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D4.1 Educational Plan

including all educational materials and aspects

POLIDIH

Polissia Digital Innovation Hub

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Polissia National University

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PRELIMINARY CHARACTERIZATION

The training plan for the Polissia Digital Innovation Hub incorporates the contributions of hub staff and concentrates on designing modern, informative, and efficient training materials.

The developed training materials correspond to the necessary requirements of the key stakeholders identified in Part B of the application.

The final version of the training plan is intended to cover all technical and human components of the training curriculum. This description encompasses methodological recommendations, a technical outline of the required equipment and software, and the final digital skills to be developed through the training services.

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Dissemination Level: PU Public

PP - Restricted to other programme participants (Including the Commission Services)
RE - Restricted to a group specified by the consortium (Including the Commission Services)
CO - Confidential, only for members of the consortium (Including the Commission Services)

Nature

PR - Prototype
RE - Report
SP - Specification
TO - Tool OT Other

Synopsis This document outlines the comprehensive project management protocols, the work plan, and the instruments for overseeing project activities, including the Reporting and Financial Management Guidelines, the Risk Management Strategy, the Quality Management Strategy, and the Communication and Exploitation Strategy for the POLIDIH Project

List of keywords education, digital transformation, GIS training, digital competencies, industrial automation, smart specialization

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Content

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INTRODUCTION

Geographic Information Systems (GIS) constitute a powerful tool for collecting, analyzing, storing, and visualizing geospatial data. Their relevance is attributable to their capacity to process large data sets, integrate information from diverse sources, and provide effective means for rapid and well-founded decision-making. GIS play a key role in fields such as ecology, transportation, urban planning, and forensic science, where spatial analysis is of critical importance. In a contemporary world of ever-increasing data volumes, these systems help structure and examine the information needed for strategic management and development in various sectors. For instance, in transportation infrastructure planning or assessing natural disaster risks, GIS enable the integration of extensive data sets, thereby enhancing both the precision and efficiency of decision-making.

GIS are widely applied in environmental monitoring, natural resource management, the agricultural sector, logistics, healthcare, military affairs, and many other areas. Accordingly, mastering such systems provides skill sets in high demand across multiple professional domains. Moreover, global challenges—climate change, land degradation, and urbanization—require solutions grounded in spatial analysis, and GIS facilitate monitoring, forecasting, and planning to achieve sustainable development objectives.

Rapid advances in software, satellite technologies, and drones create new opportunities for GIS implementation. Integrating these systems with artificial intelligence and big data makes them even more efficient, thereby driving a strong demand for specialists who possess relevant competencies. Proficiency in GIS has become a notable advantage for professionals in planning, data analytics, management, and research.

Additionally, studying GIS promotes interdisciplinary thinking, as they integrate knowledge from geography, computer science, statistics, economics, and other fields. GIS also provide the foundation for numerous innovative approaches in both education and research. Consequently, acquiring expertise in geographic information systems has become an essential aspect of modern education and science, enabling practitioners to address complex spatial-analytics tasks and offering broad opportunities for professional growth and effective responses to global challenges.

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GENERAL CHARACTERISTICS OF TRAINING IN GEOGRAPHIC INFORMATION SYSTEMS AND TECHNOLOGIES

The GIS and Geospatial Technology curriculum developed within the POLIDIH (Polissia Digital Innovation Hub) project aims not only to introduce participants to the conceptual foundations of GIS but also to guide them in mastering the most advanced methods of working with spatial data across various sectors. Through a comprehensive approach that integrates theoretical principles with practical case studies, participants will gain up-to-date knowledge on cartography, spatial modelling, remote sensing, and geodata analytics. Special emphasis is placed on integrating diverse information sources (such as satellite imagery, UAV data, and open-access databases) and employing leading software tools, particularly ArcGIS Pro and supplementary applications for in-depth spatial analysis.

This program is designed for learners at different levels—from those newly acquainted with GIS to professionals seeking specialized applications of geospatial technologies in specific fields. During the course, participants will practice creating different types of geospatial data, develop geocoding and geospatial analysis skills, and learn to apply their newly acquired knowledge to solve real-world challenges in production, management, and research. Additionally, the curriculum includes regular consultations, master classes, and themed seminars, which will help reinforce and expand participants' competencies.

Primary objectives of the training plan

1. **Provide foundational knowledge and skills in GIS use.** Participants will begin with fundamental concepts of cartography and spatial analysis, required for understanding how to work with geographic data. They will learn to navigate the ArcGIS Pro interface, create and edit shapefiles, operate with various coordinate systems, and grasp the fundamentals of cartographic projections. In addition, the curriculum will address data-analysis automation possibilities and the configuration of models in ArcGIS ModelBuilder.
2. **Foster sector-specific specialization.** The educational modules have been developed to address the needs of learners from diverse fields. For instance, in agriculture, farmers and agronomists can enhance operational effectiveness by analyzing satellite imagery and vegetation indices. Public administration professionals will learn spatial planning techniques to create maps of regional development and monitor infrastructure projects. Ecologists, meanwhile, will be equipped to track environmental changes, calculate spectral indices, define protected areas, and assess environmental risk levels.
3. **Build digital competencies.** Beyond the direct use of GIS tools, participants will be introduced to the latest methods of geodata processing, including satellite data (Sentinel, Landsat, ERA-5, among others) and drone-based imaging and mapping technologies. Participants will learn practical strategies for integrating diverse information sources into their projects and discover how to apply remote sensing algorithms for crop monitoring, resource assessment, identifying degraded lands, or planning community facilities.
4. **Support the development of a professional community.** Instruction is organized around modern learning formats, including the Moodle online platform, providing convenient access to course materials, instructor feedback, and opportunities for peer communication. A flexible format (online or offline) allows each participant to find an optimal balance between study and workload. Participants receive support in completing hands-on assignments and have the opportunity to ask questions, exchange experiences, and refine their skills even after the program has ended, thereby fostering a robust GIS professional community.

