsistent data processing
- Not harmonized data processing

### Non-electronic functions

The study of existing functions has shown that many tasks within the framework of GFMIS are performed non-electronically. These also include input data and calculations performed in Excel files. The data is processed and stored in separate files on individual employees' computers. Almost all functions in the field of budgeting, public debt, and obligations to the budget are performed in a non-electronic format. This is a large segment within GFMIS.

Non-electronic functions lead to a number of problems.

- **Data incompatibility**, a situation where the same data is stored in different files, and in one of them, there is a structural change in the data, can lead to significant problems with subsequent merging. This can result in workflow failures and inaccurate results, underscoring the importance of addressing this issue.
- **Data inconsistency**- when the same data is stored in different files, and a value change occurs in one of them, which causes problems with subsequent comparison - inconsistency,
- **Data loss** is a serious risk that occurs when any computer or disk fails. This can lead to the permanent loss of valuable data, highlighting the importance of regular data backup.
- **Workflow failures**, loss of workflow, incompatibility, and/or data inconsistency can lead to inaccurate or incomplete process results.

- **Unsafe use of confidential data**—An employee provides the security of confidential data, but this may not always be sufficient.
- **Resource-intensive, labor-intensive searching** for data in files by employees and making human decisions based on them requires much more time and human resources than would be done by automated electronic systems.
- Etc...

### **Electronic inconsistent data processing**

Data processed electronically but not systematized is considered

- Those that are developed using electronic document management tools,
- Those developed using separate electronic systems that do not integrate with other systems or the GFMIS data stream.

In almost all areas of GFMIS's business, processes receive or exchange data using electronic document management tools. These data are not integrated with any system; entering them separately into the essential systems becomes necessary. A human factor in the process reads data from one system, imports it into another, or uses it while making human decisions.

Commands during a function's execution are an example. The latter contains information on which the process should now be performed. However, this data is not integrated into the process automatically; it is entered by those who perform the function.

The problems with such processes are as follows.

- Taking into account the human factor, a technical error of input from one system to another may occur, which will lead to an undesirable result in the process,
- Since the same data is present in more than one system (in the document management system and in any other system in which the function is implemented), a change (structural or cost) in one of them, when further combined or compared, may lead to data incompatibility,
- Labor intensity and resource intensity

The problems of the processes handled by individual electronic systems are almost the same as those listed earlier. Examples of such processes are

- Accounting, which is conducted using various accounting programs and does not have data exchange with each other or with other systems,
- Accounting, which is conducted using various accounting programs and does not have data exchange with each other or with other systems,
- Accounting of public debt conducted under the DMFAS 6 program,
- Testing of internal audit or procurement specialists-exam.armeps,
- Procurement tender- armps, e-auction,
- Etc.

### **Not harmonized data processing**



Different functions independently generate data with the same semantics at different points in time in different areas of GFMIS. In the future, the latter will need to be combined or compared, and they must be equivalent. However, as mentioned earlier, these data are generated at different points in time, in various areas (by other systems or non-electronic), so their equivalence may not be ensured at some point. The processing of such data is called the **processing of non-harmonized data**.

A striking example of the processing of such data is the financial request of the budgeting, a procurement plan, and budget estimates. Budget financial requests are submitted by the authorities, not in electronic form, in the form of Excel files (for a detailed description, see the documents submitted at the previous stage), which contain data on the program, event, economic classifier, and value. After the budget is approved, a procurement plan is submitted, which includes the above data and data on CPV codes and procurement forms for the purchased goods. Because both data are presented

- Semantically matching fields,
- The connection between economic classifiers and CPV codes (in one economic article, you can specify specific goods-CPV codes),
- The connection between CPV codes, values, and purchase forms (the purchase form depends on the purchase goods and services and the from total cost),

Therefore, there is a problem of data harmonization. When submitting the authority's procurement plan, the budgeting department manually coordinates semantically matching fields and economic classifiers and CPV. An employee of the budgeting department manually checks whether the submitted procurement plan corresponds to the budget request submitted earlier and whether the submitted procurement items correspond to their economic classifiers. Verification and approval of CPV codes, values, and procurement forms are also performed manually but by employees of the Procurement policy department. After checking/correcting the data, they are imported separately (by uploading) to various electronic systems - Budget plan (based on budget requests) to LS Budget, Procurement plan to PPCM, subsequent estimates (also based on budget requests, but with quarterly distribution) to LS Finance or Client Treasury. These systems are interconnected, and another harmonization/verification is performed automatically between the systems.

As can be seen from the described process, inconsistent data processing leads to many problems.

- There is a need for manual and automatic verification/configuration,
- In case of data inconsistency or contradiction, the entire process must be repeated until an accurate result is obtained.

In all cases, such a process leads to the need to use significant resources and time.

## **1.2 Conclusion**

The research results at the previous stage showed that various authorities perform financial management functions in Armenia either in separate systems that do not interact with each other or implement them using non-electronic systems: data is processed, and Excel files are exchanged. There is specific compatibility between several separate systems (LS Finance, LS Budget, Client Treasury, PPCM);

however, by and large, it can be stated that there is no systemic connection between financial management functions in Armenia.

The implementation of GFMIS aims to solve the above problem. Therefore, investments in GFMIS must be made to ensure maximum systemic alignment of financial management functions within the established legal norms. By system binding, we mean the relationship between the functions implemented within GFMIS and the generated data, which will allow us to perform functions more optimally and automatically.

Different financial institutions and countries apply different approaches and standards to invest in GFMIS. These approaches and standards have been developed and improved over the past two decades based on the implementation of GFMIS in various countries and their further evaluation. Investments in GFMIS worldwide are supported by several international organizations, such as the World Bank, the International Monetary Fund (IMF), the United States Agency for International Development (USAID), etc. The GFMIS, represented by various authorized companies and authors, has conducted many studies and developed guidelines and recommendations (with the support of the above-mentioned international organizations) for GFMIS implementation models. One of these guides is the document «How to Design a Financial Management Information System, A Modular Approach», presented in IMF publications.

The document presents the GFMIS implementation models implemented in different countries, the principles of their choice, differences, advantages and disadvantages, etc. One approach is the modular principle, which is considered one of the modern GFMIS approaches and is recommended to be implemented in cases where, in addition to the main functions of financial management, the model should also perform secondary functions and ensure compatibility with external systems (government departmental, commercial, etc.).

- The modular principle is as follows.
- To break the entire complex system into separate, simple, independent components in which identical functions (characteristic of the element) are implemented,
- Connecting components in such a way that you can replace (or change) each of them without affecting the others,
- One component can be applied with another (one or more) components.

GFMIS modular models have been implemented in financial management systems in developed countries such as the USA, Great Britain, the Netherlands, etc. For example, in the United States, budget execution and payments made by individual departments through separate decentralized systems are treated as separate modules. These separate systems are interconnected with each other on a modular basis.

The advantages of the modular principle are

- The simplest system processing
- Lower investment costs
- Changes in individual components that do not affect the performance of the entire system
- Expansion of the system with new components

As the financial management sphere of the Republic of Armenia contains numerous multidimensional functions, it is advisable to implement GFMS modularly. The module is an autonomous electronic system that implements the functions of any domain (depending on the content and volume of data) and processes data specific to the domain. In other words, it is advisable to divide many GFMS framework processes by content - domains and implement them in appropriate modules.

We can divide the GFMS framework into the following domains based on the research.

1. Budgeting
2. Treasury
3. Public Sector Accounting
4. Procurements
5. Government debt
6. Obligations to Budget
7. Analytics and accountability
8. Specialist Management
9. Internal Audit
10. Testing
11. Training

The functions of each domain must be implemented in a separate autonomous electronic system in the module.

Each module should allow

- To maximally centralize the implementation of domain functions in the domain of a single electronic system,
- Processing and storing data in electronic format,
- Managing the sequence and order of processes,
- Interacting with other modules and the necessary external systems<sup>1</sup>, and re-applying the data processed in them (domain data).

The modular principle of introducing GFMS means

- Each module should have its own set of functions of the same content and a data frame (domain) formed during them, for which this module should be the data owner.
- Modules should exchange data by reassigning each other's data. Data that or its semantic equivalent is generated in another module should not be created in the module, but the data

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<sup>1</sup> External system—an electronic system operating outside GFMS capable of exchanging data, such as government agencies' electronic systems or electronic payment systems.

generated in the latter should be reused through interaction. This will ensure consistent data processing, as well as comparability and consistency.

- Each module should be a separate autonomous electronic system. One module's failure should not affect others' functions, which do not depend on any data processed in the failed module.

The GFMS implementation model should allow the Republic of Armenia to carry out its financial management functions using the above mentioned principles

## Chapter 2: Structure of the GFMIS model

As the previous chapter showed, implementing GFMIS should be carried out in modular stages. According to one principle, a separate module should be provided for each domain.

This chapter presents the connection at the general level (high level) and the data flow between the modules of the GFMIS framework, which are given later in the module descriptions. A document intended to describe each module provides a detailed description of each module and descriptions of the structure and functions in its context (a list is in the "Documents" section). Some modules are described in this document.

The operation of electronic systems also requires the implementation of non-standard functions, such as determining access to electronic data for different users, determining compatibility, etc. Therefore, the provision of similar functions should also be considered when developing the GFMIS model. They are also planned on a modular basis.

Based on the above, the GFMIS model, in addition to modules designed for specific domains, should also have.

- A user management module that will allow access to GFMIS modules according to untrained users.
- A compatibility module that will ensure compatibility between modules as well as between external systems.

There are Domains whose functions can be divided into separate modules depending on the specifics of the functions, a specific group of users, etc.

