

# Technical Solution

## 1 Introduction

Indrivo commits to providing the services described in the offer using its own resources, without concluding subcontracting agreements with other companies or organizations.

Through this project, our company will provide a team with the necessary technical expertise, capable of developing the "Study in Moldova" website and integrating a new feature that meets the objectives set by MEC.

Below, you will find all the necessary information regarding the chosen technology, the actual technical solution, and all the details required for the successful implementation of the project.

## 2 Solution Architecture

For the system architecture, we propose the use of the Drupal platform for the development and updating of the online platform, ensuring that the website optimally meets the requirements from the specifications.

The modules will be developed using the Drupal CMS. The IT platform will also include additional modules for the subsequent management of the platform: backup, audit, control, security, etc. The platform will run on a server with a UNIX-family operating system, an Apache web server, and a MySQL database. It will be possible to access the site from the internet.

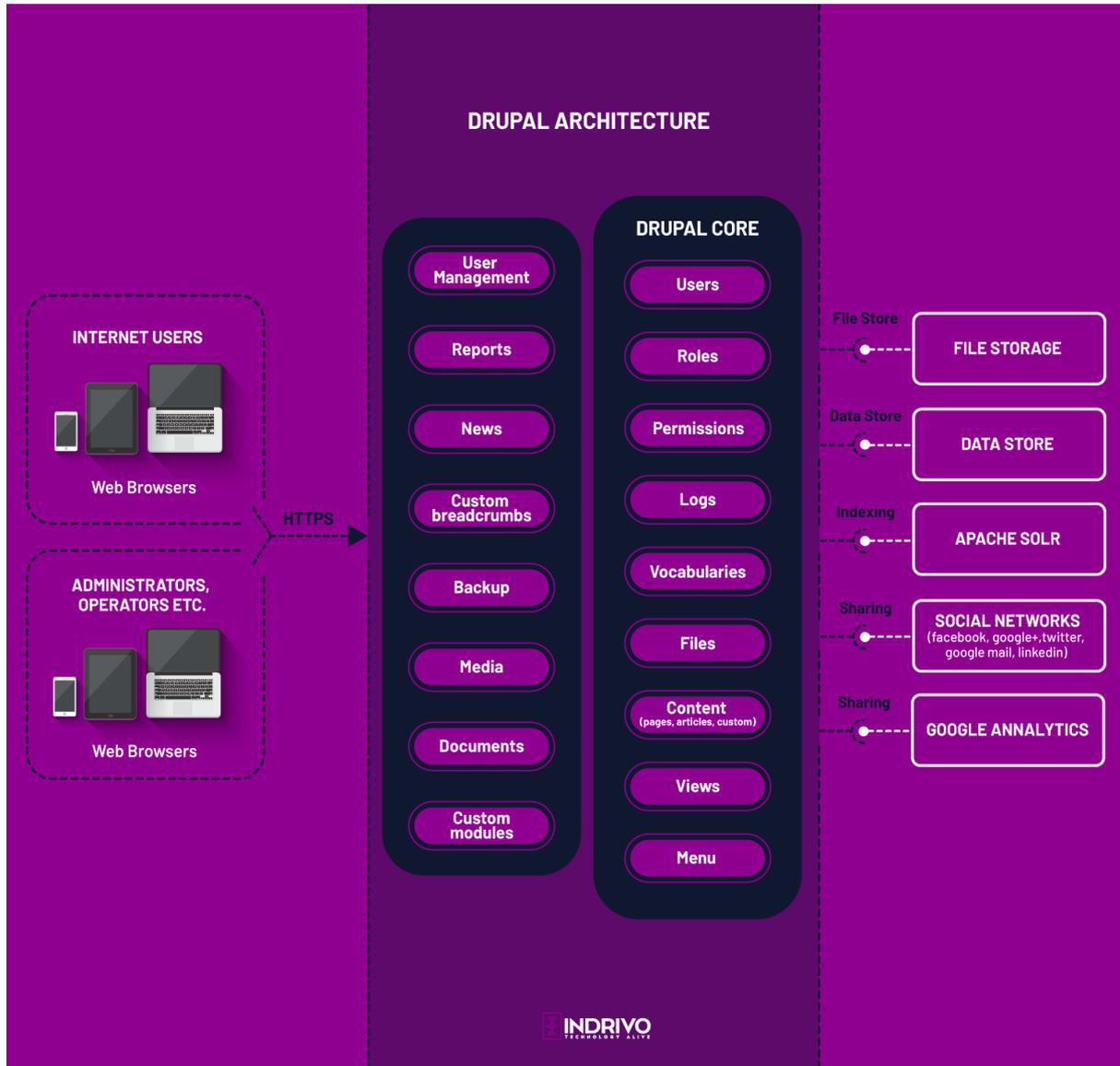
During the business analysis phase, Indrivo will define the final architecture to consider all the requests from the Beneficiary's team.