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GENERAL CHARACTERISTICS OF AUTOMATION TRAINING

Automation training is organized by Encon, a partner in the POLIDIH project consortium, through the activities of the ITM Automation School training center, which specializes in preparing and upskilling technical professionals in industrial automation. The programs are designed for software engineers, specialists in automated process control systems, technical staff, electrical system designers, and occupational safety engineers.

This training is highly relevant due to the need for increasing production efficiency, retraining specialists, adapting enterprises to production changes, and addressing issues that arise when relocating production facilities. Conducted in a state-of-the-art laboratory equipped with training stands from leading manufacturers in automation, robotics, and safety systems, the courses offer participants the choice of in-person or online formats, allowing for flexible integration of training with their work schedules.

Primary objectives of the training plan

The main objectives of the automation training plan aim to comprehensively prepare professionals in industrial automation, providing them with practical skills and an understanding of modern technologies. Course programs focus on enhancing the qualification level of engineers and technical personnel working with controllers, frequency converters, network technologies, and safety systems.

A key objective is to develop skills for working with programmable logic controllers, specifically their programming, configuration, and testing in the TIA Portal environment. Particular attention is devoted to hardware components, functional blocks, memory management, timers, counters, and the implementation of complex control algorithms.

The curriculum also targets proficiency in modern industrial networks such as PROFIBUS and PROFINET, which facilitate efficient interaction among automation devices. Course participants study methods for configuring, commissioning, and troubleshooting these networks, enabling them to anticipate and resolve potential malfunctions in industrial systems.

Another major focus is training in the use of SINAMICS G120 frequency converters. Participants gain knowledge in configuring, operating, and diagnosing these devices—crucial for optimizing electric-drive systems in production processes. Such expertise ensures precise control of motor speed and torque, ultimately enhancing the efficiency of equipment operation.

Finally, a dedicated component of the program addresses the safety of machine equipment. By examining international standards such as ISO 12100 and ISO 13849, engineers learn to design and implement safe automated systems. Practical sessions cover the creation of emergency-stop mechanisms, safety light curtains, and diagnostic measures for safety automation, thereby protecting both personnel and machinery.

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TRAINING DIRECTIONS

1. BASIC GIS COURSE (FOUNDATIONS OF GEOGRAPHIC INFORMATION SYSTEMS)

Course Objective

Provide a fundamental understanding of the basics of geographic information systems (GIS), principles of working with spatial data, and essential cartographic approaches, while instructing participants in the core methods of collecting, processing, and visualizing geospatial information. The course also demonstrates how GIS can be applied across diverse sectors (ranging from geography and ecology to urban planning).

Key topics

- **Introduction to GIS**. Overview of foundational concepts, introduction to the major components of GIS, and types of spatial data.
- **Basic Cartography**. creating and editing maps, principles of projection use, and various cartographic projections.
- **Working with GIS Software (ArcGIS, QGIS)**. Configuring the environment, creating and editing layers, and data import and export.
- **Spatial Data Analysis**. Spatial queries, buffering, clustering, and geostatistical analysis.
- **Open Geoinformation Resources**. Working with OpenStreetMap, locating and utilizing existing geodatabases and satellite imagery.

Competencies

- **Understanding Theoretical GIS Foundations**. Data classification, principles of geocoding, and the relevance of different coordinate systems.
- **Ability to Assess Geospatial Data Quality**. conducting basic validation of data accuracy and completeness.
- **Skills in Applying Spatial Analysis Methods**. Solving common analytical tasks (determining distances, finding optimal routes, identifying data patterns).

Practical skills

- **Map Creation, Editing, and Visualization**. Working with ArcGIS or QGIS environments.
- **Layer Management**. Loading, filtering, layering, and styling data sets, as well as editing legends.
- **Basic Analysis Operations**. Buffering, merging, intersecting layers, and generating thematic maps.
- **Using Online Resources for Data Searches**. Accessing open data portals and satellite services.

Outcomes

Graduates of this course will be able to use the acquired knowledge to create basic cartographic products, analyze the spatial characteristics of objects, and search for geodata in open sources. Participants will also understand how to integrate GIS solutions into the workflows of different fields and where to seek additional resources and more advanced information.

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2. TRAINING COURSE FOR AGRONOMISTS AND FARMERS

Course objective

Familiarize participants with modern approaches to using GIS technologies in agriculture and teach them to apply spatial data for optimizing production processes. Demonstrate how GIS can boost yields, improve crop-status monitoring, and make more efficient use of resources (soil, water, and fertilizers).

Key topics

- **Specifics of Agricultural GIS.** Field monitoring, soil and crop-status analysis, and the use of historical data.
- **Working with Satellite Imagery (Sentinel, Landsat)**. Downloading, processing, and analyzing images; identifying vegetation indices (NDVI, EVI, etc.).
- **Agrotechnological Maps**. Developing maps of terrain, moisture content, soil types; planning crop rotations and fertilizer application rates.

Competencies

- **Knowledge of Remote Sensing Fundamentals**. Understanding critical agronomic parameters (soil moisture, acidity, vegetation indices).
- **Ability to Analyze and Interpret Satellite Data.** Detecting problem areas (erosion, plant diseases, nutrient deficiencies).
- **Capacity to Integrate GIS Analysis Results into Practice**. Optimizing expenses, planning irrigation, and using fertilizers.

Practical skills

- **Creating and Configuring Layers**. Depicting field conditions, crop coverage, and farm boundaries.
- **Performing Basic Operations with Satellite Images**. Georeferencing, clipping, corrections, and calculating vegetation indices.
- **Developing Agrotechnological Maps**. Yield maps, fertilization recommendations, and irrigation zones.
- **Analyzing Trends and Making Forecasts**. Assessing crop development and potential yield.