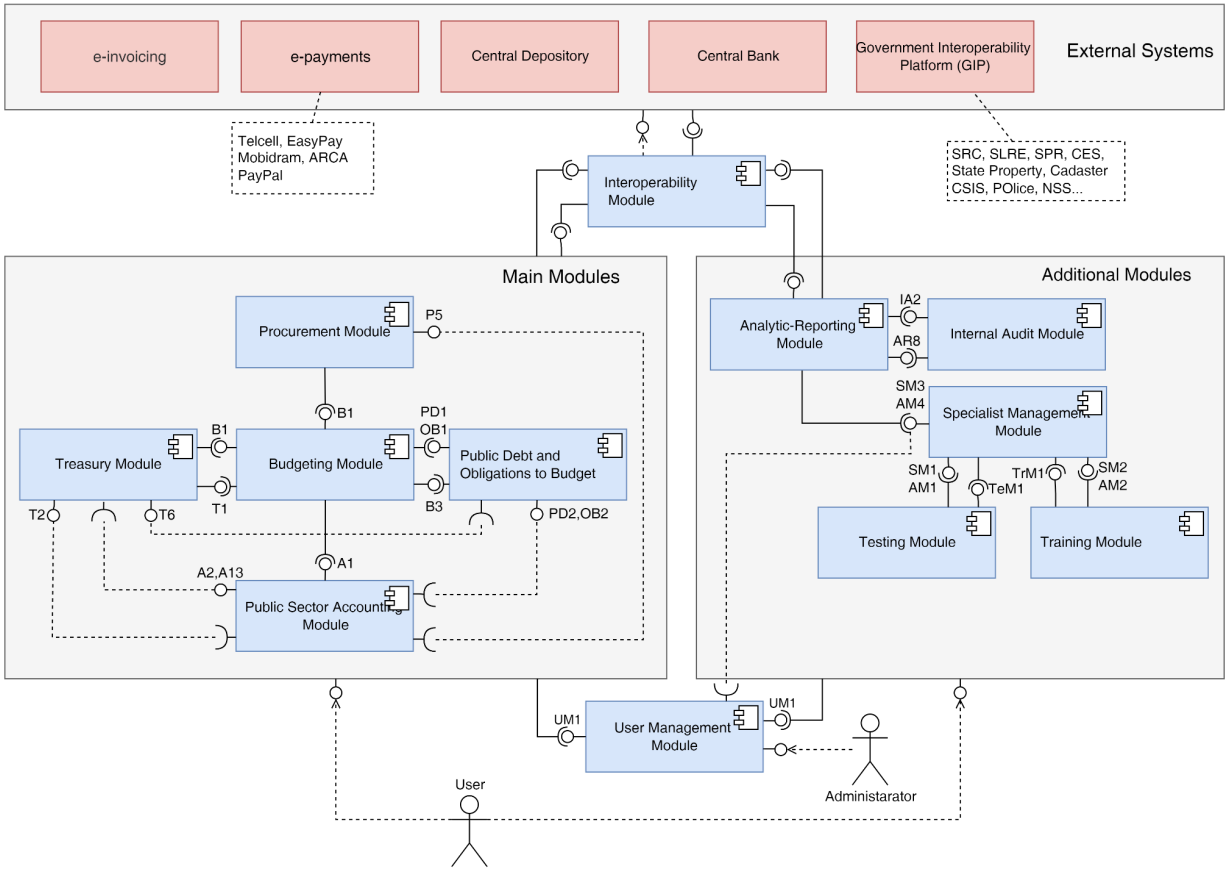
Among such domains are

- Procurements can be divided into several modules<sup>2</sup>: the functions of the purchases themselves, the management of procurement specialists, the management of participants, and an information portal.
- Internal audits can also be divided into internal audits and the management functions of auditors.

Thus, the block diagram of the proposed GFMIS model is shown in Figure 2.1.

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<sup>2</sup> The separated functional modules will be presented in the corresponding module documentation

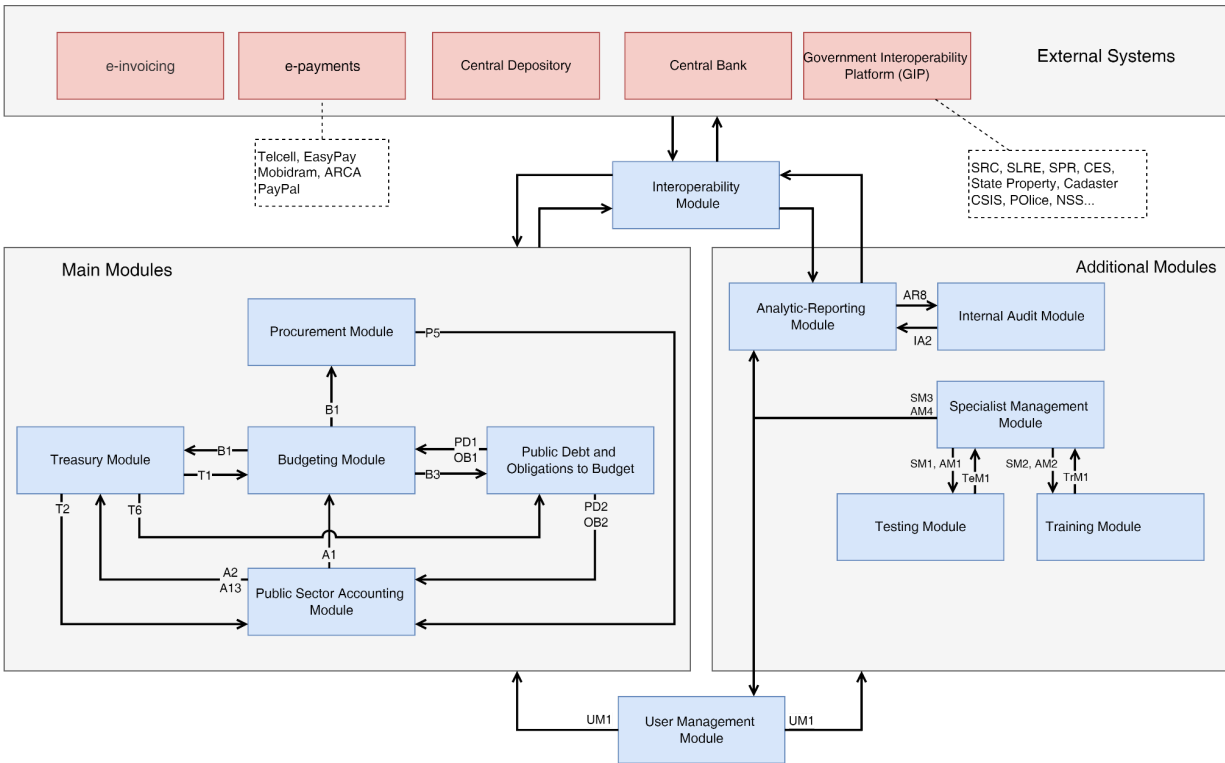


**Figure 2.1 Diagram of the proposed GFMS model**

Figure 2.2 shows the data flow between modules and external systems within the GFMS model.

For further description, the modules have been divided into several groups

- Key modules - between which the GFMS master data flows,
- Additional modules - which implement auxiliary functions, providing more accessible and high-quality processing of primary data,
- External systems operate outside GFMS, where the processed data is needed in the main and additional modules.



**Figure 2.2 Data flow of the recommended GFMIS model**

## 2.1 Key modules

As mentioned earlier, the main GFMIS data flow occurs between the main modules.

In the proposed GFMIS model, the main data flow looks like this.

- The budgeting module performs budgeting (cost estimates, plan adjustments, reallocation, etc.) based on data generated in the public sector accounting module (A1-inventories, main methods, contracts, employees, etc.),
- As a result of budgeting conducted in the Budget Module, current or approved (at different points in time they have different names and meanings) budget data are created: **B1**.
- **B1** data comes from the budgeting module to the Treasury and procurement modules. The change in **B1** data is immediately transmitted to the specified modules, which make the necessary changes to them (information about the changes made to each module is presented below) by the new data received. This allows you to implement data harmonization.
- The Treasury module, receiving **B1** data, which also contains the execution schedule, oversees the budget's execution in accordance with the limits and schedule based on it. Monitoring is also carried out using contract data obtained from the GFMIS Centralized Contract Management

submodule, **A13** (explanation in the next paragraph). This approach allows for more efficient funds management in the shared resources account.

- The procurement module receives **B1** data and generates procurement plans based on them, based on which tenders or auctions can be conducted. The result of the tender/auction is procurement contracts, **P5**, which are transferred to the GFMIS Centralized Contract Management module/submodule. In the proposed GFMIS model, contract management is intended to be implemented in the Public Sector Accounting submodule; therefore, **P5** data is transferred to the Public Sector Accounting module.

- The budgeting module, in addition to the budgeting formation, also performs functions in the budget balance, the basis for which is the **B1** data processed inside it, as well as data obtained from the following modules.

1. Treasury module: **T1**-data on the free balance at the beginning of the year and the stabilizing deposit account,

2. Public debt module: **PD1**-data on the inputs and outputs of debt instruments (for a detailed description of the data, see paragraph 2.4 "data exchange"),

3. Obligations to Budget Module- **OB1** Data on receipts and expenditures on instruments of obligation (budget loans, sub-loans, debts, promissory notes, and guarantees) (for a detailed description of the data, see paragraph 2.4, "data exchange").

The **B3** data generated as a result of the balance sheet, the amount of the budget deficit, is transferred to the public debt module for the effective execution of the fundraising process.

- The public debt module receives **B3** data and performs debt collection based on them, this results in contracts for debt instruments and data that are part of them, with repayment and maintenance schedule **PD2**, which are also transferred to the Public Sector Accounting module for centralized management of GFMIS contracts. Since managing debt instruments is carried out in the public debt module, the **PD2** data also represents changes made to debt instruments. The basis for the changes may be the Treasury's input and output data on debt instruments obtained from the Treasury module, **T6**.

- **OB2** data processed in the Obligations to Budget module is also transferred to the Public Sector Accounting Module: contracts for commitment instruments and data that are part of them, with a repayment and maintenance schedule. Since the commitment instruments management process is carried out in the Obligations to Budget Module, the **BP2** data also represents changes made to the commitment instruments. Treasury inputs and outputs related to commitment instruments derived from the Treasury module, **T6**, can also be the basis for changes.

- The main functions of the Public Sector Accounting Module are Accounting and Contract Management. Contracts, in addition to the modules of Public Debt, Obligations to Budget, and Procurement, can be formed inside the module itself. One of the accounting functions is payments, which it performs. This allows you to manage contractual obligations formed in all modules from one point: give them accounting wording, make and receive payments, consider all



types of payments, etc. The Public Sector Accounting Module receives account information - **TR2** (limit, account balance, etc.) - from the Treasury Module, based on which functions such as payments will be allowed.