### 2.1 Architecture Decisions

Indrivo's proposal is to have a modular architecture based on separate functional layers, which entails the existence of multiple components each fulfilling a complex functionality within the application. At each application level, modules will be responsible for various functionalities. The data flow within the platform will be organized so that the separation between the database layer, the business layer, and the presentation layer is clear.

Separating the application into modules will enable more efficient permission division and will better refine functionalities so that the administrator can create roles and permissions as accurately as possible.

In the following diagram, we will illustrate the relationship between the main functional modules of the platform:



## 2.2 Development Technologies – Drupal CMS (Framework)

### 2.2.1 General Description

Drupal is an open-source content management system (CMS) platform developed in PHP and distributed under the GNU General Public License. It is used by at least 2.1% of all websites worldwide, ranging from personal blogs to online stores, government portals, presentation websites, and even social networks. The standard installation of Drupal, known as Drupal Core, includes the essential features of a content management system.

These features include:

- User account management

- Management of content types (articles, pages, and other types) and content creation (for example, descriptions of locations, venues, etc.)
- Classification of content using taxonomies (the ability to search within the site based on a word or group of words)
- Menu management (enabling the selection of common components for all pages)
- RSS feeds (allowing the distribution of news in XML file format)
- Customizable graphic themes

There are over 21,000 free modules contributed by the Drupal community, available for modifying and extending the CMS's core capabilities. These modules add new features or customize Drupal's functionality and appearance. Through these modules and its modular design, Drupal is the most versatile open-source content management system.

Drupal is also described as a web platform on which various web applications, known as Drupal distributions, can be created. Although Drupal offers a sophisticated programming interface for developers, it is still very accessible to individuals without programming knowledge who want to use the basic Drupal installation and manage their own sites.

Drupal runs on any platform that supports a web server capable of running PHP (including Apache, IIS, Lighttpd, Hiawatha, Cherokee, or Nginx) and a database (such as MySQL, MongoDB, MariaDB, PostgreSQL, SQLite, or even Microsoft SQL Server).

## 2.2.2 Benefits of Drupal Development

The main advantages offered by the Drupal platform are:

**Easy to Use** – The administration interface facilitates daily tasks with a range of features for web builders and content editors. It will easily assist in drafting pages, adding/editing/deleting profiles of social entrepreneurs/schools, experts in social entrepreneurship on the site, and all the administrator functions such as monitoring registrations, managing publication records, adding communication languages, generating and downloading lists of registered social entrepreneurs and experts, etc.

**Flexible** – Users with allocated rights can define their own content structure and add custom fields to content modules, users, vocabularies, comments, entities, and more. The data for these fields can be stored in SQL or NoSQL databases, or even remotely. In addition, any of the already available Drupal modules can be used.

**Scalable** – A site built on Drupal will be fast, responsive, and able to support increased traffic thanks to improved JavaScript code, CSS optimizations, better caching, and more.

**Extensible** – Thanks to the community's collective effort, over 21,000 Drupal modules are available or under development, including Views, Pathauto, and WYSIWYG, with at least one released every day.

**Open Source** – Thousands of people work together to continuously improve the Drupal platform, modules, themes, and distributions. Most modules and themes are free, which significantly reduces web development costs. Therefore, it is highly likely that a difficult problem has already been solved.

**Customization (Appearance and Structure)** – In terms of features, functionality, layout, and design, Drupal is extremely customizable, offering many choices for developers and designers to meet clients’ requirements. The platform allows precise control over what appears on the screen through its Render API and several truly advanced hooks. The new RDF module provides semantic web markup. This will help with the site’s graphics: fonts, colors, and logos, all used in accordance with the IarmarEco Brandbook.