Outcomes

Participants will be able to plan agricultural operations more efficiently, identify critical areas in their fields, and respond proactively to risks such as pests, diseases, or drought. Acquired knowledge will enhance operational effectiveness, reduce costs, and help conserve natural resources.

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3. TRAINING COURSE "GIS FOR PUBLIC MANAGEMENT AND ADMINISTRATION"

Course objective

Equip public management and administration professionals with the skills to utilize GIS for allocating, monitoring, and developing territorial assets, foster an understanding of spatial planning methods, and provide tools for efficiently managing community infrastructure.

Key topics

- **Foundations of spatial management**. Concepts, methodologies, and the role of GIS in strategic regional development.
- **Analysis of infrastructure facilities.** Distribution of roads, utilities, educational and healthcare institutions; identifying bottlenecks and priority areas for development.
- **Monitoring Community Conditions**. Collecting and processing demographic, budget, and social indicators; integrating satellite data and other open-source information.

Competencies

- **Understanding mechanisms of spatial management**. Fundamentals of urban and rural infrastructure planning.
- **Ability to apply gis analysis**. Supporting investment decisions, road maintenance, and construction of public facilities.
- **Proficiency in combining open data with internal data**. Using government registries, open-data portals, and proprietary information to optimize resource management.

Practical skills

- **Modeling community development scenarios**. Accounting for the geographic placement of resources and facilities.
- **Using analytical tools**. Buffering, accessibility-radius settings, and multifactor analysis for informed managerial decisions.
- **Creating thematic maps of infrastructure distribution**. Conducting spatial assessments of community needs.
- **Preparing GIS-based reports and presentations**. Communicating findings to the public, investors, or government agencies.

Outcomes

Participants will be able to plan local resource use more effectively, optimize infrastructure, and enhance transparency in community governance. Their newly acquired expertise will facilitate auditing current conditions and shaping development strategies aligned with the genuine needs of the population.

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4. TRAINING COURSE "GIS IN ECOLOGY"

Course objective

Provide participants with a comprehensive understanding of the role of geographic information systems in environmental monitoring and ecological risk assessment. Teach spatial analysis methods for determining environmental conditions, identifying degraded areas, and planning conservation measures.

Key topics

- **GIS in environmental protection.** Fundamentals of ecological mapping and types of ecological data.
- **Ecosystem monitoring**. Using satellite images (Sentinel, Landsat) and spectral indices (NDVI, NDMI, etc.) to analyze vegetation and water resources.
- **Developing environmental restoration plans**. Employing GIS to evaluate anthropogenic impacts, create ecological risk maps, and model improvement scenarios.
- **Thematic maps of ecological issues.** Visualizing pollution hotspots and delineating buffer zones around protected areas.

Competencies

- **In-depth understanding of ecological processes and indicators**. Biodiversity, pollution levels, and forest health status.
- **Ability to analyze environmental changes.** Applying multitemporal satellite imagery and integrated databases.
- **Capacity for critical assessment of ecological conditions**. Offering scientifically sound recommendations for nature conservation and restoration.

Practical skills

- **Working with diverse environmental data sources.** Field measurements, satellite imagery, open environmental registries.
- **Image analysis and classification**. Detecting landscape degradation, monitoring forest and water body health.
- **Calculating spectral indices, creating suitability maps**. Building models of contaminant spatial dispersion.
- **Composing ecological maps and preparing analytical reports**. Presenting findings to a broad audience.

Outcomes

Graduates of this course will be able to competently assess the status of natural resources, forecast adverse impacts, and develop plans for environmental protection and restoration. By mastering methods of ecological monitoring and mapping, participants will effectively implement conservation initiatives and contribute to sustainable regional development.

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5. TRAINING COURSE "TRAINING AND RETRAINING OF AUTOMATION SPECIALISTS"

Course objective

Conduct training and enhance the competencies of technical professionals in the industrial automation sector.

Key features

The course comprises multiple sub-courses designed to offer comprehensive educational services for upskilling employees in the field of automation. Participants may opt for the particular modules that interest them the most or take all components at once.

Course components:

1. **STEP 7 – 1200 BASIC**
2. **STEP 7 – 1200 ADVANCED**
3. **SINAMICS G120** – Configuration and Commissioning
4. **PROFIBUS** – Network Configuration and Diagnostics
5. **PROFINET** – Network Configuration and Diagnostics
6. **PNOZmulti**: Programming and Maintenance
7. **Fundamentals of Machine Safety**

Practical skills

Overall, the practical skills acquired will vary depending on the client's chosen course components. By completing the full program, participants will gain comprehensive skills ranging from a basic understanding of the automation process and programming to equipment maintenance and the creation of a safe industrial environment.

Outcomes

Upon completing the course, clients will be capable of implementing automation systems at their facilities. They will independently perform diagnostics, address operational issues, and establish safe automation conditions within their enterprises.

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TARGET GROUPS

Depending on each course's specifics, different categories of participants can derive maximum practical benefit from the training. Below is a list of the primary target groups, considering their professional needs, level of preparation, and fields in which the acquired knowledge may be applied.

1. BASIC ARCGIS PRO COURSE

Target audience:

- Students and young professionals aiming to acquire initial skills in geoinformation technologies.
- Specialists without prior GIS experience who wish to understand fundamental principles of cartography, spatial analysis, and software operation.
- Professionals from other fields (engineers, managers, marketers, etc.) looking to integrate GIS tools into their projects.
- Teachers and instructors planning to incorporate GIS elements into curricula for pupils and students.
- Hobbyists and cartography enthusiasts interested in spatial data analysis and geographic visualization in their free time.

