# DESIGN OF AN INTEGRATED SOFTWARE ENVIRONMENT FOR MANAGING INDUSTRIAL COOPERATION IN A DIGITALIZED REGION

**Quldosheva Gulnoz**
*University of Information Technologies and Management, master's student*

**Abstract**: *The digitalization of a region creates new requirements for coordinating industrial enterprises, suppliers, service organizations and public administration bodies within a single information environment. Traditional cooperation between industrial structures is often based on fragmented communication, incomplete data and delayed decision-making. This paper proposes the design of an integrated software environment for managing industrial cooperation in a digitalized region. Unlike a general platform concept, the study focuses on software requirements, functional modules, data flows, partner-selection logic and regional management indicators. The proposed environment includes an enterprise registry, production-capacity database, cooperation request module, verification service, matching algorithm, digital workflow, contract-support block and analytical dashboard. A formal scoring model is developed to recommend cooperation partners according to capacity fit, sectoral compatibility, logistics accessibility, reliability, digital maturity, budget compatibility and time feasibility. The scientific novelty of the study is the interpretation of regional industrial cooperation as a software-coordinated management process supported by transparent algorithms and measurable regional indicators. The proposed approach can be used as a methodological basis for a master's research project and for the development of a practical prototype of an industrial cooperation platform.*

**Keywords**: *regional digitalization, industrial cooperation, software environment, platform architecture, partner selection, production capacity, data-driven management.*

## 1. Introduction

Regional development increasingly depends on the ability of industrial structures to cooperate in flexible and transparent production chains. Industrial enterprises need suppliers of components, subcontractors, logistics providers, repair services, certification support and technological partners.

When these participants are not connected through a common digital environment, cooperation becomes slow and uncertain.

In the conditions of regional digitalization, the task is not only to create a website for enterprises. A more complex software environment is required. It must collect enterprise data, verify information, identify unused production capacity, compare cooperation requests with available resources and support management decisions at both enterprise and regional levels.

The relevance of this research is determined by the need to develop a software-oriented approach to industrial cooperation. Such an approach is close to a master's thesis because it connects theoretical platform design with practical software development: requirements analysis, architecture, modules, database logic, algorithmic partner selection and evaluation indicators.

The aim of this paper is to propose an integrated software environment for managing industrial cooperation in a digitalized region. The object of the study is the cooperation process between industrial structures. The subject of the study is the software architecture and algorithmic logic used to coordinate this cooperation.

**2. Research Problem and Development Requirements**

The main research problem is that regional industrial cooperation is usually distributed across different information channels. Some data are stored in enterprise accounting systems, some in procurement documents, some in regional databases and some only in personal communication between managers. This creates information asymmetry and prevents small and medium enterprises from entering wider industrial chains.

For this reason, the proposed software environment must satisfy several development requirements. First, it must provide a verified registry of industrial structures. Second, it must describe production capacity in a standardized form. Third, it must allow enterprises to publish cooperation requests. Fourth, it must recommend potential partners through a transparent algorithm. Fifth, it must provide analytical information for regional development management.

The software solution should also be scalable. A regional platform may start with several enterprises and later include hundreds of participants from different sectors. Therefore, the architecture should support modular expansion, data security, role-based access, audit logs and integration with

external information systems such as e-government services, logistics databases and industrial statistics.

**3. Proposed Software Environment Architecture**

The proposed software environment is designed as a modular information system. Its main idea is to transform fragmented enterprise information into structured digital cooperation decisions. The system is not limited to simple registration of enterprises. It supports the full cycle from data entry and verification to partner selection, digital workflow and regional analytics.

The architecture includes three main layers: the data and user layer, the platform core layer and the management output layer. The first layer receives enterprise profiles, production capacity data, cooperation requests and digital readiness information. The second layer verifies the data, applies a matching algorithm and supports digital workflow. The third layer generates ranked partner lists, dashboards, bottleneck maps and regional reports.

