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Property Investment Management Collaboration Digital Platform – A Proposed Blockchain Solution

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ABSTRACT (10 PT)

In this paper, we propose a way to design a digital platform as a solution concept specifically created to serve as the foundation for the development and ongoing enhancement of tools that streamline and accelerate the management of investment project. Particularly, we present PIMCOD, a blockchain-driven Property Investment Management Collaboration Platform aimed at improving civil engineering investment projects. Leveraging blockchain, PIMCOD offers secure, real-time highly transparent project management with cryptographic security features. It represents a transformative approach to civil engineering project management, distinguishing itself from traditional solutions. In response to evolving technological landscapes, PIMCOD –an implementation of our solution concept, streamlines processes, enhances efficiency, and reduces costs. Future plans include tokenization, IoT, AR/VR, different monitoring technologies, extended BIM, analytics, mobile apps, and supply chain enhancements.

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1. Introduction

The modern digitization and optimization of the investment process in civil engineering is based on the principles of cost minimization and efficient business practices. Both industry and academia emphasize the importance of increased efficiency, reduced time consumption, and enhanced speed of action. These factors are imperative for economic entities due to the constant changes brought by the internet and fast communication technologies (Laudon & Traver, 2009) (Gerstner et al. no date). The reduced time consumption and enhanced speed of action should naturally lead to cost reductions, while increasing efficiency.

Recently (Jovanovic, 2023) discusses of using digital twin technology and its applications in the different technical disciplines with a reference to construction. The research of Shishehgarkhaneh et al. 2023 reveals that the primary study topics regarding the blockchain technology are in the construction industry, supply chain management, smart contracts, sustainability, building information modeling (BIM), the Internet of

Things (IoT) and energy efficiency. They discuss the challenges and opportunities associated with adopting IT solutions, addressing both cost and efficiency. Wang and Chan (2023) discuss the integration of Building Information Modeling (BIM) into project management process. They propose a systems development process for BIM-based project management. The potential benefits of using BIM in civil engineering projects include improved efficiency and data integration. Penzes (2018) explore the application of blockchain technology in the construction industry. He highlights the benefits of using this technology, such as transparency and security. Also, author discusses challenges related to implementing blockchain in construction and suggests future directions of research.

When it comes to optimization, Teixeira et al. 2023 proposed a genetic algorithm to locate the optimal position of columns in a regular building. Marković et al. 2023 have applied artificial neural networks in multi-criteria decision-making in civil engineering. The paper deals with the multi-criteria decision making using Hopfield network which belongs to a class of artificial neural networks. The general procedure has been defined based on the application of Hopfield network. By using the model based on Hopfield auto-associative memory, the defined procedure has been applied for solving a specific problem, which is to select the best variant solution of the route of gas trunk line. Popović-Miletić in 2022 showed the support of Decision Lab 2000 software in the decision-making process in construction using the multi-criteria decision-making method PROMETHEE-GAIA. He et al. (2018) presented a decision-making optimization framework for energy efficiency retrofit investment in numerous buildings under financing budgetary restraint. A multi-objective optimization model with the economic goals being the net present value and time of return, and the environmental goals being the energy saving and emission reduction is presented, and then the intelligent optimization method combing particle swarm optimization and genetic algorithm is designed to search the retrofit investment strategy. Ryzhkova and Ginzburg (2020) consider the possibilities to create conditions for the sustainable development of cities through the sustainable development of the construction industry on the territory of the Russian Federation. Wnag et al. (2018) use advanced data analytics and data engineering techniques for prediction of the quality problems of steel bars, formworks, concrete, cast-in-place structures and masonry, regarding the construction projects. One can see from these research articles that optimization is not always addressed purely from a mathematical programming viewpoint, i.e., sometimes a heuristic and experiential approach is considered.

In this paper, we propose a way to design a digital platform as a solution concept designed to serve as the foundation for the development and ongoing enhancement of tools that streamline and accelerate the management of investment project. Particularly, we discuss about developing of expert system for cost assessment. Roughly speaking, expert systems are defined as a set of facts, observations, heuristic and experiential rules given in a logical, coherent, and clearly understanding form, i.e., a highly developed skill to apply old data and practices on a new and current task.

FIDIC, which stands for the International Federation of Consulting Engineers (in French) is a world known international organization that produces a suite of standard forms of contract for use in the construction and engineering industry. Among many guidelines and proposals, the latest FIDIC suggestions for attached documents to "Contract agreement" are "Letter of acceptance", "The Bid", "Particular Conditions", "FIDIC General Conditions", "Bill of Quantities", "Price Schedule", "Form of Guaranties", "Technical Data", etc. In this paper, our focus is closely related to the "Bill of Quantities".