Expected impact of training:

Participants will gain fundamental knowledge and practical experience in the basic functionality of GIS software, establishing a solid foundation for further development in their chosen field or transition into more specialized courses.

2. TRAINING COURSE FOR AGRONOMISTS AND FARMERS

Target audience:

- Agronomists and farmers seeking to optimize agrotechnological processes, increase yields, and make efficient use of resources.
- Soil, plant, and crop monitoring specialists who aim to integrate innovative approaches in agricultural data analysis.
- Consultants in the agricultural sector offering modern, GIS-based solutions to clients.
- Agribusiness employees responsible for planning, analytics, and scaling agricultural operations.
- Government officials involved in formulating and executing agricultural programs, looking to deepen their understanding of digital tools in farming.
- Students of agricultural specialties wishing to master modern GIS methods for research and future work in the agro-sector.

Expected impact of training:

Participants will be able to implement precision farming, thoroughly evaluate crop conditions, rapidly identify problem areas, and develop effective agrotechnological measures, grounded in satellite imagery and spatial analytics.

3. TRAINING COURSE "GIS FOR PUBLIC MANAGEMENT AND ADMINISTRATION"

Target audience:

- Managers at infrastructure companies (transportation, communications, energy) and engineers coordinating large territorial projects.
- Analysts and project managers overseeing spatial resources and seeking solutions for optimal infrastructure placement.
- Urban planning and municipal specialists engaged in community planning, urban infrastructure development, and organizing recreational and transportation zones.
- GIS consultants aiding businesses and government bodies in implementing geoinformation solutions for asset management.
- Project leaders responsible for launching and developing infrastructure or socioeconomic initiatives at regional and community levels.
- Students majoring in territory and asset management who aspire to acquire practical experience in using GIS tools in public administration.

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Expected impact of training:
Course participants will learn to plan and monitor the spatial distribution of assets efficiently, set development priorities for territories, analyze demographic data, and implement strategic decisions that enhance the effective use of community resources.

4. TRAINING COURSE "GIS IN ECOLOGY"
Target audience:

- Ecologists, environmental engineers, and environmental organization professionals involved in evaluating and preserving natural resources, monitoring ecosystems, and planning conservation activities.
- Researchers and academics examining the effects of human activities on the environment and seeking scientifically grounded methods to minimize negative impacts.
- Students of environmental specialties aiming to acquire modern techniques for environmental research and advance professional GIS competencies.
- Representatives of government agencies responsible for natural resource management who wish to improve decision-making procedures using spatial data.
- Environmental policy consultants engaged in creating and implementing conservation programs, conducting environmental assessments, and proposing legislative measures.

Expected impact of training:
Participants will be able to assess environmental conditions accurately, conduct environmental monitoring with satellite data, forecast ecological risks, and design comprehensive protection measures. Mastering GIS tools will facilitate identifying degraded areas, planning restoration projects, and formulating strategies for sustainable development.

5. TRAINING COURSE "TRAINING AND RETRAINING OF AUTOMATION SPECIALISTS"
Target Audience:

- Software engineers
- Process Control System (PCS) engineers
- Electricians and technical personnel responsible for maintenance
- Electrical system designers
- Automation engineers
- Occupational safety engineers
- Project managers
- Machine designers
- Individuals in charge of equipment acceptance

Expected impact of training:
The training aims to enhance the qualifications of technical specialists in industrial automation, enabling them to program and commission controllers independently, work with frequency converters, and configure communication networks. Participants will develop diagnostic and troubleshooting skills for PROFIBUS and PROFINET networks while gaining an advanced understanding of modern machine-safety approaches. They will effectively apply international safety standards (ISO) and EU directives, mitigating production-related risks. Moreover, this instruction prepares specialists to operate in conditions of modernization, reconfiguration of enterprises, and the adoption of new technologies, ultimately boosting production efficiency and fostering their career advancement.

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Communication strategy

Communication with participants is organized through the Moodle platform, which serves as the main digital channel. All training materials are uploaded to the platform, and participants receive personalized access to the relevant courses. Through this system, participants can:

- interact with instructors and mentors;
- receive feedback;
- discuss issues with other course participants;
- take tests and receive certificates.

In addition to Moodle, the following are provided:

- online consultations and master classes;
- hybrid learning format (offline and online) to ensure flexibility.

2. **Promotion Strategy and Information Dissemination**
The promotion of training covers the following main channels:

a) Digital Marketing

- The official POLIDIH website — includes a complete course catalog, registration instructions, certificate samples, and contact information.
- Social media (Facebook, LinkedIn, Instagram) — announcements of course enrollment, video overviews of modules, participant feedback, live sessions with trainers.
- Email campaigns to partner organizations, universities, local governments, business associations, and agricultural advisory services.

b) Offline Channels

- Information sessions in communities and at enterprises.
- Booklets, posters, and flyers in universities, Administrative Service Centers, agro-enterprises, and city councils.
- Presentations at industry forums (e.g., digital days, agro exhibitions, local self-government forums).

c) Partner Networks
Recruitment of participants through:

- Polissia National University (students, faculty, researchers);
- Encon and ITM Automation School — for promoting automation courses;
- The EDIH network, agrohubs, and business associations — through invitations and joint informational campaigns.

3. **Recruitment and Support Mechanism**

- Online registration via Google Form — enables rapid group formation.
- Personalized messages after registration (instructions, start dates, support).

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- Upon course completion — issuance of electronic certificates (free of charge) or printed certificates (for an additional fee), along with opportunities for continued participation in the alumni community and consulting events.

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POLIDIH's Capacity for Delivering Training

The Polissia Digital Innovation Hub (POLIDIH) possesses all the necessary technical, human, and organizational resources to effectively deliver high-quality training programs in Geographic Information Systems (GIS) and digital technologies across the fields of public administration, agriculture, and ecology.