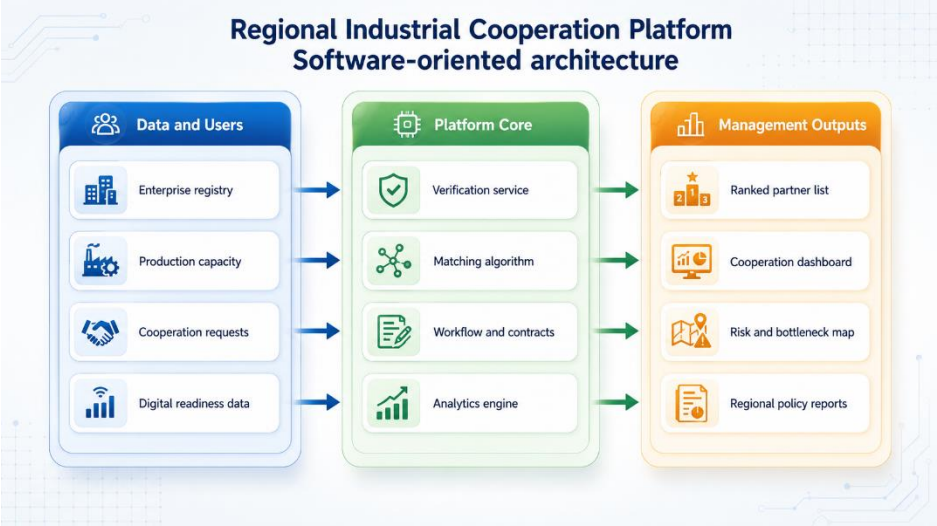


***Figure 1.*** *Software-oriented architecture of the regional industrial cooperation environment.*

The functional modules of the proposed software environment are presented in Table 1. These modules can be implemented as separate services or as components of a single web-based platform. The selected modular structure makes it possible to gradually develop the system, test each module and integrate additional functions during the master's research process.

*Table 1. Functional modules of the integrated software environment.*

| Module | Main function | Expected result |
|---|---|---|
| Enterprise registry | Stores verified data about industrial structures | Reliable digital profile of each participant |
| Capacity database | Describes machines, equipment, workforce and production lines | Visibility of available industrial resources |
| Cooperation request module | Collects needs for components, services and subcontracting | Structured demand for cooperation |
| Matching service | Compares requests with available capacities | Ranked list of suitable partners |
| Digital workflow | Supports applications, confirmations and document exchange | Faster cooperation procedures |
| Analytical dashboard | Shows cooperation density, bottlenecks and unused capacity | Data-driven regional management |

**4. Algorithmic and Mathematical Model**

The partner-selection mechanism is the central algorithmic component of the proposed software environment. Let enterprise i submit a cooperation request, and let enterprise k be a potential partner from the set of available candidates $K_i$. All evaluation indicators are normalized in the interval from 0 to 1. This makes it possible to combine technological, logistical and organizational factors in one transparent score.

The weights of the indicators must be non-negative, and their total value must be equal to one:

$$\sum_{m=1}^{7} w_m = 1, \qquad w_m \geq 0, \qquad m = 1, 2, \ldots, 7$$

(1)

where $w_m$ is the weight of the m-th evaluation indicator. The cooperation attractiveness score between enterprise i and candidate partner k is defined as follows:

$$A_{ik} = w_1 S_{ik} + w_2 Q_{ik} + w_3 L_{ik} + w_4 R_k + w_5 M_k + w_6 B_{ik} + w_7 T_{ik}$$

(2)

In formula (2), $S_{ik}$ is sectoral compatibility, $Q_{ik}$ is production capacity fit, $L_{ik}$ is logistics accessibility, $R_k$ is partner reliability, $M_k$ is digital maturity, $B_{ik}$ is budget compatibility and $T_{ik}$ is time feasibility. A higher $A_{ik}$ value means that the candidate partner is more suitable for the cooperation request.

The production capacity fit can be calculated by comparing the available capacity of enterprise k with the requested production volume of enterprise i:

$$Q_{ik} = \min\left(\frac{C_k}{V_i}, 1\right)$$

(3)

where $C_k$ denotes the available production capacity of candidate partner k, and $V_i$ denotes the requested production volume of enterprise i. If the candidate can fully satisfy the request, $Q_{ik}$ becomes equal to one.

Logistics accessibility is calculated according to the distance between the enterprises:

$$L_{ik} = 1 - \frac{d_{ik}}{d_{\max}}, \qquad 0 \le d_{ik} \le d_{\max}$$

(4)

where $d_{ik}$ is the distance between enterprises i and k, and $d_{max}$ is the maximum acceptable distance for the selected cooperation type. This formula gives a higher score to geographically closer partners.