### **2.1.1 Budgeting Module**

The Budgeting Module is designed to perform the following functions

- Forming budget financial requests by state bodies
- Revenue forecasting,
- Budget balancing
- Inclusion of approved community budget

The description of the budgeting module in the context of the GFMIS implementation model is presented in the document "GFMIS Implementation model: Budgeting module," which describes in detail the structure of the module, the connections between GFMIS modules and external systems, as well as a description of the functions implemented using the module.

### **2.1.2 Treasury Module**

The Treasury module is designed for

- accounting of state budget revenues in accordance with the budget classification,
- financing and cost accounting with preliminary control,
- maintaining state treasury and off-budget accounts,
- implementation of operations with shared government resources.

Treasury module description in the context of the GFMIS Implementation model is presented in the document" GFMIS Implementation Model: Treasury Module," which describes in detail the structure of the module, the links between GFMIS modules and external systems, as well as a description of the functions implemented using the module.

### **2.1.3 Public Sector Accounting Module**

The Public Sector Accounting Module is designed for

- Centralized accounting and auditing of public sector organizations of the Republic of Armenia
- GFMIS for centralized contract management.

A description of the Public Sector Accounting Module in the context of the GFMIS implementation model is presented in the document "GFMIS Implementation Model: Public Sector Accounting Module," which describes in detail the structure of the module, the links between GFMIS modules and external systems, as well as a description of the functions implemented using the module.

The research and analysis required to implement the Public Sector Accounting Module are presented in the following documents.

1. Analysis of significant differences between the GFS methodology and accounting standards of the RA public sector: balance sheet/statement of financial position
2. Comparative analysis of centralized, decentralized, and outsourced accounting options
3. Overview, study of the current methodology for consolidating financial statements
4. Preparation of consolidated financial statements at the state and ministry levels, the type of information expected to be obtained as a result of each process, and the rights and obligations of relevant specialists related to the business process.
5. Study of the structure of the RA public sector accounting chart of accounts and proposals for making changes or additional elements to the chart of accounts
6. Summary and conclusion of the study of budget performance reports

## **2.1.4 Procurement Module**

The procurement module is designed for

- Procurement planning for state bodies,
- Implementation the procurement process (depending on the form of procurement),
- Management of procurement agreements,
- Qualification testing and training of procurement coordinators.

A description of the procurement module in the context of the GFMIS implementation model is presented in the document "GFMIS implementation model: Procurement module," which describes in detail the structure of the module, the links between GFMIS modules and external systems, as well as a description of the functions implemented using the module.

## **2.1.5 Public Debt Module**

The Public Debt module is designed for

- Public Debt management,
- Organization of the auction of state bonds,
- Electronic sale of savings bonds,
- Maintaining a register of primary and secondary agents.

The description of the public debt module in the context of the GFMIS implementation model is presented in the document "GFMIS implementation model: Public Debt and Obligations to Budget Modules," which describes in detail the structure of the module, the links between GFMIS modules and external systems, as well as a description of the functions implemented using the module.

## 2.1.6 Obligations to Budget Module

Obligations to Budget Module is designed to manage the following functions

- simple and transferring bills
- budget guarantees
- budget loans
- sub loans
- Obligations to Budget, including residents (Georgia)

The description of the Obligations to the Budget Module in the context of the GFMIS implementation model is presented in the document "GFMIS implementation model: modules for managing public Debt and budget obligations," which describes in detail the structure of the module, the links between GFMIS modules and external systems, as well as a description of the functions implemented using the module.

## 2.2 Additional modules

Additional GFMIS modules perform auxiliary functions, providing more accessible data processing in the main modules and providing data of the highest possible quality.

### 2.2.1 Analytic-Reporting Module

The Analytic-Reporting Module is designed for

- Perform analysis based on data collected from various GFMIS modules, as well as from external systems,
- Provide analysis results and necessary data to GFMIS modules during various processes,
- Receive static, dynamic, and private reports.

A description of the analytic-reporting module in the context of the GFMIS implementation model is presented in Chapter 3 of this document, which describes in detail the concept of the module, the structure, the links between GFMIS modules and external systems, as well as a description of the functions performed using the module.

### 2.2.2 Internal Audit Module

The Internal Audit Module is designed for

- Implementation of internal audit in state bodies and processing of its data,
- For qualification testing and training of auditors.

The description of the Internal audit module in the context of the GFMIS implementation model is presented in the document "GFMIS implementation model: Internal Audit Module," which describes in detail the structure of the module, the links between GFMIS modules and external systems, as well as a description of the functions performed using the module.

### **2.2.3 Testing Module**

The testing module is designed to test the qualifications of specialists in various fields. Based on the assessment of the existing state, it can perform the procurement and testing functions of internal auditors. However, the testing module can also test other industry professionals, such as public sector accountants, budgeting specialists, etc.

Chapter 5 of this document describes the testing module in the context of the GFMIS implementation model, detailing the module's concept and the functions implemented.

### **2.2.4 Training Module**

The training module is designed to train specialists in various fields to conduct online and/or offline courses. Based on the assessment of the existing state, it can perform the functions of procurement and training of internal auditors. However, the training module can also be a refresher course for other industry professionals, such as public sector accountants, budgeting specialists, etc. The description of the training module in the context of the GFMIS implementation model is presented in Chapter 6 of this document, which describes in detail the concept of the module and the functions implemented.

### **2.2.5 Specialist Management Module**

Based on the study of the existing situation, only the work of procurement specialists and internal auditors is currently carried out in an unsystematic electronic version.

The Specialist management module is designed to maintain a coordinated register of industry specialists (procurement specialists, internal auditors, etc.), which will allow processing data based on data obtained from testing and training modules, as well as providing data to the user management module (Chapter 5), which will define the powers of the relevant specialists based on the data, received from the registry.

Here, the specialist management module is presented in a generalized form since it can be used to maintain registers of specialists from different sectors.

In special cases, the documentation of the procurement and internal audit modules considers the management modules of the relevant specialists, their relationship to the procurement and/or internal audit modules, and their functions.

### **2.2.6 Interoperability Module**

The interoperability module is designed to ensure data exchange between all GFMIS modules and external systems.

The module allows to.

- Set rules for data exchange between modules,
- Check the integrity and security of the transmitted data,
- Receive data from external systems (there may be different standards and structures),
- Convert them to the standard and structure adopted in the GFMIS modules,

- Provide the converted data to the required modules,
- Provide data processed in GFMIS modules to external systems.

This is a technical module that users do not use. All modules communicate with each other through this module. For clarity, the relationship between the modules is presented directly in the following descriptions. However, it should be noted that data exchange is not carried out directly but through the interoperability module in compliance with its rules.

## **2.2.7 User Management Module**

The User Management module is designed for centralized user management of GFMIS modules.

- Set and manage complete GFMIS user security policies,
- Identify the administrators of each module, who themselves can manage the users of this module by granting them the appropriate authorizations.

The functions of the GFMIS modules will be available only to authorized users due to the user management module. Each GFMIS module will interact with the user management module to identify the user and obtain the latter's authority within this module.

A description of the user management module in the context of the GFMIS implementation model is presented in chapter 4 of this document, which describes in detail the concept of the module, the structure, the links between GFMIS modules and external systems, as well as a description of the functions implemented using the module.

## **2.3 External systems**

External systems are systems operating outside GFMIS, in which the processed data is necessary for functions implemented in GFMIS modules. Data exchange between external systems and GFMIS modules is carried out using the Compatibility module.

### **2.3.1 Government Interoperability Platform**

The Government Interoperability Platform unites the information systems of state bodies, local governments, and other legal entities, providing data exchange between them. The platform integrates electronic data provision systems for state departments, such as

- State Revenue Committee (SRC)
- State Register of Legal Entities (SRLE)
- State Population Register (SPR)
- Compulsory Executor of Judicial Acts (CEJA)
- State Property Management Committee
- Cadastre,
- The police, which provides vehicle registration data,
- National Statistical Service (NSS),
- etc.

The data processed in these systems must be used in various GFMIS modules, the compatibility of which is presented in their descriptions.

### **2.3.2 Central Bank of the Republic of Armenia**

The Central Bank provides free banking services to the government through the procedures established by laws and other legal acts. The central bank's systems ensure the inflow and outflow of funds between the Treasury and commercial banks operating outside the treasury system. Therefore, proper data exchange between the treasury module and the central bank systems is necessary to fully perform the Treasury's functions. It is described in the document "GFMIS Investment Model: Treasury Module."

The Central Depository of Armenia, according to the procedure established by the Central Bank's regulatory legal acts and rules, performs the functions of a centralized depository, a centralized registrar, and an operator of the securities settlement system.

Within the GFMIS framework, the public debt module interacts with the central securities depository when issuing government and savings coupon bonds.

The document "GFMIS Implementation Model: Public Debt and Obligation to Budget Module" describes the relationship between the public debt module, the depository, and the bond issuance process.

### **2.3.3 The Central Depository of the Republic of Armenia**

The Central Depository of Armenia, according to the procedure established by the Central Bank's regulatory legal acts and rules, performs the functions of a centralized depository, a centralized registrar, and an operator of the securities settlement system.

Within the GFMIS framework, the public debt module interacts with the central securities depository when issuing government and savings coupon bonds.

The document "GFMIS Implementation Model: Public Debt and Obligation to Budget Module" describes the relationship between the public debt module, the depository, and the bond issuance process.

### **2.3.4 E-payments system**

The electronic system of government payments (e-payments. am ) allows payment or administrative fines levied by the legislation of the Republic of Armenia for state duty or local duty or services provided by state or municipal local self-government bodies in electronic form.

GFMIS interacts with this system in the Treasury module, which receives data on the amounts collected using the system, and in the public debt module, through which payments are made for the electronic sale of savings coupon bonds. These interactions are described in the relevant documents "GFMIS Investment Model: Treasury Module" and "GFMIS Investment Model: Public Debt and Obligations to the Budget Module."

### 2.3.5 E-invoicing system

Electronic invoicing (electronic settlement documents and books) is a system for providing electronic write-off of settlement documents and maintaining electronic books on forwarding and movement, which allows the issuing of settlement documents online, creating, suspending, or re-register e-books for delivery and transportation, and keeping registered books. With the help of the system, you can view the settlement documents issued and received from other persons. In offline mode, the system also allows the preparation of new tax invoices, editing previously completed settlement documents, and making entries in pre-opened electronic books of shipment and transportation.