**Image and File Management** – Adding images to content is a built-in feature. The platform allows the generation of different image styles for thumbnails, previews, sliders, and other image formats. Files can be handled privately or as public files.

**Automated Code Testing** – Drupal includes an automated testing framework with over 30,000 built-in tests, allowing continuous integrated testing of all changes made to the Drupal core and community-created modules. Thus, each update guarantees a bug-free platform.

**Good Database Support** – Drupal has a database layer that improves out-of-the-box support for SQLite, MySQL/MariaDB, and PostgreSQL. Modules created by community members can also be installed to use MS SQL Server, Oracle, and many others.

**Creating Installation Profiles for Distributions** – Drupal uses the concept of installation profiles to create distributions or even Drupal-based products. A new API and portable configurations allow the code to include multiple settings.

**Enterprise-Class Solution** – In terms of scalability, flexibility, reliability, manageability, security, interoperability, and resource availability, Drupal is an enterprise-class solution. The platform can be easily integrated with other applications such as SAP, phpBB, etc. It allows the generation of any type of questionnaire.

**Enhanced Security** – Building platforms on Drupal allows adherence to best practices in application security, with measures that prevent vulnerabilities included in the OWASP TOP 10. This involves security measures for both the server side and the platform side.

**Extended API Support** – Drupal offers extensive API support for integration with Facebook, Twitter, Google Apps, Google Analytics (site visitor statistics), YouTube, Vimeo, Facebook Pixel, etc. The site will reflect comments made on any of these authority pages. Custom modules can be created at any time using such a well-documented API.

**SEO-Friendly** – Since SEO plays a vital role in any company’s online marketing strategy, Drupal enables the creation of SEO-friendly websites with great flexibility in displaying content in a search engine-friendly manner.

**Mobile Responsive** – The growth and spread of smart devices open the doors to a new marketing platform for companies. For users of smart devices, the Drupal site can be viewed just like on a desktop. Small businesses can rely on this feature to generate more leads.

**Interface Compatible with Most Modern Browsers** – Microsoft Internet Explorer, Mozilla Firefox, Opera, Google Chrome, or Safari are all supported.

**Localization and Translation** – Drupal is developed to support any language, and the interface can be customized for various languages.

**Push Notifications** – To iOS (iPhone/iPad) and Android devices using Apple’s APNS (Apple Push Notification Service) as well as Google Cloud Messaging (GCM) and the Cloud to Device Messaging (C2DM) framework. This module does not rely on any external service, allowing site owners to send free push notifications to any mobile device.

**Localization and Translation** – Drupal is developed to support any language, and the interface can be customized for different languages.

### **Projects Implemented by Indrivo Based on Drupal Technology:**

- Corporate and promotional websites to facilitate marketing efforts and establish a digital presence
- Intelligent solutions for SMEs (Drupal for business environments) to accelerate work processes: collaboration systems (Drupal intranet platforms, project management tools); ERP – study planning and corporate training systems (LMS); Digital asset management – event management applications
- Drupal-based SaaS products for startups and tech enterprises: complex software helping companies deliver on-demand quality services to their clients
- Community solutions: platforms for NGOs, including platforms for organizing crowdfunding campaigns

The Indrivo team constantly improves its expertise and is a technology leader in the Drupal community, being involved in the creation and maintenance of Drupal modules and supporting the Drupal Association.

## **2.2.3 Drupal Security**

Drupal is a proven, secure CMS and application framework that confronts the world’s most critical internet vulnerabilities to prevent the worst outcomes. Drupal is mature, stable, and designed with robust security in mind.

### **Secure Access**

Drupal account passwords are encrypted when stored in the database. Drupal can support a wide variety of password policies, such as minimum length, complexity, or expiration. Standard industry authentication practices are also supported, including SSL and two-factor authentication. Many single sign-on (SSO) systems are integrated with Drupal in production environments, including LDAP, Shibboleth, OpenID, and SAML.