The software environment recommends the partner with the highest cooperation attractiveness score:

$$k^* = \arg\max_{k \in K_i} A_{ik}$$

(5)

At the regional level, the platform can calculate a platform cooperation index. It reflects how strongly the region can satisfy enterprise cooperation requests through available local partners:

$$PCI_r = \frac{1}{N_r} \sum_{i=1}^{N_r} \max_{k \in K_i} A_{ik}$$

(6)

where $PCI_r$ is the platform cooperation index of region r, and $N_r$ is the number of active cooperation requests in the region. This indicator can be used to compare different periods, sectors or districts within the region.

**5. Analytical Results and Discussion**

The proposed software environment can be evaluated analytically by comparing three cooperation organization approaches: manual cooperation, a static enterprise registry and the proposed integrated software environment. The comparison is based on criteria that are important for regional industrial development and software implementation.

***Table 2.*** *Comparison of industrial cooperation organization approaches*

| **Criterion** | **Manual cooperation** | **Static registry** | **Proposed software environment** |
|---|---|---|---|
| Partner search | Personal contacts | Search by directory | Algorithmic recommendation |
| Capacity visibility | Low | Partial | Structured and updated |
| Decision support | Subjective | Limited | Score-based and transparent |
| Document flow | Fragmented | External channels | Integrated digital workflow |
| Regional analytics | Almost absent | Delayed statistics | Dashboard and index indicators |
| Scalability | Low | Medium | High modular scalability |

The comparison shows that the proposed software environment provides a wider management effect than a static enterprise registry. A registry only stores information, while the integrated environment processes this information and converts it into cooperation decisions. The matching algorithm helps avoid random partner selection and makes the recommendation logic understandable for users.

Another important advantage is the possibility of regional monitoring. The platform cooperation index can show whether local enterprises can satisfy each other's production needs. If the index is low, regional authorities can support missing sectors, attract new partners or develop logistics infrastructure. If the index increases, it means that local industrial cooperation is becoming more active.

From a software development perspective, the proposed architecture is suitable for gradual implementation. At the first stage, the enterprise

registry and capacity database can be developed. At the second stage, cooperation requests and matching algorithms can be introduced. At the third stage, digital workflow, dashboards and integration with external systems can be added.

**6. Scientific Novelty and Practical Value**

The scientific novelty of the article is that industrial cooperation in a digitalized region is interpreted as a software-coordinated management process. The study does not repeat a general platform concept. Instead, it specifies the architecture, functional modules, data flows and partner-selection algorithm that can be used in the development of a real software product.

The second novelty is the formalization of partner selection through a transparent multi-criteria score. The algorithm combines sectoral compatibility, capacity fit, logistics accessibility, reliability, digital maturity, budget compatibility and time feasibility. Each indicator has an interpretable meaning, which increases the trust of enterprises and regional managers in the recommendation result.

The third novelty is the introduction of the platform cooperation index for regional-level analysis. This indicator links individual enterprise cooperation with regional digital management and can be used to assess the effectiveness of industrial cooperation policy.

The practical value of the study is connected with its direct applicability to a master's thesis and prototype development. The proposed architecture can be used for preparing a technical assignment, designing a database, developing user roles, building a web interface, testing partner-selection logic and preparing analytical dashboards.

**7. Conclusion**

This paper proposed a new article topic and developed a software-oriented study close to the master's research direction on a regional industrial cooperation platform under digitalization conditions. The article presented an integrated software environment for managing industrial cooperation in a digitalized region.

The proposed solution includes an enterprise registry, production capacity database, cooperation request module, verification service, matching algorithm, digital workflow and analytical dashboard. The mathematical model provides a correct and interpretable method for

selecting cooperation partners and calculating a regional platform cooperation index.

The results show that the proposed software environment can improve partner search, capacity visibility, decision support and regional analytics. Future research should focus on prototype development, database schema design, user interface testing, integration with regional information systems and empirical validation using real enterprise data.

**References:**

1. Rustamov A. B. DEVELOPMENT OF SOFTWARE FOR DIGITAL INDUSTRIAL STRUCTURE TRANSFORMATION PROCESSES //Экономика и социум. – 2024. – №. 6-2 (121). – С. 593-597.
2. Bahodirovich R. A., Ismatova S. R. STRATEGY AND POLICY FOR ENSURING CYBERSECURITY IN THE DIGITALIZATION PROCESS //Global Science Review. – 2025. – Т. 4. – №. 5. – С. 699-705.
3. Rustamov A. B. THEORETICAL PRINCIPLES OF INNOVATIVE DEVELOPMENT OF DIGITAL INDUSTRIAL STRUCTURE //Экономика и социум. – 2024. – №. 12-2 (127). – С. 757-761.