The E-invoicing system interacts with the GFMIS Public Sector accounting module described in the document "GFMIS Implementation Model: Public Sector Accounting Module."

### 2.4 Exchanged data

A summary list of data that can be exchanged between modules included in the GFMIS model is shown in the table below.

Interface	Data	Provider Module	Application Module
B1	Data on costs and budget output	Budgeting	1. Treasury 2. Procurements 3. Budgeting
B3	The deficit part of the budget	Budgeting	Public Debt
T1	Balance of the stabilization account, free balance at the beginning of the year	Treasury	Budgeting
T2	Account Information' Treasury account, account limit, estimate and payment schedule, input of funds, output of funds, account balance, rejected transaction data exchange rates, Customs and anti-dumping debt of the EAEU	Treasury	Public Sector Accounting
T6	Input/output to the Treasury on obligation instruments	Treasury	Obligation to Budget
P5	The procurement contract and the data confirming its execution	Procurements	Public Sector Accounting/Contracts
A1	Registered data	Public Sector Accounting	Budgeting

A2	<ol style="list-style-type: none"> <li>1. Summary of certificates, obligations, application for financing</li> <li>2. Payment orders</li> <li>3. Application for reformulation</li> </ol>	Public Sector Accounting	Treasury
A13	Contracts and payment schedules	Public Sector Accounting	Treasury
PD1	Integrated funds, their repayment and maintenance	Public Debt	Budgeting
PD2	Debt collection and repayment accounting <ol style="list-style-type: none"> <li>1. Debt Instrument Agreements (appendix, schedule, other)</li> <li>2. Direct payments</li> </ol>	Public Debt	Public Sector Accounting
OB1	Data on bills, loans and debts, and budget guarantees	Obligation to Budget	Budgeting
OB2	Accounting for the issuance and repayment of bills of exchange, loans and debts, budget guarantees	Obligation to Budget	Public Sector Accounting Module
IA2	Analytic information created in the internal audit module	Internal Audit	Analytic-Reporting
AR8	Analytical data developed in all GFMIS modules, analytical data necessary for risk assessment	Analytic-Reporting	Internal Audit
SM1	Testing applications/bids	Specialist Management Module	Testing
SM2	Data on procurement professionals to be trained	Specialist Management Module	Training
SM3	Analytic data	Specialist Management Module	Analytic-Reporting
AM1	Application	Auditors Management	Testing
AM2	Data on auditors to be trained	Auditors Management	Training
AM4	Analytic data	Auditors Management	Analytic-Reporting
TeM1	Data on the tested specialists	Testing	<ol style="list-style-type: none"> <li>1. Specialist Management Module,</li> <li>2. Auditors Management</li> </ol>



TrM1	Data on trained specialists	Training	1. Specialist Management Module, 2. Auditors Management
UM1	The scope of the user account's authority	User Management Module	All modules

## Chapter 3: Analytic-Reporting Module

Before describing the Analytic-Reporting Module itself, let's introduce the concept of the BI architecture since it is planned to be implemented based on this architecture.

In multimodular and complex systems, effective decision-making processes depend on high-quality information. This is a fact in modern systems that require flexible access to a data warehouse organized in such a way as to increase efficiency and ensure fast, accurate, and up-to-date data acquisition. The BI (business intelligence) architecture is designed to meet these requirements, taking the data warehouse as a basis.

### What is the BI architecture?

BI architecture is a term used to describe standards and policies for organizing data through computer technology and technology implementing data analysis systems for visualization, reporting, and analysis of online data.

One of the components of the BI architecture is the data warehouse. Data processing, storage, cleaning, and export must be performed through a central storage system, which is considered BI's main component.

### What is data storage and BI?

Data storage and BI are terms used to describe the following processes

- storing all system data (from different sources) in internal or external databases
- Analysis and visualization based on stored data using BI tools.

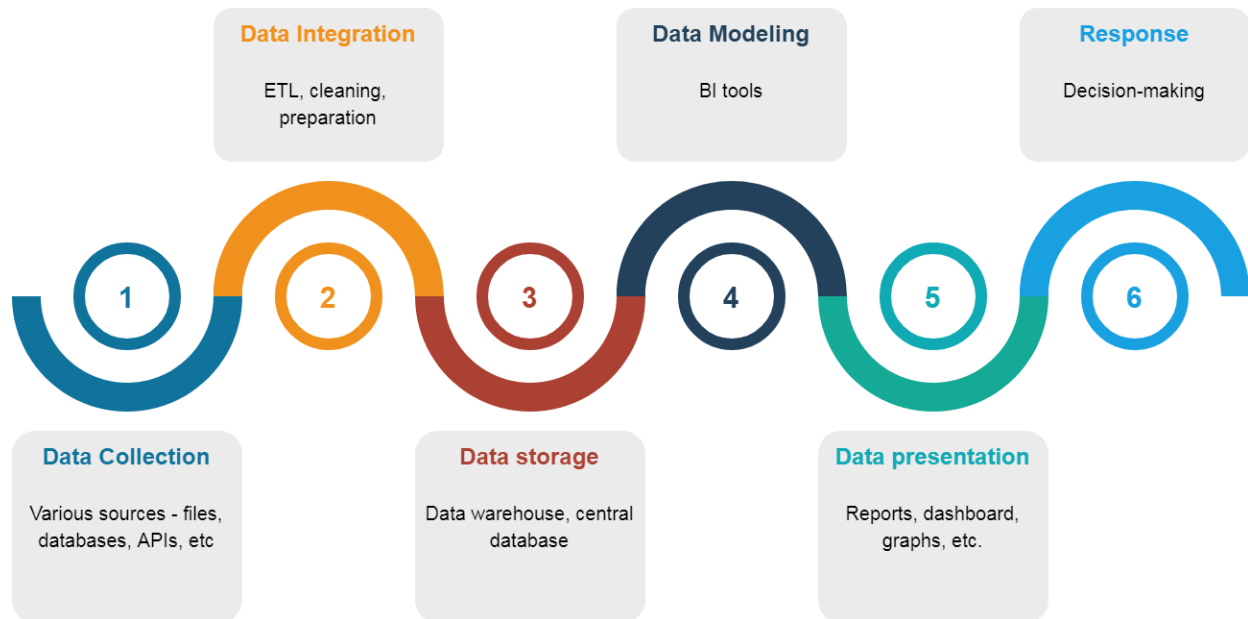
One cannot give the necessary result without the other.

### BI architecture scope

The structure of the BI architecture consists of specific steps. Each of these steps has its purpose, which are

1. **Data Collection** - The first step is to collect relevant data from various external and internal sources, such as databases, other systems, files, or APIs.
2. **Data Integration** - The data collected at this stage is integrated into a centralized system, often using ETL processes (extraction, transformation, loading). Here, the data is cleaned up and prepared for analysis.
3. **Data Storage** - At this stage, Data warehousing is performed. A data warehouse is a place where structural or structured data is stored. It makes the data available for queries and analytics.
4. **Data Modeling** - After the information is processed, saved, and cleared, it is ready for modeling. With the help of tools, data is modeled for various purposes, such as provision to other systems or modules, reports, analytics, etc.

5. **Data presentation** - Data models can be transformed into graphs, charts, reports, dashboards, provided data, etc.
6. **Response** - The last stage of the architecture process is to extract applicable ideas from the data and use them to make decisions.



As we have already mentioned, the analytic-reporting module is planned to be implemented based on the BI architecture concept, which will allow GFMIS to solve several vital tasks.

- Collect all analytical data from various GFMIS modules, as well as from external systems,
- To carry out an analysis based on the collected data,
- Provide necessary data to GFMIS modules during various processes,
- Receive static, dynamic, and private reports.

This is one of the most important GFMIS modules, as it allows automated decision-making, data processing, and other processes that use the latest BI (business intelligence) tools.

The implementation of the analytic- reporting module will also allow

- Abandoning data processing in various Excel files and centralizing their processing in one common environment using analytical tools,
- Centralize the data being processed and to be processed in one domain for sharing by different processes and different participants within the GFMIS.

It can also be used as a set of tools in the Department of Macroeconomic Policy functions since the latter are engaged in data processing using BI tools.

In addition to performing the department functions mentioned above, the analytical reporting module will allow the modeling of various data for GFMIS modules. For example, in the Budgeting Module, when reducing costs, the average price of a product with any CPV code for a certain period can be indicated, allowing the person responsible for budgeting to present the optimal cost. Or, in the "Public Debt and Obligations to Budget" module, at the stage of registration of a debt tool, it can provide analytical data for decision-making based on the data of the tool's project.

There are many similar examples, and they are given in the "Functional Description" section (Chapter 3) of the document of each module (listed in the "Documents" section).

In addition to the mentioned features, the analytical reporting module will be used first to obtain the necessary reports in all modules. As it uses business intelligence tools, it will allow you to get reports of any type from data collected in various GFMIS modules.