In 1979 a famous "Principles of Measurement (International) for Works of Construction" was published by Royal Institution of Chartered Surveyors (Royal Institution of Chartered Surveyors, 1979). It provided guidelines and standards for the measurement and description of construction works (SMM). Lately, (Royal Institution of Chartered Surveyors, 2012) published new rules of measurement (NRM) titled as "Detailed Measurement for Building Works", known by an acronym NRM2. NRM2 focuses on providing a comprehensive framework for the detailed measurement and quantification of building works, allowing for accurate cost estimating, budgeting, and cost control in construction projects. In Serbian legislation, for now, there are no requirements regarding the measurements in construction engineering. However, in Serbia, construction engineers and investors are heavily oriented towards the FIDIC guidelines. Therefore, although our focus was on the Serbian legislation, the ideas and products that we present in this paper are not depend on any particular juridical form. Furthermore, we present our own platform, as a work in (continuous) progress, called PIMCOD (Property Investment Management Collaboration Digital Platform). Basically, the concept and its realization -- PIMCOD -- should ensure that all activities occur in (almost) real-time without unnecessary management energy and waste of resources. The tools integrated into it should greatly facilitate the realization of the aforementioned vision. From practical point of view, the goal is a development of software which will present the digital marketplace of services that will integrate real estate transactions, workforce booking, material and time manipulation, using the contemporary blockchain technology. This process is reminiscent of booking for labor, tools, machinery, and similar resources. The platform can be utilized for the construction of a metaverse (Weber et al. 2021) based on Deutsches Institut fur Normung

Standards (Blind & Jungmittag, 2005), or for a video game in which a digital world is constructed, and the same game can be used for building objects in the material world (Squire, 2012). In a way, we can think of PIMCOD as a BIM module upgrade, especially when it comes to the use of blockchain technologies.

To the best of the authors' knowledge, the first company to embark on such ideas was Monday.com, founded in 2012, but their focus was not on the construction domain, nor was the platform intended to be integrated with blockchain technology (Mann et al., no date) When it comes to construction jobs, the Austrian company PlanRadar has introduced its solution by developing a platform for building, managing, and overseeing real estate (Plan Radar Team, 2023). However, similar to Monday.com, it does not appear to have blockchain integration, at least as far as our knowledge extends.

Chapter 2 briefly presents the motivation, i.e., the argumentation concerning the need for such platform. Chapter 3 covers the solutions offered by our proposition, while Chapter 4 elaborates on our product as an information system. In the final Chapter 5, alongside a brief recapitulation, some further development steps and lines of research planned for the future are provided.

2. Motivation

The rationale for digitization and optimization of an investment project in the construction industry can be broken down into the following components (Figure 1): cost reduction, sustainability, security, transparency, and visual plasticity.

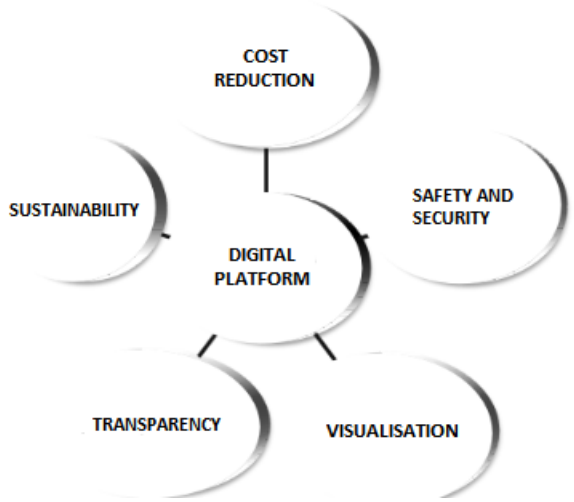

Figure 1. The dimensions of motivation, regarding the need for software platform which will improve the investment process in civil engineering.

2.1. Cost Reduction

Reducing administrative costs and optimizing other expenses in the investment process is, at this moment, an immeasurable category, considering that the investment construction process using the platform is potentially entirely shifted from its current framework. Specifically, this means that savings in resources and time cannot be predicted with certainty, but it can certainly be asserted that such savings are multiplied.

If information is tracked through an information system, and interactions occur in real-time, the speed of project execution depends solely on the efficiency and effectiveness of the participants themselves, while all other barriers, including administrative and time constraints resulting from the need to physically transmit information, are overcome. For example, the integration of mobile technology involves equipping mobile devices with applications for instant access to project plans, tracking the progress of the investment project, reporting problems during execution, and real-time team communication. This enables efficient data collection, eliminates paperwork, and accelerates decision-making.