1. **Material and Technical Infrastructure**
   Training is conducted in a specially equipped computer laboratory located at Polissia National University. The lab includes:

- 12 modern computers, each equipped with:
  - high-performance processors (Intel i7),
  - 16 GB of RA,
  - SSD drives for fast software operation,
  - monitors with Full HD resolution or higher.

2. **Software**
   POLIDIH utilizes licensed ArcGIS Pro software, which is the industry standard for spatial data processing. This ensures:

- full training delivery in both basic and specialized modules (ecology, agri-GIS, municipal governance);
- operations with geospatial data, satellite imagery, model building, and index calculations (NDVI, NDMI, etc.);
- execution of practical cases supported by ArcGIS Online tools, Living Atlas, and WMS services.

3. **Human Resources**
   The instructional team consists of four qualified trainers with experience in:

- using ArcGIS in environmental, agricultural, and municipal development projects;
- developing educational content and conducting practical training sessions;
- integrating satellite imagery, open data, and GIS tools into real-world case studies.

Each trainer is capable of conducting both introductory and advanced modules, tailored to the needs of specific target groups — students, local government staff, agronomists, ecologists, and others.

4. **Flexible Training Organization**
   Training is available in in-person, online, and hybrid formats.
   The Moodle platform is used to provide remote access to materials, feedback, and assessments.
   Upon completion, participants receive electronic or printed certificates.

In summary, the availability of modern equipment, qualified teaching staff, and licensed software enables POLIDIH to deliver training at a high professional standard and ensures the development of digital competencies among participants.

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Oriented KPI

Number of training courses conducted

Target: at least 4 courses per year.

Course completion rate

Target: ≥ 85% of registered participants successfully complete the course.

Participant satisfaction rate

Target: ≥ 90% positive feedback based on post-training surveys.

Number of online master classes / webinars conducted

Target: minimum of 2 online events per year.

Number of certificates issued

Target: at least 30 certificates per year.

Number of requests for repeat or additional training

Target: ≥ 20% of participants return for additional courses.

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Description of required equipment and software for GIS training

1. Computer equipment

- Laptops or desktop computers (with high-performance processors (Intel i5/i7 or AMD Ryzen 5/7 and above), at least 8 GB of RAM (16 GB recommended), and SSD drives for fast program loading).
- Monitors for PCs (featuring sufficient resolution (Full HD or higher) to facilitate comfortable work with maps and data).

2. Software

- GIS software (commercial – ArcGIS (licensed)).
- Supplementary software:
  - Spreadsheet processors (Microsoft Excel, LibreOffice Calc) for data processing.
  - Remote sensing software (SNAP, ENVI).

3. Geoinformation data and databases

- Open geodata resources such as OpenStreetMap, Landsat, Copernicus (Sentinel).
- Local databases (downloaded regional map data or proprietary data sets for practical assignments).

4. Network equipment

- High-speed internet for accessing geodata, satellite imagery, and cloud-based GIS services.
- Local or cloud solutions for collaborative work with large data sets.

5. Training materials and classroom equipment

- Projectors or interactive panels.
- Printers for printing maps and reports.
- Flipcharts, markers, and boards.

Description of the necessary equipment for training according to the automation direction

1. Specialized equipment

ITM Automation School Laboratory: includes training stands built with modern equipment from automation and robotics manufacturers, as well as safe automation systems.

2. Network equipment

High-speed internet for accessing online courses.

3. Training materials

Magnetic boards, flipcharts, markers, projectors, etc.

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Availability and organization of training materials

Training materials for the courses of the Polissia Digital Innovation Hub will be organized and made accessible through the Moodle platform, ensuring convenient access for all participants.

1. Access organization

- **Learning platform**. All materials will be uploaded to Moodle and structured according to the courses and topics.
- **Access levels.** Users will receive personalized accounts with access to the relevant training modules.
- **Material formats**. PDF assignments to be completed during practical sessions.

2. Course completion confirmation

- Each course participant may receive an electronic certificate free of charge. Additionally, participants may order a printed certificate issued by Polissia National University for an extra fee.

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Basic ArcGIS Pro Course

Topic 1: General introduction to ArcGIS. Creating a shapefile

- **Description**: the course begins with an introduction to the ArcGIS Pro interface, project setup, and core functionalities. You will learn how to create a new project, load a world map, use bookmarks for quick navigation, and create "Polygon" and "Point" shapefiles. The practical part includes creating the borders of Zhytomyr Oblast, adding layers for regionally significant cities, and customizing their appearance (color, line thickness, style). The topic also covers shapefile export and sharing for future use.
- **Hours**: 2
- **Skills**: creating new projects and shapefiles, editing geometry, customizing layer styles, working with the "Catalog" panel.

Topic 2: Coordinate systems and projections

- **Description**: an overview of coordinate systems and their use in ArcGIS Pro. Students will learn to change project coordinate systems, determine the geographic coordinates of points in different units (degrees, meters), and measure distances and areas on a map. The topic includes detailed instructions on converting layers to other projections using the "Project" tool. Practical tasks include creating tables with coordinates of regionally significant cities and calculating area and perimeter of selected territories.
- **Hours**: 2
- **Skills**: understanding coordinate systems, measuring on maps, changing projections, data preparation for analysis.

Topic 3: Working with attribute information

- **Description**: students will become familiar with attribute tables that store data about layer features and will learn to analyze and edit them. The lesson covers creating new fields, entering text and numeric values, and removing or excluding data unrelated to the study area. The practical task involves creating a population table for cities in Zhytomyr Oblast, as well as tables for calculating geometric parameters (area, perimeter).
- **Hours**: 2
- **Skills**: working with attribute tables, adding new data, basic feature parameter calculations.