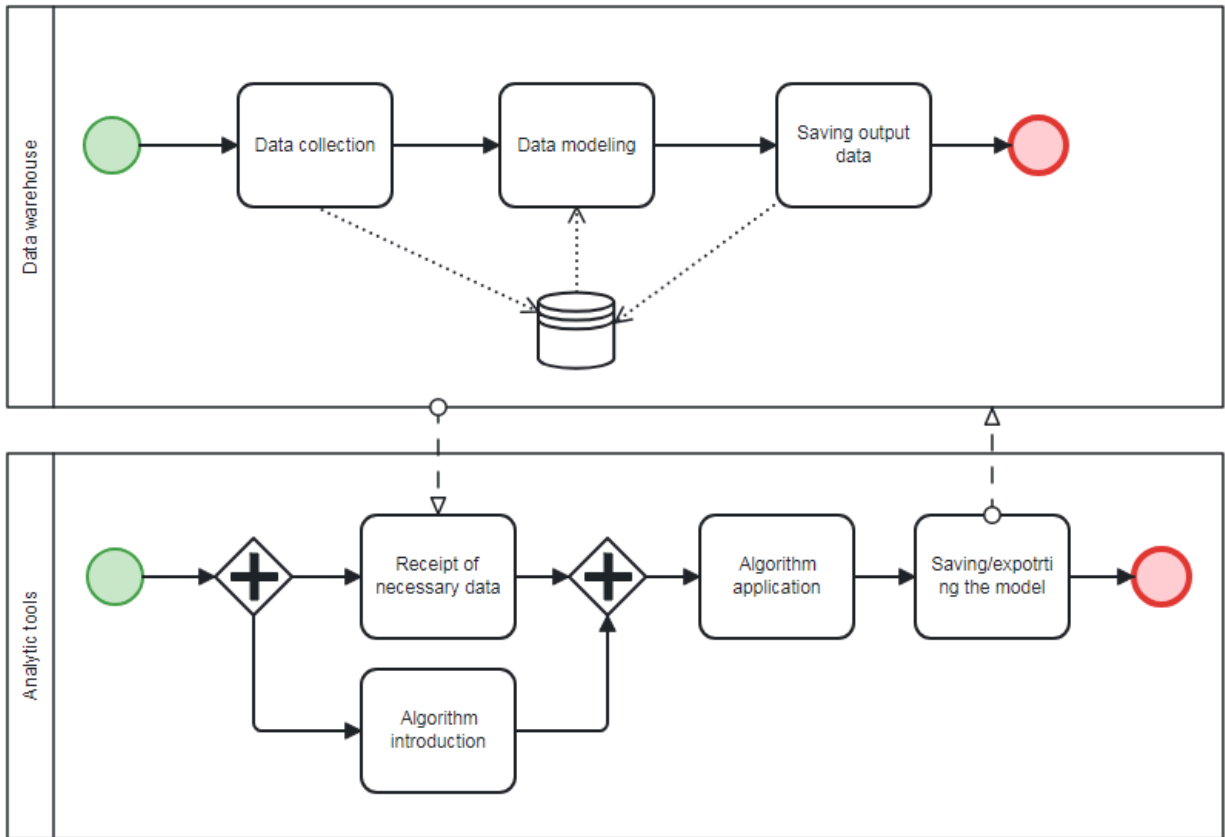
- **Static** - with specific established requirements (for example, annual reports)
- **Dynamic** - with the input of any input data (for example, for any period or region, etc.)
- **Private (ad-hoc)** - with an overlay of arbitrary data and reports of arbitrary type.

It is worth noting that the application of this module will require employees with special professional knowledge and data processing specialists who can model the necessary data and implement accurate data collection and application algorithms.

In general, the analytical reporting module allows data to be obtained from various GFMIA modules and other external sources, conducting various simulations, obtaining the necessary data models, including reports, and providing them as needed. Typical functions of the module are

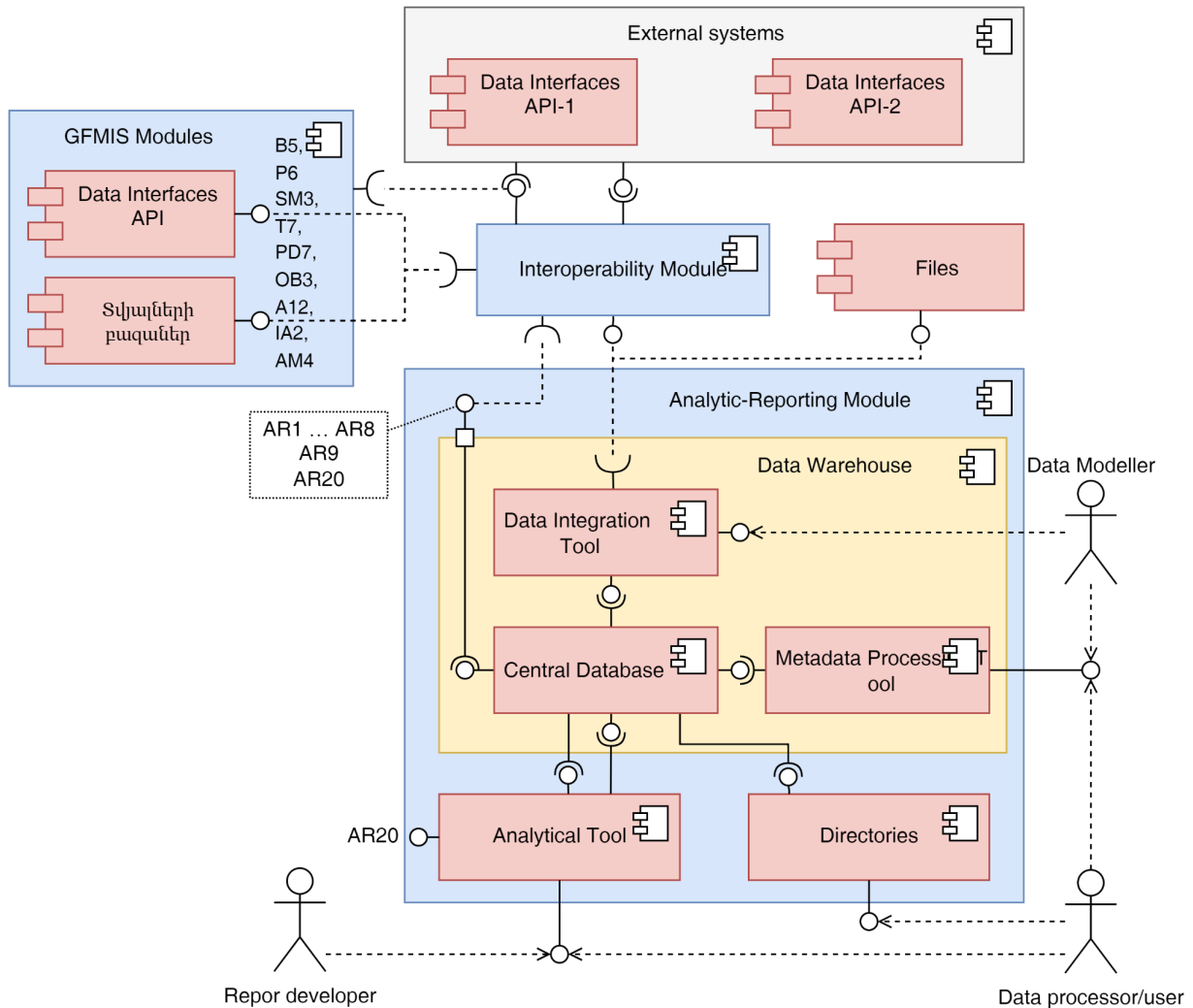
- Collection of necessary and sufficient data from various sources,
- Implementation of suitable analytical algorithms/formulas,
- Application of inlaid algorithms to the necessary data (input data),
- Saving and/or exporting the output data obtained from applying algorithms to the model (they will be used as input data in other processes or algorithms).

The process representation of these functions is shown in Figure 3.1.



**Figure 3.1 process representation of analytical and reporting functions**

One of the best solutions for implementation is the implementation of a data warehouse and business intelligence tools. From now on, we will call the solution the Analytic-Reporting Module, which is universal and can be used by various GFMIS modules. The structural diagram of the Analytic-Reporting Module is shown in Figure 3.2.



**Figure 3.2 Structural diagram of the Analytic-Reporting Module**

The following is a description of the components shown in the diagram in Figure 3.2.

### 3.1 Interoperability Module

As mentioned in paragraph 2.2.6 of this document, the interoperability module is a data transfer point between GFMIS modules and between them and external systems. By the same principle, in the context of the Analytic-Reporting module, the interoperability module performs data exchange from the GFMIS modules to the Analytic-Reporting module and vice versa, as well as from external systems to the Analytic-Reporting module. In other words, the Analytic-Reporting module receives data from both external and internal modules using the interoperability module. Data is also provided to the GFMIS module using the same module. Using the interoperability module, analytic data can also be provided to external systems if necessary.

## 3.2 External and internal data sources

The Analytic - Reporting Module uses external and internal data sources of the modules to collect data. The data can be files (in various formats: .xls, .xlsx, .csv, .json, .xml, etc.), data delivery interfaces – API (from the internal GFMIS system, external departmental electronic systems, etc.), internal databases (other databases operating inside the GFMIS system or in MF).

## 3.3 Data integration tool

The data integration tool combines data from multiple sources into a single data warehouse. Integration tools are used to perform transformations and filter various data (obtained from different sources), allowing us to bring all the data into a single format and save them in a central database (ETL-extract, transform, load). During the integration process, the data collector performs the following steps

- **Receipt of data** - Data from different sources is collected in the same processing environment. The data obtained can be either structured or unstructured.
- **Transformation** - The data available in the processing environment is subjected to various transformations and/or filtering to bring them to a single unified format.
- **Loading** - The transformed/processed data is moved from the processing environment to the central database. The processed data can be either added to existing ones or replaced with them.

## 3.4 Central database

This component is a relational database that allows you to save structured data processed using a modeling tool and provide it to other components. Analytical tools and a metadata processing tool use the data provided by this component.

## 3.5 Metadata Processing Tool

Metadata is data about both data stored in a central database and data obtained from other sources. They are stored in the storage (data warehouse) available in the metadata processing tool and contain information of the following nature

- The structure of the Analytic - Reporting Module: description of data sources,
- Central database structure: data structure.
- Semantic description of the data,
- Other information required for the application.

The metadata processing tool will allow the data collector to process the presented information using graphical tools.

This is an essential component because the data will be centralized and will be applied by different participants (also in different GFMIS modules), so it will be necessary for all developers to understand the meaning of the data correctly before using it.

### **3.6 Analytic or BI tool**

It is a component by which a data processor can apply structured data in a central database for various purposes.

- Creation of static, dynamic and ad-hoc reports,
- Performing analysis using pre-developed algorithms or formulas, providing a model,
- Statistics, reporting, dashboard, etc.

The tool will also allow you to save the processed data in a central database for future use.

### **3.7 Directories**

The Analytic-Reporting Module plans to develop and maintain reference books used throughout GFMIS (for example, regions, cities, economic articles, CPV codes, etc.). The "Directories" submodule is provided for this purpose. It allows the data processor to enter, modify, or delete directories and store them in a central database.



## Chapter 4. User Management Module

As already presented, GFMIS is a modular system. Each module will be an autonomous electronic system with data exchange connected to each other. However, each module (or standalone system) is not recommended to have its own submodule for managing individual users. This will lead to inconvenience. For example, suppose a user has to use the functions of several modules. In that case, the latter will be required to have multiple user accounts and apply the corresponding user account when logging into different modules. This is an inconvenience from the user's point of view. However, this, in turn, will lead to non-centralized user management, i.e., separate management for each module, separate security policy, etc. This is one of the most severe security problems that is unacceptable when implementing such systems.