### **User Access Control**

Drupal can give administrators complete control over user rights (it determines who can see and who can modify each part of a site). Drupal operates on an extensible user role and permissions system. Administrators can create user roles and give them specific, limited permissions. For example, a site might need an “author” role that can create and update content but cannot publish or delete it—permissions reserved for the “editor” role—while all administrative settings are reserved entirely for a separate role. Authenticated users can be assigned any number of roles, and their permissions are cumulative. Menu links and features are automatically hidden from users who do not have the appropriate access.

### **Database Encryption**

For high-security applications, Drupal can be configured for extremely strong database

encryption. When encrypting the entire database is not desirable, granular controls are available to protect more specific information: user accounts, specific forms, and even specific field values can be encrypted in a database that otherwise remains in plaintext. The encryption system can be configured to comply with the strictest PCI, HIPAA, and state privacy laws, including managing encryption keys off-site.

### **Prevention of XSS, CSRF, and Other Malicious Data**

Drupal's Form API ensures that data is validated and sanitized before being inserted into the database. The system checks if user input data—and even the form fields themselves—match the expected formats and values. Tokens are introduced into each form as they are generated, to protect against potential CSRF attacks. Drupal's database abstraction layer performs additional security checks on data as it is written to and retrieved from the database.

### **Brute Force Attack Detection**

Drupal protects against brute force password attacks by limiting the number of login attempts from a single IP address over a predefined period. Failed login attempts are logged and can be viewed in the administrative interface. Drupal can also be configured to allow administrators to block individual IP addresses and IP ranges.

### **Mitigation of Denial of Service (DoS) Attacks**

Drupal's extensive caching layer is preconfigured with basic page, JavaScript, and CSS caching. The system supports deep integration with performance-enhancing technologies such as Memcache, Redis, Varnish, and many popular CDNs. Separate Drupal components are typically cached and can have granular expiration settings, which is a common feature. This multi-layered caching architecture is highly resilient to high traffic volumes.

### **Remediation of OWASP Top 10 Risks**

Drupal includes features that address all of the Open Web Application Security Project's top 10 security risks—a list of the most commonly encountered security risks in practice.

## **2.2.4 Drupal Structure**

Drupal has a modular structure composed of five main levels:

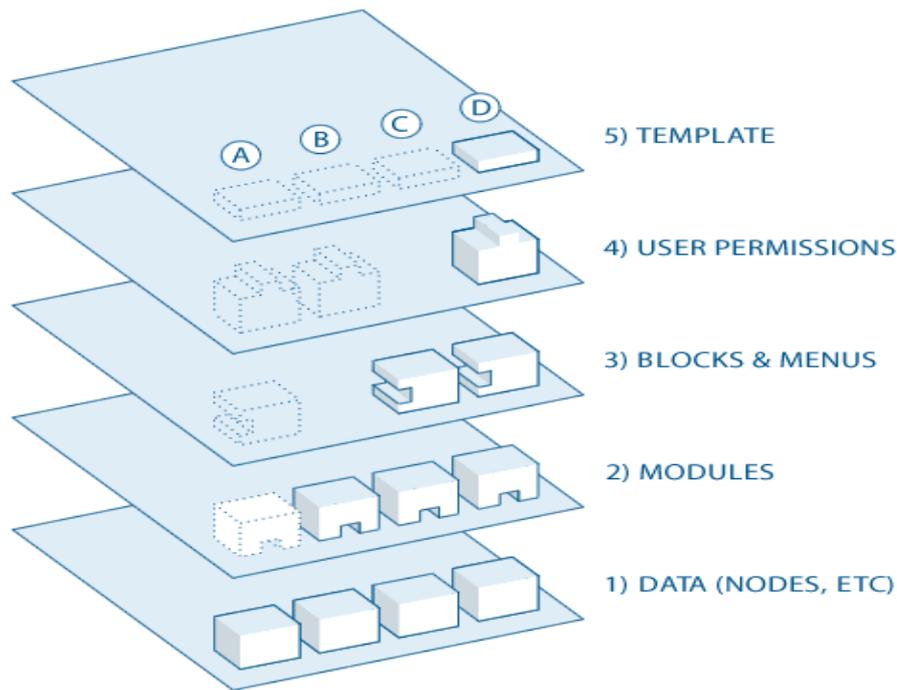


Figure 1: Drupal Levels Diagram

## Explanation of Drupal’s Modular Structure

### 1. Data Level

At the foundation of the system lies the concept of “nodes,” which are configurable data structures that store the platform’s content. Before information can be displayed on the site, it must be entered into the system as nodes.