Topic 4: Attribute data processing

- **Description**: this lesson focuses on data filtering. It covers selecting features by geographic boundaries (circle, rectangle), attribute characteristics (e.g., area greater than 10 km^2), and location (features within a certain distance from a city). The practical task includes selecting settlements in Zhytomyr Oblast, visualizing them, and preparing for further analysis.
- **Hours**: 2
- **Skills**: using data selection tools, applying filters, selecting and visualizing features based on conditions.

Topic 5: Infographics

- **Description**: creating visual materials for data presentation on maps. Students will learn to work with graduated colors, link Excel tables to map layers, and generate thematic maps showing indicators such as grain exports. The topic also includes building and customizing charts and diagrams.
- **Hours**: 2
- **Skills**: creating thematic maps, data integration, visualizing data using charts and diagrams.

Topic 6: Working with raster data (georeferencing)

- **Description**: introduction to raster images, georeferencing them to geographic coordinates, and adjusting display parameters. The lesson covers basic georeferencing techniques using control points and correcting geometric distortions.
- **Hours**: 2
- **Skills**: georeferencing raster images, assessing georeferencing accuracy, adjusting raster display parameters.

Topic 7: Working with raster data (clipping and classification)

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- **Description**: processing raster images: clipping to specified boundaries, calculating vegetation index (NDVI) for vegetation assessment, and basic land classification (forests, fields, water bodies).
- **Hours**: 4
- **Skills**: raster image processing, using spectral indices, basic data classification techniques.

Topic 8: Data sources in ArcGIS

- **Description**: searching and downloading geographic data from external sources such as Living Atlas, WMS services, and satellite imagery (Sentinel-2, Landsat 8). Integrating this data into projects and adjusting for analysis.
- **Hours**: 2
- **Skills**: using external data sources, integrating data into projects, preparing for analysis.

Topic 9: Map layout

- **Description**: preparing reporting documents: composing map layouts, adding scale bars, legends, and titles. Creating printable maps with additional graphic elements.
- **Hours**: 3
- **Skills**: report layout, map preparation for printing, data visualization.

Topic 10: Local scenes in ArcGIS

- **Description**: working with 3D scenes: converting 2D maps to 3D format, adding terrain layers, adjusting lighting and perspective. Creating interactive visualizations for analyzing local areas.
- **Hours**: 3
- **Skills**: creating local 3D scenes, working with terrain, interactive analysis.

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Training course for agronomists and farmers

Topic 1: Vectorization of a farming enterprise

- **Description**: introduction to the basics of creating vector objects for modeling a farming enterprise. Includes the construction of fields, an office, a grain elevator, and a mechanized technology park (MTP). Training in editing polygon shapes, colors, and geometry. The assignment concludes with exporting vector objects to shapefiles.
- **Hours**: 2
- **Skills**: creating vector layers (polygons, points), geometry editing, exporting vector objects.

Topic 2: Working with vector objects

- **Description**: training in selecting, editing, and merging vector objects. Includes working with administrative data (communities, districts) and natural features (rivers, roads, settlements). The assignment involves data clipping for a defined area.
- **Hours**: 2
- **Skills**: data merging, location-based selection, creation of new vector layers.

Topic 3: Working with attribute data

- **Description**: introduction to attribute tables. Includes joining with Excel tables, adding new fields, calculating area, and visualizing attribute data on maps. Tasks relate to analyzing historical crop data and technological schemes.
- **Hours**: 2
- **Skills**: working with attribute tables, joining external tables, calculations within tables.

Topic 4: Introduction to raster data. Georeferencing soil maps

- **Description**: georeferencing raster layers, such as soil maps. Determining chemical properties of soil (organic carbon, nitrogen, acidity) for specific fields. Spatial analysis of soil type distribution.
- **Hours**: 4
- **Skills**: georeferencing raster images, zonal statistics, analysis of soil chemical parameters.

Topic 5: Basic work with raster data

- **Description**: working with topographic raster data. Tasks include clipping layers, building contour lines, slope and aspect analysis, and calculating zonal statistics for fields.
- **Hours**: 2
- **Skills**: processing topographic data, terrain analysis, applying zonal statistics.

Topic 6: Basic work with optical imagery

- **Description**: downloading and processing Sentinel-2 satellite images. Analysis of spectral bands, creation of multispectral images, band combinations, and comparison of spatial resolution.
- **Hours**: 4
- **Skills**: working with multispectral data, band combination, spatial resolution analysis.

Topic 7: Working with indices

- **Description**: calculation of spectral indices (NDVI, NDMI, MNDWI). Time series analysis of indices to determine vegetation status and identify problem areas in fields.
- **Hours**: 4
- **Skills**: index calculation, dynamics analysis, detecting vegetation anomalies.

Topic 8: Suitability mapping

- **Description**: field data interpolation and development of land suitability maps for agricultural use. Data reclassification and use of weighted sum for integrative parameter analysis.
- **Hours**: 4
- **Skills**: interpolation, suitability mapping, multi-layer data analysis.

Topic 9: Map layout

- **Description**: creation of presentation cartographic materials. Includes adding legends, scale bars, labels, and creating print-ready documents.
- **Hours**: 4
- **Skills**: report layout, formatting, map printing.

Topic 10: Solving thematic tasks using UAV imagery

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- **Description**: processing multispectral drone data, calculating vegetation indices, analyzing average spectral band values for field condition monitoring.
- **Hours**: 4
- **Skills**: UAV data processing, vegetation index calculation, monitoring data analysis.

Topic 11: Downloading satellite imagery and comparative analysis of satellite and UAV imagery

- **Description**: downloading satellite images, calculating vegetation indices, and comparing them with UAV data. Analysis of accuracy differences between aerial and satellite imagery.
- **Hours**: 4
- **Skills**: Satellite data downloading, index calculation, comparative analysis of different data sources.