In addition to the mentioned inconveniences, the introduction of a separate user management submodule for individual modules will also lead to increased financial costs, since the same functionality must be implemented in different modules. This is a multiple work and multiple cost. Changing any global function or rule within GFMIS will require changing the software in all modules.

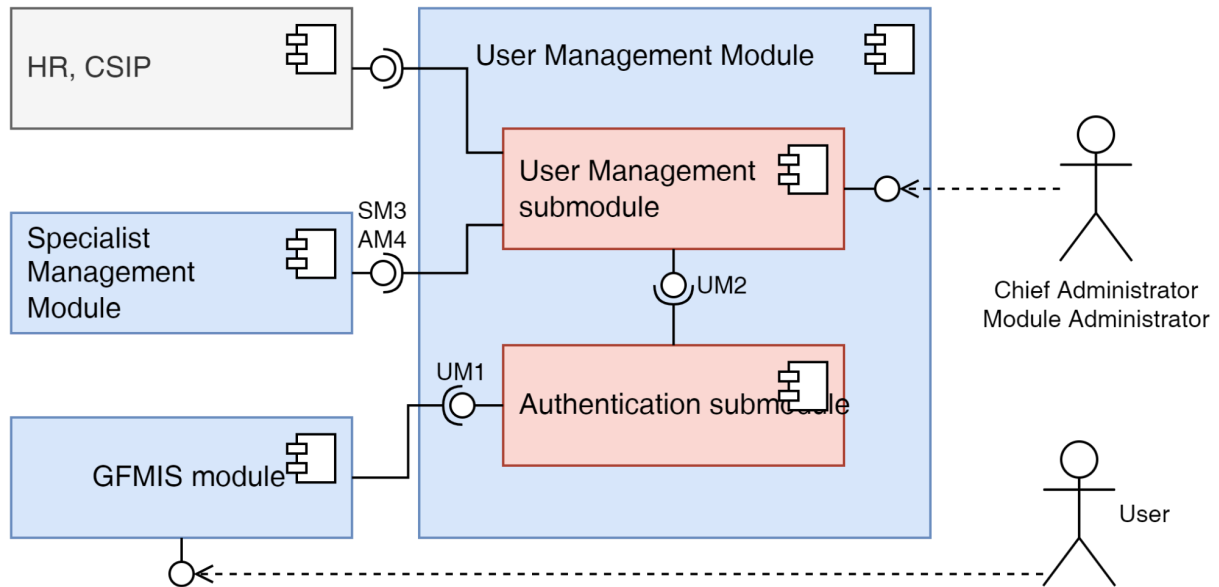
To avoid such inconveniences, security problems and costs, it is recommended to implement a centralized user management module that will allow.

- centralized set and manage the entire GFMIS user security policy,
- Provide assistants with the administrative powers of individual modules, which will, in turn, create an environment for other users and authorize the functionality framework of this module,
- Implement the functions of various modules within the scope of authority using a single user account.

GFMIS plans to introduce a separate module, the user management module, which will apply the principle of centralized management.

### 4.1 Structure

The structure of the user management module is shown in Figure 4.1. It consists of two submodules: User Account Management sub-modules and Authentication sub-modules.



**Figure 4:1 Structure of the user management module**

### 4.1.1 User Account Management sub-module

The submodule is used by the chief administrator or the module administrator.

#### **The chief administrator.**

- Establishes the GFMS's general user management policy (e.g., the complexity and frequency of password changes, hourly deactivation of user accounts, and their dismissal, etc.).
- Creates administrative support tools for other modules: module administrator.

#### **The module administrator.**

- Creates users
- Creates roles (groups), giving them the appropriate authorities within the module
- Assigns roles and/or gives separate authorizations to existing users
- Manages user accounts: deactivates the authorization given to them, deletes them, etc.

The user account management submodule can interact with the human resources management system operating in the body, as well as with CSIP for user management. User accounts can be opened, deleted, or deactivated based on information from the above systems.

### 4.1.2 Authentication Sub-module

The authentication module is used to authenticate users (authentication) and provide the scope of authority (authorization). GFMS modules work directly with this submodule. When a user tries to access any module, the latter obtains the range of permissions (UM1) for this user account from the

authentication submodule with the data of the user account logging in to provide only the available functions.

### **4.1.3 HR, CSIP**

If the authority has a separate HR management system that can be integrated with other systems, it can be integrated with the user management module through the user account management submodule. This will allow to manage users whose data is available in the HR management system. If data about an employee is deleted from the HR management system or an employee is on vacation, this data may allow the account of this employee to be automatically deactivated.

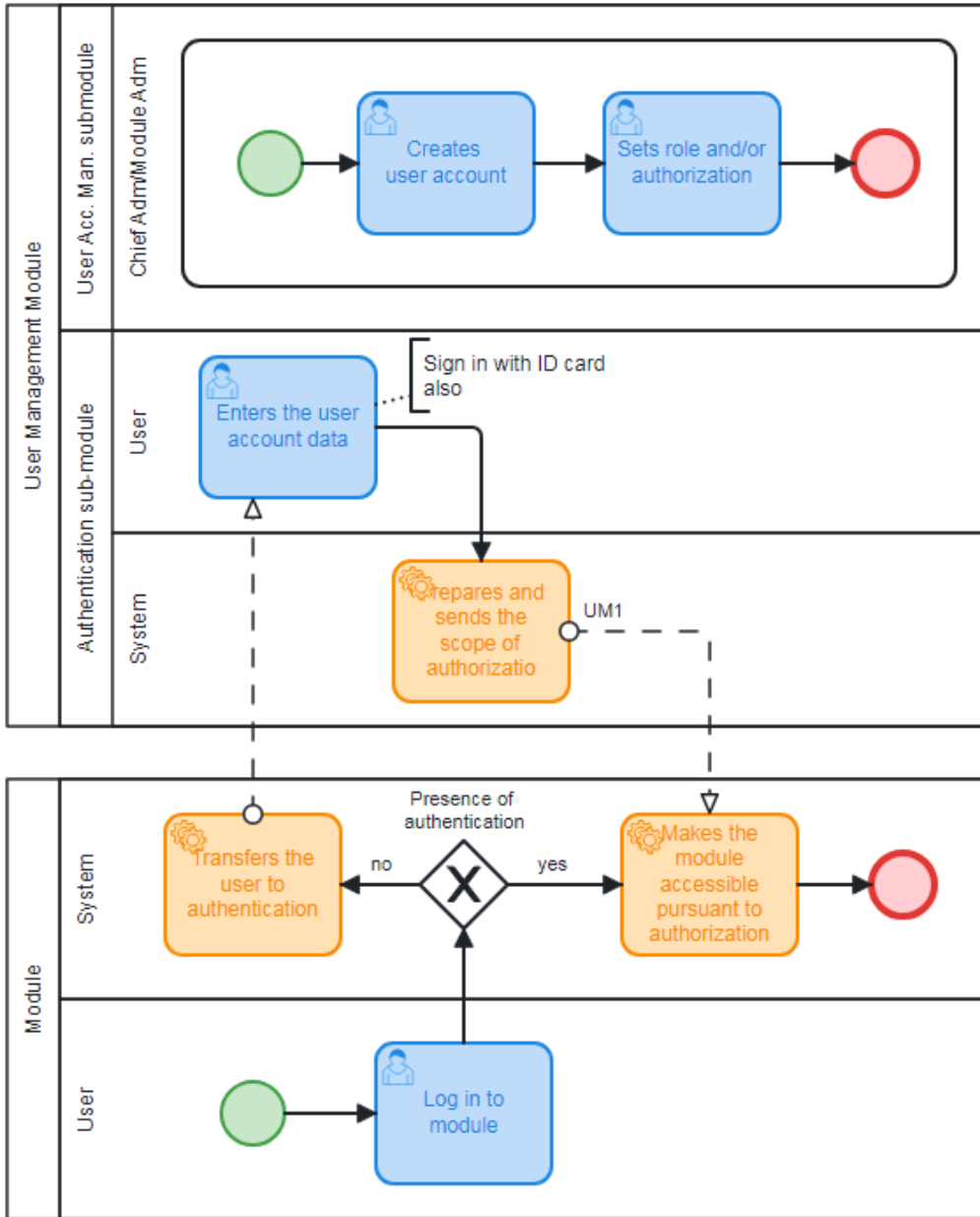
This possibility may also be provided in the case of CSIP integration.

### **4.1.4 Specialist Management Module**

The account management submodule uses the Specialist management module to determine the authority of industry specialists (procurement specialists, internal auditors). The data of specialists available in the latter's registry, PM3, AM4 (presence in the registry, status, or other) will allow the creation of user accounts for specialists available in the registry and manage the user account automatically.

## **4.2 Functions**

The primary function of the user management module is to identify users and grant the scope of authority to GFMIS modules. An essential prerequisite for this is the creation and management of users, which is implemented in the user account management submodule. The identification and granting of the scope of authority to the GFMIS module, when the user logs on to the system, are described in the diagram shown in Figure 4.2 and the following description.



**Figure 4. 2 Identification and authorization**

<b>Goal</b>	Providing a working interface to the user in accordance with the authority
<b>Process</b>	To access any module, a user account with the appropriate permissions must first be created and implemented by the primary administrator or module administrator in the user management submodule. When a user tries to access a module, the module checks for authentication. If authentication is available, Modul makes it available and allows only those functions that are defined within the authority of the identified user. If

	<p>identification is unavailable, the user is moved to the authentication submodule of the user management module, where he enters his account details.</p> <p>The data can be a username and password, an ID card (PKI), or biometric data. If such a user already exists and has permissions, the latter is sent to the module from where the process was started. The module becomes available and allows only functions defined within the scope of the user's authority. Otherwise, the process ends: the user cannot access the module.</p>
<b>Domain</b>	Any GFMIS module, User Management Module
<b>Performers</b>	Chief/Modul Administrator, User
<b>Input Data</b>	User Account Data
<b>Output Data</b>	UM1

## 4.3 Other functionalities

The idea of roles and attributes can be applied to make user management more convenient and flexible.