### 2. Modules Level

The next level consists of modules. Modules are functional plugins that can be part of Drupal’s core or developed by contributors from the Drupal community. They build on Drupal’s basic functionality and allow for the customization of data elements (fields) on node types, programmatic sorting, and the display of customized content based on user-defined filters.

### 3. Blocks and Menus Level

Blocks provide a way to display information from a module or custom content. They can be placed in different regions of a template (theme). Blocks can be configured to appear in various ways and to be shown only on certain defined pages or to specific users. Menus serve as navigational elements in Drupal. They define the content displayed for each defined address (relative URL). Menus are a core Drupal component, offering links to all pages created within Drupal.

### 4. Permissions Level

This level consists of user permissions. It checks the configured settings to determine what types of users have viewing or editing access. Permissions are defined for different roles. Users are assigned to these roles to inherit the associated permissions.

### 5. Presentation Level

At the top level is the site’s theme. The theme is primarily composed of XHTML and CSS, with some Twig variables interspersed so that the generated Drupal content can

be displayed in the appropriate places. Each theme also includes a set of functions that can override standard module functions, ensuring complete control over how content is rendered. Templates can also be assigned at runtime based on user permissions.

This bottom-up directional flow dictates how Drupal operates.

## 2.3 Modules

The core components to be developed on the Study in Moldova Website online platform will be:

### 2.3.1 News Module

The news module will be designed to enable the publication and management of news articles, announcements, and other types of informational content. Its structure and essential features include:

- Intuitive WYSIWYG editor (What You See Is What You Get) or an advanced text editor that allows easy creation and formatting of articles. This includes functionalities for inserting images, videos, links, and other multimedia elements.
- Article classification into categories and tagging with relevant keywords to improve organization and facilitate searching and filtering.
- Scheduled publishing of articles at a specific date and time, allowing the editorial team to plan content in advance.
- Multiple versions and auto-save features for managing multiple versions of an article and automatic backups, enabling authors to revert to a previous version if necessary.
- Responsive display ensuring that articles and the news list are displayed correctly on all devices, including desktop, tablet, and mobile.
- News lists and dedicated article pages, providing a dedicated page for each article, including title, content, author, publication date, and possible comments.
- Display of recent articles in a carousel or slider to draw attention to the most important news items.
- Filtering by category, date, or other relevant parameters.
- Permission system controlling who can create, edit, approve, or publish news articles, ensuring that only authorized users can manage content.
- Content protection against unauthorized access or hacking attempts.

### 2.3.2 Comments Module

Structure and essential features include:

- Comment system integration that allows readers to share opinions and interact with authors and other readers.
- Comment moderation with options to approve, reject, edit, or delete inappropriate comments.

### 2.3.3 Social Sharing Module

Structure and essential features include:

- Integration of social sharing buttons for various social networks (Facebook, Twitter, LinkedIn, etc.) to increase content visibility.

- Optimization of articles for correct display on social media, including adding images and specific meta descriptions.

#### **2.3.4 Advertising Module**

- Website banners with image or code insertion
- Sharing on Facebook, Telegram, X.com (formerly Twitter)
- Automatic addition of YouTube videos via link

#### **2.3.5 Analytics Module**

- Visitor statistics for news pages from the CMS

#### **2.3.6 User Module**

- User account management
- Login via Google and Apple ID
- User system logs, with timestamps and recorded actions
- User administration

#### **2.3.7 Surveys Module**

This module allows for the creation, distribution, and analysis of surveys directly from the platform. Key functionalities include:

- User-friendly survey editor that allows adding questions and answer options.
- Support for various question types: multiple choice, open-ended responses, rating scales, etc.
- Distribution via email, direct link, SMS, or embedded on a web page.
- Targeted distribution to specific user groups or market segments.
- Options for anonymous responses or linking responses to a specific user.
- Real-time viewing of responses as they are collected.
- Detailed reporting and charts to highlight survey results.
- Exporting collected data in CSV, Excel, or PDF formats for further analysis.
- Data interpretation and action recommendations based on results.