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Training course “GIS for public management and administration”

Topic 1: General introduction to ArcGIS. Working with vector data

- **Description**: introduction to the basics of working in ArcGIS. Study of vector data, its structure, and features. Creating vector objects such as points, lines, and polygons. Analyzing community boundaries using vector layers.
- **Hours**: 2
- **Skills**: working with vector layers, creating geometric objects, basic navigation in ArcGIS.

Topic 2: Data sources. Working with Living Atlas and catalog

- **Description**: study of key spatial data sources such as Living Atlas and other open data catalogs. Downloading and using shapefiles to analyze community territorial characteristics.
- **Hours**: 2
- **Skills**: using open data sources, integrating layers in ArcGIS, spatial object analysis.

Topic 3: Working with attribute information. Determining community spatial characteristics using ArcGIS

- **Description**: introduction to attribute tables and their use in GIS. Calculating the area and perimeter of a community, analyzing distances between settlements.
- **Hours**: 2
- **Skills**: working with attribute tables, area and perimeter calculation, spatial analysis.

Topic 4: Working with attribute information and presenting results

- **Description**: analysis and editing of attribute data, adding new parameters, and sorting information. Visualizing data through diagrams and creating map layouts.
- **Hours**: 2
- **Skills**: creating graphs and diagrams, cartographic design, working with administrative data.

Topic 5: Using information resources for remote sensing data

- **Description**: introduction to satellite data and its use in GIS. Using the Copernicus platform to access and process community imagery.
- **Hours**: 2
- **Skills**: searching and downloading satellite images, remote sensing data processing.

Topic 6: Working with raster data

- **Description**: basics of working with raster data, loading, georeferencing, and basic editing. Applying various methods for raster layer editing.
- **Hours**: 2
- **Skills**: image georeferencing, raster data processing, working with color schemes.

Topic 7: Climate conditions of the community

- **Description**: analyzing the community's climate conditions based on climate data to assess the region’s natural potential.
- **Hours**: 4
- **Skills**: working with climate data, analyzing average annual indicators, map layout.

Topic 8: Natural potential of the community

- **Description**: assessment of the community's natural resources, including terrain, soil, water bodies, and mineral resources.
- **Hours**: 4
- **Skills**: using DEM maps, analyzing soil characteristics, working with geological maps.

Topic 9: Visualization of natural potential

- **Description**: creating cartographic layouts that display components of the community’s natural potential. Analyzing the results and preparing them for use in planning.
- **Hours**: 2
- **Skills**: map layout, geographic data visualization, preparation of graphic materials.

Topic 10: Environmental conditions of the community

- **Description**: assessing the environmental condition of the community using satellite data and open resources. Analyzing air, water, and soil pollution levels.
- **Hours**: 2

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- **Skills**: using environmental maps, analyzing ecological indicators, working with pollution indices.

Topic 11: Social development of the community

- **Description**: analyzing the level of community social development through the study of infrastructure, educational and healthcare facilities. Using diagrams to present socio-economic indicators.
- **Hours**: 4
- **Skills**: working with socio-economic data, statistics visualization, infrastructure analysis.

Topic 12: Financial status of the community

- **Description**: community budget analysis based on open financial data. Calculating income and expenditures, average economic indicators of enterprises.
- **Hours**: 4
- **Skills**: working with the OpenBudget portal, financial analysis, applying statistical methods.

Topic 13: Business development in the community

- **Description**: studying the community's business environment and identifying the most economically active sectors. Analyzing businesses and their impact on the local economy.
- **Hours**: 2
- **Skills**: working with business registries, analyzing economic activity, creating business maps.

Topic 14: Developing a community profile

- **Description**: summarizing the obtained results and creating a comprehensive community profile. Preparing a report containing the main characteristics, potential, and development prospects of the community.
- **Hours**: 6
- **Skills**: analytical work, summarizing spatial data, report writing.

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Training course “GIS in ecology”

Topic 1: Vectorization of environmental protection objects

- **Description**: creation of new vector objects to represent environmental data. The assignment includes building polygons for designated areas (forest massifs, nature reserves), point objects (monitoring stations, water wells), and editing their shape, color, and other attributes. The task ends with exporting the created data for further analysis.
- **Hours**: 2
- **Skills**: creating polygons and points, editing geometry and styles, exporting to shapefiles.

Topic 2: Working with vector objects

- **Description**: processing existing vector layers such as administrative boundaries, water bodies, and roads. The task includes selecting, filtering, and clipping vector features for ecological analysis within specified areas (community, district).
- **Hours**: 4
- **Skills**: selecting objects by geometry, clipping areas, creating new layers with data filtering.

Topic 3: Working with attribute data

- **Description**: analyzing and editing attribute tables. Includes adding new calculated fields (e.g., area or ecological risk), joining external tables with field data, and creating thematic maps. The task includes chart creation and data visualization for environmental analysis.
- **Hours**: 2
- **Skills**: adding new attributes, table joins, calculating geometric characteristics, creating charts.

Topic 4: Introduction to raster data

- **Description**: georeferencing raster images such as soil or biodiversity maps. The task includes identifying soil types, analyzing environmental characteristics (organic carbon, nitrogen, acidity), and integrating results into vector layers.
- **Hours**: 4
- **Skills**: raster data georeferencing, calculating regional averages, analyzing soil types.

Topic 5: Basic work with raster data

- **Description**: processing topographic raster layers. Tasks include area clipping, contour line creation, slope and aspect analysis, and calculating average elevation for selected territories.
- **Hours**: 2
- **Skills**: working with topographic layers, zonal statistics calculation, contour line generation.