### 4.3.1 Roles

The idea of a role makes it easier to manage users. In addition to the user, the idea of a role is introduced, which is given a range of authorities. The user is then given a role. This means that this user is granted the amount of authority that was granted to this role. For example, let's assume that in any department of authority, there is more than one similar position- a senior specialist, who should have the same authority. One position, "senior specialist," is created, and the scope of authority is given to her. These users are then assigned the created role instead of granting each user a set of authorities individually. This means that all users to whom the role was assigned have the authority that the latter received from this role. Suppose it becomes necessary to change the authorizations of any position in the future. In that case, this can be done by changing the scope of authorizations of the corresponding position, which, in turn, will change the scope of authorizations of all those who are assisted and to whom this position is attributed.

One assistant can be assigned more than one role. If any user needs to be granted temporary authority for another position, the appropriate role can be attached to this user.

### 4.3.2 Attributes

The idea of attributes allows you to make authorizations more flexible. In addition to granting the user any authorizations, you can limit these permissions to an attribute. For example, the user of the public

sector accounting module is given the authority to manage treasury accounts. Using attributes allows the authorizations of a given user to be limited only to the accounts of his body. You can also restrict access to specific accounts in his body, but not all of them. In this case, the user's body and specific authorized accounts act as attributes. The definition of authorizations is located next to attribute-based authorizations.

## Chapter 5: Testing module

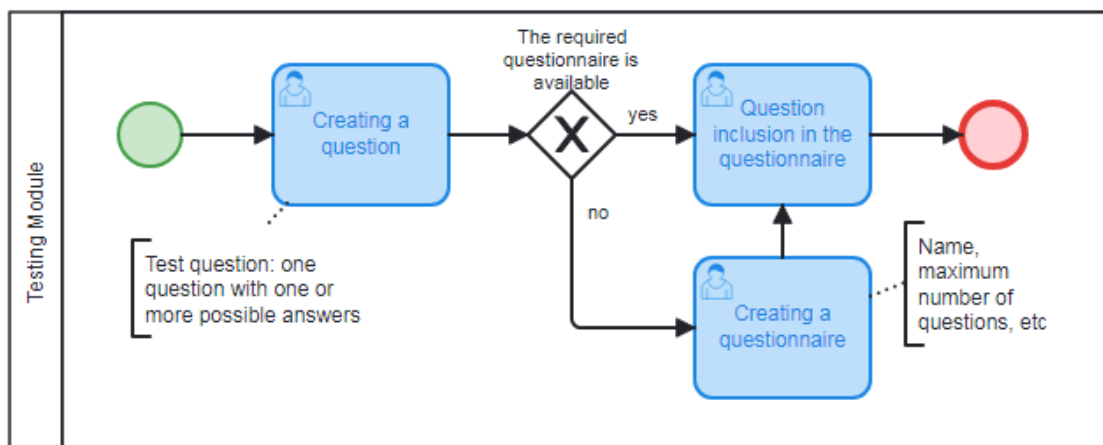
The implementation of the testing module will allow the implementation of the processes for conducting an examination for the assignment of qualifications to specialists within the GFMIS, for example, testing for the assignment of qualifications to procurement coordinators, internal auditors, etc. Still, it must comply with each module's requirements and legal acts.

If necessary, the module should also enable the testing processes of other GFMIS modules.

The testing module will allow us to perform the following processes.

- creating a test questionnaire
- test activation
- conducting the test

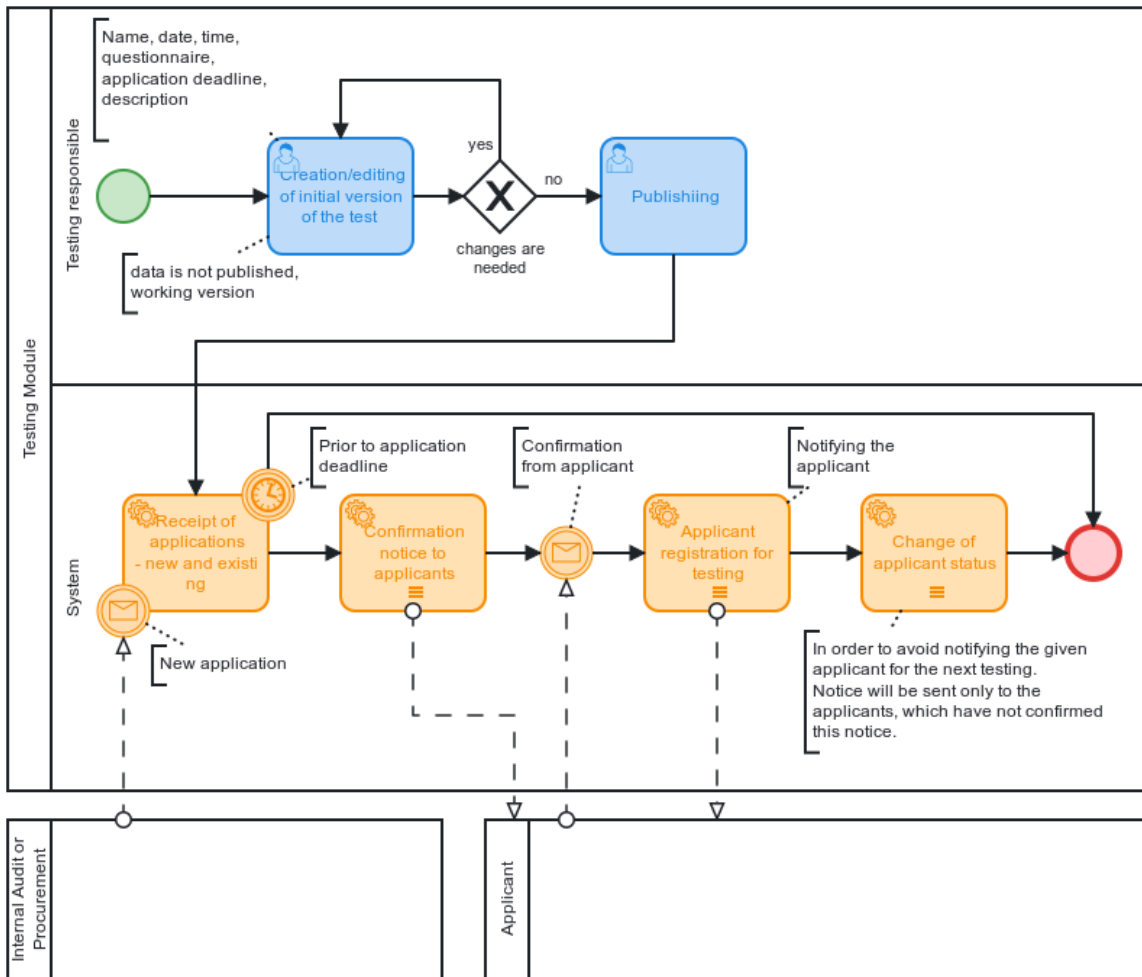
### 5.1 Creating a test questionnaire



For testing, a prerequisite for the system is the availability of a questionnaire that must meet the following requirements.

- It should consist of questions with one or more possible answers, and if the latter are available, the questions can be edited and/or refined.
- Have a title, description, maximum number of questions, etc.
- Each question should have clearly defined and/or possible grades.

## 5.2 Test activation



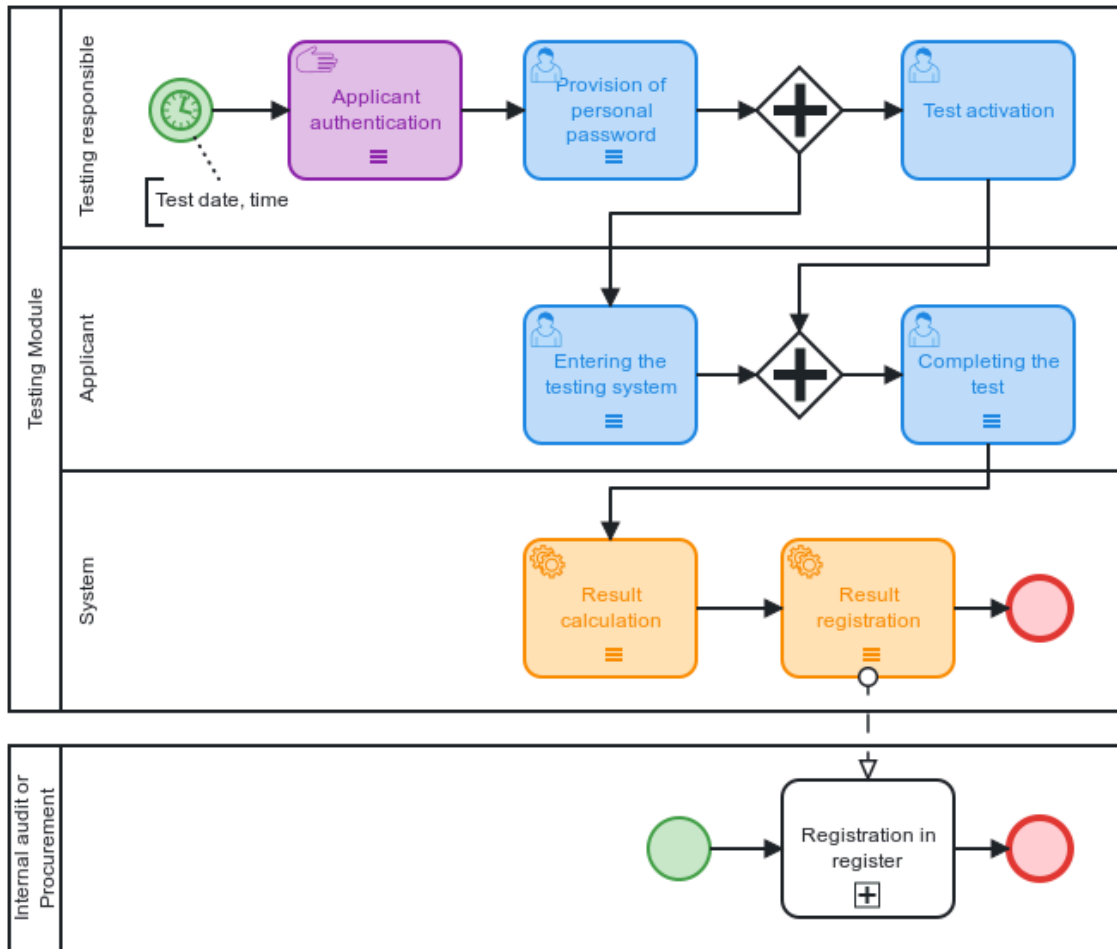
1. An employee of the authorized body (hereinafter referred to as the person responsible for testing) creates and/or edits a preliminary version of the test in the system (name, day, time, questionnaire, deadline for submitting applications, duration, passing threshold, number of questions, description, etc.). If necessary, the test is edited and published on the necessary websites (for example, the information portal of the procurement module, the official website of the Ministry of Finance of the Republic of Armenia, etc.). Notification of test activation can also be sent to applicants.
2. The following options are proposed for submitting applications.