#### **2.3.8 Search Module**

- Site search plus Google Search module integration
- Advanced search functionality enabling users to quickly find articles based on title, content, author, or tags.

#### **2.3.9 Content Management Module**

- Creation of static pages and arranging them in the menu
- Ability to create and rearrange blocks, news, banners, etc.
- Ability to create and edit news categories
- Administration of all pages, words, and information within the CMS

#### **2.3.10 SEO Module**

- **Option to add meta descriptions, keywords, and SEO titles for each article** to improve search engine visibility.
- **Features for managing internal and external links within articles**, thus optimizing site structure for SEO.

### 3 Project Stages for Website Development

As part of this project, we will follow a comprehensive methodology for implementation, based on a preliminary analysis of functional needs, defining the implementation plan, and ensuring post-implementation monitoring.

#### 3.1 Platform Development

Activity	Deliverable	Involved Personnel
Indrivo will develop the program code of the website, its functionality, and integrate the graphic design and modules into a prototype version of the IT system, demonstrating the existence of all functionalities required in the terms of reference and documented in the specifications.	Complete source code of the modules and components necessary for compiling the delivered software product.	Web Developer

#### 3.2 Testing (QA)

Quality Assurance (QA) is a significant branch of the entire Software Development Life Cycle (SDLC) and is an integral and critical stage of every software development project. This process not only anticipates requirements but also ensures secure and stable software, guaranteeing adherence to all agreed standards and procedures.

The QA process involves verifying all the developed software solutions and ensuring that they meet the Beneficiary’s specifications and expectations. Quality assurance is a critical aspect from the initiation phase right through to the software launch phase.

Testing Phase Activities	Deliverable	Involved Personnel
Testing the site’s functionalities:		
• Identifying the functions the software must perform;		
• Creating input data based on the function specifications;		
• Determining the expected output based on function specifications;		
• Executing the test case;		
• Comparing actual and expected results;		
• Verifying that the application works as per the client’s requirements.	Test report detailing results for:	
• Functionality		

• Mobile responsiveness		
• Performance		
• Security		
• Acceptance criteria	QA Tester, Project Manager	
<b>Mobile Responsive Testing:</b>		
• Flexible layouts: Building a website with a flexible grid that can be easily resized to any dynamic width.		QA Tester, Project Manager
<b>Performance Testing:</b>		
Performance testing is conducted to evaluate the performance of system components under a certain workload. During these tests, system components are monitored to verify the stability of the tested system. Performance testing will be run in the pre-production environment to ensure the system meets performance criteria similar to those in production.		QA Tester, Project Manager
<b>Security Testing:</b>		
Security testing is a non-functional testing process to determine if the security mechanisms of the IT system protect data and maintain intended functionality. It checks if the application or product is secure, verifying no information leaks occur in the app's encryption, and ensuring that the system cannot be breached or accessed without authorization. The security requirements to be verified will be specified in the security analysis report. Security testing will be carried out in the pre-production environment under conditions similar to production.		QA Tester, Project Manager
<b>Acceptance Criteria / User Acceptance Testing (UAT):</b>		
<b>Acceptance testing is performed at two levels - alpha and beta testing.</b>		
<b>Alpha testing includes unit, integration, and system testing. Once the supplier provides the beneficiary with the system for acceptance testing, alpha testing is considered done.</b>		
<b>User Acceptance Testing (UAT) is conducted by the client with the supplier's support. For Beta Testing, the Beneficiary (with the Supplier's assistance) will run all the acceptance test scenarios for the entire system or delivered component. Acceptance tests will be carried out in accordance with the test plan prepared by the Supplier and agreed upon with the Beneficiary. This plan will be consistent with the entire contract lifecycle: testing stages distributed across iterations, sets of functionalities, or other types of tests.</b>		
<b>The system's correct operation will be considered in terms of meeting requirements, data consistency, time constraints, data validations, and error handling,</b>		QA Tester, Project Manager

**including for existing functionalities that have been extended or modified. Success criteria – the system passes all tests defined in the test plan agreed upon with the Beneficiary.**