Topic 6: Working with optical imagery

- **Description**: downloading Sentinel-2 satellite images, analyzing spectral bands, and creating false-color composites to assess vegetation condition and identify degradation zones. The task includes analyzing spatial resolution.
- **Hours**: 4
- **Skills**: working with spectral bands, creating multispectral compositions, assessing spatial resolution.

Topic 7: Using spectral indices

- **Description**: calculating vegetation (NDVI), moisture (NDMI), and water body (MNDWI) indices. The task includes identifying areas with high ecological risk or degradation based on index values.
- **Hours**: 2
- **Skills**: spectral index calculation, time-series analysis, identifying problem zones.

Topic 8: Suitability mapping

- **Description**: interpolating field data and generating raster suitability maps for various ecological goals (forest restoration, reserve creation). Applying weighted sum methods to integrate multiple parameters.
- **Hours**: 4
- **Skills**: interpolation, raster reclassification, suitability mapping.

Topic 9: Result layout

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- **Description**: preparing reporting documents with ecological analysis results. Includes creating maps, diagrams, and integrating visuals into print-ready layouts. The task concludes with exporting final documents.
- **Hours**: 2
- **Skills**: layout of graphic materials, map design, export for printing.

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Training course "Training and retraining of automation specialists"

Sub-course: STEP 7 – 1200 Basic

- **Description**: a structured course on controller programming. It is designed for professionals with basic knowledge of automation systems who plan to program and commission controller applications.
- **Duration**: 5 days / 35 hours
- **Course content**: SIMATIC S7-1200 compact controllers; TIA Portal environment – programs, licensing, online functions, and hardware configuration; creating basic control programs; working with memory – triggers, edge detection, timers, counters; data blocks – information recording and access methods; analog inputs and outputs; numerical operations; reading system information; data exchange with HMI panel; PLCSIM software simulator.

Sub-course: STEP 7 – 1200 Advanced

- **Description**: designed for specialists with a basic understanding of controller programming in the STEP 7 environment who plan to develop and commission advanced automation programs.
- **Duration**: 5 days / 35 hours
- **Course content**: advanced processor hardware configuration; functions and function blocks; interrupt mechanisms – cyclic, hardware-based; operations with arrays and array blocks; bit group operations; programming in SCL language; integrated web server; process log creation; PROFINET IO network configuration.

Sub-course: SINAMICS G120 – Configuration and commissioning

- **Description**: based on the SIEMENS Sinamics frequency converter, one of the leading converters in modern industry. It is notable for its intuitive configuration and suitability for training in classical electric drive theory.
- **Duration**: 2 days / 16 hours
- **Course content**: SINAMICS G120 family of converters; configuration via BOP-2/IOP; commissioning and setup using STARTDRIVE; digital and analog input control; PROFINET-based control – configuration, frame types, CDS/DDS datasets; freely configurable functional blocks – free modules; converter functions (flying start, braking methods, feedback operation); integrated safety functions; diagnostics and troubleshooting.

Sub-course: PROFIBUS – Network configuration and diagnostics

- **Description**: participants will learn to detect and analyze common errors, diagnose the physical network layer, and eliminate protocol-level faults to ensure effective industrial network management.
- **Duration**: 2 days / 16 hours
- **Course content**: introduction to PROFIBUS; hardware and installation recommendations; PROFIBUS DP network configuration and commissioning; common errors in PROFIBUS DP networks; physical layer diagnostics; protocol-level error analysis.

Sub-course: PROFINET – Network configuration and diagnostics

- **Description**: participants will learn to work with network topology, the MRP protocol, data exchange in RT and IRT modes, and to diagnose physical layer issues and analyze protocols for fault detection.
- **Duration**: 2 days / 16 hours
- **Course content**: introduction to PROFINET; hardware and installation recommendations; PROFINET IO network configuration and commissioning; network topology; MRP protocol; RT and IRT data exchange; physical layer diagnostics; protocol analysis.

Sub-course: PNOZmulti – Programming and maintenance

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- **Description**: this course focuses on modern approaches to machine safety, including the use of the PNOZmulti Configurator software.
- **Duration**: 1 day / 8 hours
- **Course content**: introduction to modern machine safety technologies; overview of PNOZmulti Configurator; creating programs for emergency stop, protective fencing, light curtains, diagnostics; troubleshooting using PNOZmulti Configurator.

Sub-course: Fundamentals of machine safety

- **Description**: participants will learn to assess risks, implement mitigation methods, modernize equipment, and ensure safe machine operation and maintenance.
- **Duration**: 1 day / 4 hours
- **Course content**: introduction to Machinery Directive 2006/42/EC (machine and mechanism safety) aimed at reducing accident risks; ISO 12100, ISO 13849, ISO 13857; LOTO procedures; safe operation and maintenance; machine modernization; risk reduction methods – overview and selection.

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Useful links

1. *Planet Earth. Google Planet*. https://www.google.com/intl/uk_ALL/earth/about/
2. Tarariko, O., Syrotenko, O., Ilyenko, T., & Kuchma, T. (2019). *Agroecological Satellite Monitoring. Agrarian Science.*
3. Topolnytskyi, P., Pyvovar, P., Nikolyuk, O., & Tereshchuk, V. (2021). *Geoinformation Systems and Technologies. Polissia National University.*
4. *Copernicus Browser*. (n.d.). Copernicus Browser. https://browser.dataspace.copernicus.eu/?zoom=5&lat=50.16282&lng=20.78613&demSource3D="MAPZEN"&cloudCoverage=30&dateMode=SINGLE
5. *Esri Community*. Esri Community. https://community.esri.com
6. *Google Earth Engine*. Google Earth Engine. https://earthengine.google.com/
7. *ITM AUTOMATION SCHOOL*. *https://itmas.com.ua/*

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