**Option 1.** Applicants will be notified of the exam based on the applications received and/or available before the deadline for submitting applications. After receiving approval from the applicants, the applicants are registered for testing. The applicant's status is being changed in the system to not notify the applicant indicated on the next test.



**Option 2.** Applicants choose a day suitable for passing the exam and fill in the necessary data. If all the required documents are available, the registration of applicants for testing is confirmed within the prescribed period, and they will be notified of the testing details.

### 5.3 Conducting the test



1. On the set test day, the person responsible for testing identifies all applicants by checking their identity documents and comparing them with the information filled out by applicants in the preliminary system.
2. To log in, the applicant enters an individual password, with which the system identifies the applicant and activates the test. The following options are available for entering a password

**Option 1.** The personal password is provided to the applicant by the person responsible for testing on the day of testing.

**Option 2.** The individual password is sent in advance to the applicant's email address.

3. The system generates a certain number of questions for each applicant and provides the necessary amount of time to answer the questions.

4. After choosing the answers to the questions, the applicant completes the exam. The exam also ends after the set time has elapsed.
5. The test is calculated based on the selected answers, and in the case of questions that have not been answered, the points are not calculated.
6. After the exam is completed and the results are calculated, the system immediately reflects the points scored by this applicant. The system transmits the calculated test results of all participants to the necessary modules (Internal audit, Procurement, etc.).

## Chapter 6: Training module

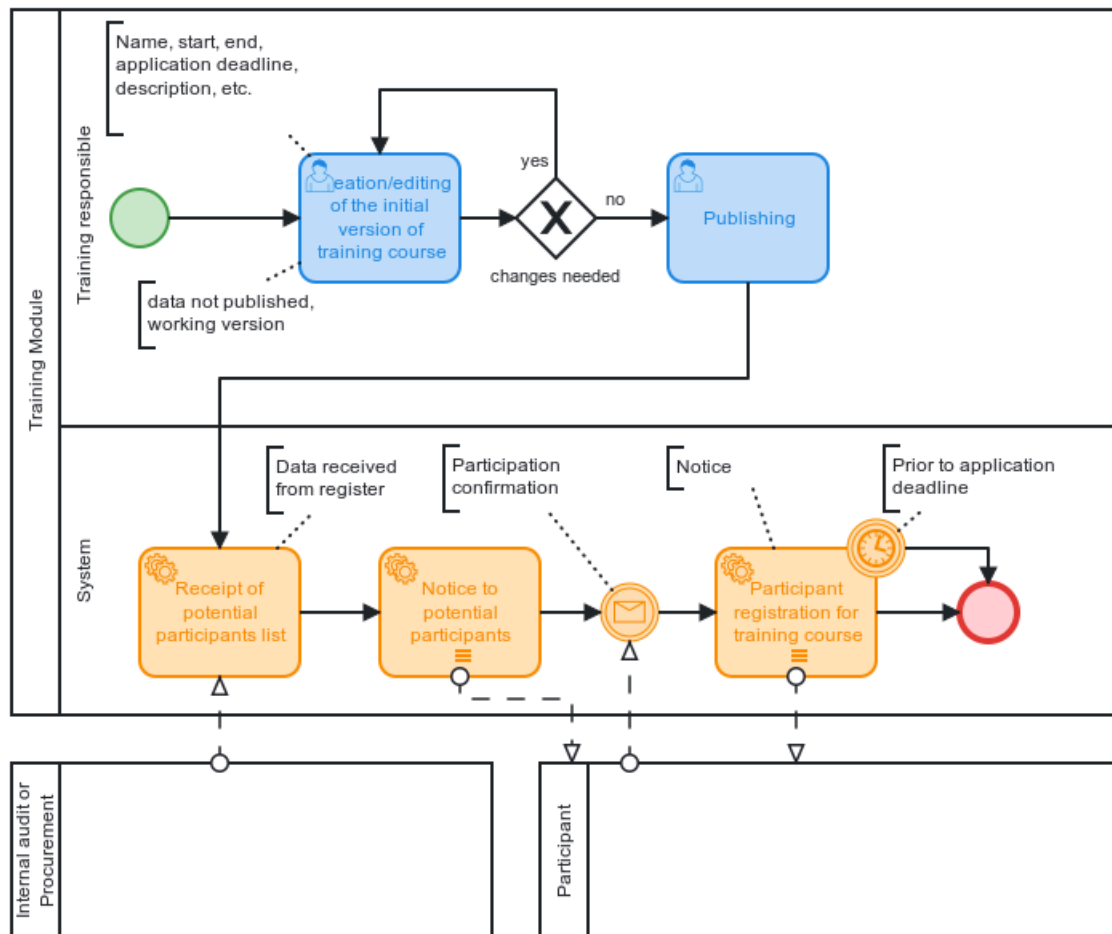
The implementation of the module will provide training for specialists in various fields to conduct online and/or face-to-face courses.

The training module will allow to implement the following processes.

- Course activation
- Course conduction

The tests should be conducted both online and in an accessible form.

### 6.1 Course activation

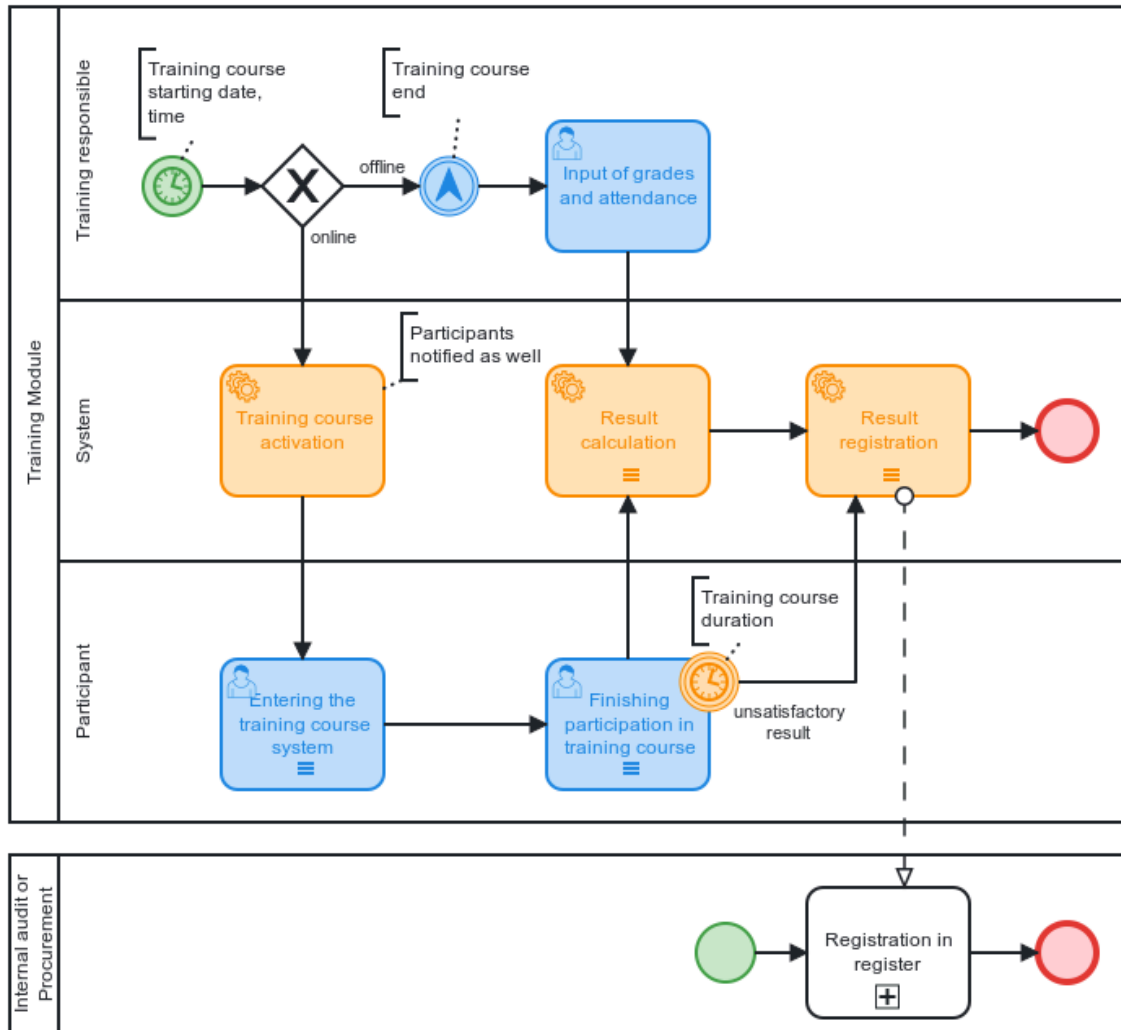


1. An employee of the authorized body (hereinafter referred to as the person responsible for testing) creates and/or edits a preliminary version of the course in the system (name, day, time, questionnaire, deadline for submitting applications, duration, passing threshold, number of questions, description, etc.). If necessary, the course is edited and published on the necessary

websites (for example, the information portal of the procurement module, the official website of the Ministry of Finance of the Republic of Armenia, etc.).

- Notification occurs after the system receives a list of potential participants. The latter, having received an invitation to participate in the training, confirms or rejects his participation.
- In case of confirmation of participation, the system registers the participant for the course, about which the participant receives a corresponding notification.

## 6.2 Course conduction



Courses for those to be trained are offered both in person and online.

- The persons who have confirmed their participation, in accordance with the established schedule, come to the training venue with the necessary documents (if the course is conducted online, then according to the established and approved links and format).

2. The person to be trained is considered to have not completed training, did not participate in the established total duration of the training course, and did not ensure the receipt of the appropriate number of points.
3. After completing the training course, the results are calculated and summarized based on scores and attendance, after which the results are entered into the register.