### 3.1 User Training

Below is the requested tabular format for Section 3.1 User Training:

No.	Activity	Deliverable	Involved Personnel
1	Training users to operate the implemented system under appropriate conditions, as well as the use of work procedures specific to the technology.	Customized system usage training course	Project Manager
2	Training the Beneficiary’s administrators to ensure proper system administration, improving risk management and control of activities associated with the system, and maintaining operating parameters.	Customized administration training course	Project Manager
3	Preparing a user manual, containing at least: <ul style="list-style-type: none"> <li>• Description of functionalities grouped by user type</li> <li>• Coverage of use cases</li> </ul>	User Manual	Project Manager
4	Preparing an administrator’s manual, containing at least: <ul style="list-style-type: none"> <li>• Description of application configuration functionalities</li> <li>• Description of backup/recovery functionalities from the administration area</li> <li>• User/role/permission management</li> <li>• Management of taxonomies</li> </ul>	Administrator’s Manual	Project Manager

*The training course is Indrivo’s proposal; the final decision will be made in consultation with the Beneficiary.*

### 3.2 Data Migration

In a data migration operation, it is very important that all functionalities provided by the old system are appropriately adapted to the new system.

Data migration is labeled as a one-time process, but in reality, various custom configurations of servers, operating systems, security policies, and databases can lead to incompatibilities between the old and the new system. Therefore, proper attention must be paid, following a structured and methodical approach, implementing all security measures and RESTORE possibilities during the data migration process.

Activity	Deliverable	Involved Personnel
Data migration includes:		
• Audit;		
• Forming an active team;		
• Describing existing procedures;		
• Performing backups and testing their restoration;		
• Describing procedures for installing the new systems;		
• Installing and configuring the new systems;		
• Migrating data;		
• Testing;		
• Starting to use the new systems;		
• Monitoring the functioning of the new systems.	Final version with a test report certifying identified issues or the absence of objections after data migration	Web Developer, QA Tester

### 3.3 Commissioning

Activity	Deliverable	Involved Personnel
Publishing the site on the server will be done after the intermediate acceptance from Stage 1, within the established execution period according to the concluded service contract.		
During this phase, the Supplier will contact the Beneficiary's representatives to clarify any aspects arising in the website's implementation and will make all efforts to avoid any delays in contract execution that are not the Beneficiary's fault.		
Upon completion of this phase, the Supplier will draft and submit to the Contracting Authority a report on the installation, testing, and commissioning of the website and will notify the Contracting Authority in writing about the completion of Stage 2 – effective implementation, posting online, and testing of the webpage. After this step, the Supplier will prepare a commissioning report. On this occasion, a complete backup of the website will be provided in electronic format.	Final version with a test report attesting identified issues or absence of objections	Web Developer, QA Tester

Test plan and internal testing results (functional, performance, security).		
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**Post-Implementation**

The Supplier prepares the website management guide for the administrator and hands over all source codes of all website components and other information necessary for website administration. All artifacts will be copied onto electronic media.

**Deliverables:**

- Complete source code of the modules and components necessary for compiling the delivered software product;
- Final packaged product for easy installation in the proposed technological environment;
- Documentation on installing and configuring the site;
- Source code for applications and components developed within the project;
- Special libraries and tools needed to compile the site’s components (the developer will demonstrate the ability to compile the source code).

**In addition:** The Supplier trains the Beneficiary’s assigned specialists responsible for website administration.

**Deliverable:**

- Training, including:
  - User Manual
  - Administrator’s Manual (including a disaster recovery plan)

**12-Month Technical Support Period** These services will include possible updates and/or modifications, additions to the webpage format. Any request for such services must be made in writing by the Beneficiary, establishing an agreed deadline with the Supplier (who must justify in writing the necessary time for the updates, modifications, additions). After completing these services for each request, a reception protocol will be signed specifying the exact number of allocated hours.

After the completion of the service contract, the system’s users should be able to update the website without specialized knowledge (e.g., HTML, XHTML, CSS, JavaScript, or any other programming or web design skills).

After completing this phase, a final reception protocol will be signed, during which the Supplier will deliver a complete backup of the site, including all accumulated information (including databases), to the Contracting Authority.