Blockchain technology additionally facilitates significant cost reduction in the property investment management process. One of the primary cost-saving benefits stems from the decentralized nature of blockchain, which eliminates the need for intermediaries and streamlines transaction processes. Smart contracts, a key component of blockchain technology, automate and enforce contractual agreements, reducing the reliance on legal and administrative services. Furthermore, blockchain enhances transparency

and trust among stakeholders, minimizing the likelihood of disputes that could incur additional legal costs. The immutable and tamper-resistant nature of blockchain ensures that once information is recorded, it cannot be altered, providing a secure and auditable trail of all transactions and activities. In terms of operational efficiency, the use of blockchain in property investment management simplifies complex workflows. The distributed ledger allows for seamless and simultaneous access to information by authorized parties, eliminating the need for redundant data entry and reconciliation. This not only reduces the risk of errors but also optimizes the allocation of resources that would otherwise be spent on rectifying discrepancies. Additionally, the integration of blockchain in the investment construction process promotes a more robust cybersecurity framework. The decentralized nature of blockchain makes it inherently resistant to hacking and fraud, enhancing the overall security of sensitive financial and project-related data. This, in turn, mitigates the potential financial losses associated with security breaches and safeguards the integrity of the investment platform.

2.2. Sustainability

When it comes to the investment process in construction engineering, sustainability has become a crucial and integral aspect of modern project development. There are many key points to be considered: environmental impact, resource efficiency, renewable energy integration, green building practices, social and economic aspects, regulatory compliance, biodiversity preservation, long-term resilience, etc.

In the last 10 years, sustainability has also started to be considered from the perspective of blockchain technology (Yun et al. 2019). All data is stored in the decentralized Interplanetary File System (IPFS) (Benet, 2014), which allows interested parties to participate in network maintenance. The role of interested parties in maintaining the system is, in the simplest case, reduced to running programs and sharing disk space to be used for data storage from the system. By using the filecoin protocol (or something similar), participants in the system can be rewarded for sharing their resources, receiving a certain amount of altcoins based on the flow and quantity of data (phase 2 of the project) (Benet, 2018). This simple idea makes involving blockchain technology a setting for a collaboration, as each user has the opportunity for co-creation of content, leading to continuous development through the experiences and activities of all users.

2.3. Safety and Security

Safety and security are paramount considerations in the investment process in construction engineering. Ensuring the well-being of workers, safeguarding project sites, and protecting assets are critical aspects of responsible project management. Usually, the following key points are considered: occupational health and safety (OHS), risk assessment and management, compliance with safety standards, site security, emergency preparedness, training and education, collaboration and communication, materials and equipment safety, cybersecurity, public safety, etc.

Particularly, new trends in IT development emphasize cybersecurity. If there is an information system that manages the investment process, we need to address the critical aspects of securing sensitive data, safeguarding against potential cyber threats, and ensuring the integrity of the system. Robust cybersecurity measures should include regular security audits, encryption protocols for data transmission and storage, access controls with role-based permissions, and continuous monitoring for any suspicious activities. Additionally, user education and awareness programs are essential to promote a security-conscious culture within the organization. By implementing comprehensive cybersecurity measures, we can fortify the resilience of the information system, protect against unauthorized access, and uphold the confidentiality and reliability of crucial investment data.

Access control to the platform and all its features can be managed through certificates/security policies known as Attribute-based Access Control (ABAC). This control is based on predefined assigned roles in the system, which are authenticated through licenses, certificates, and digital signatures (e.g., Engineer, Professor, Contractor). On the platform itself, we utilize the advantages of blockchain technology in the context of security needs (refer to (Pilkington, 2016)).

2.4. Transparency

Transparency represents the ability to present and verify specific records (transactions in a general sense) in a visible and clear manner with minimal potential for corruption or data misuse. In construction engineering, transparency plays a pivotal role in establishing accountability and fostering a climate of trust among project stakeholders. Transparent communication and documentation throughout the investment process, from project initiation to completion, are essential for building confidence among investors, regulatory bodies, and the broader community. This commitment to transparency involves openly sharing

project plans, cost estimates, progress reports, and compliance documentation. By adopting transparent practices, construction engineering projects not only adhere to ethical standards but also contribute to the overall credibility and sustainability of the industry. The integration of transparent processes empowers stakeholders to make informed decisions, promotes collaboration, and ultimately enhances the success of investment endeavors in construction engineering.

Information technologies and information systems play a crucial role in enhancing transparency in the investment process within construction engineering. Here are several key aspects of their role:

- Data Accessibility. Information systems facilitate the easy and secure accessibility of data related to the investment process. Stakeholders can retrieve relevant information such as project plans, financial records, and regulatory compliance documentation in real-time.
- Digital Documentation. Digital systems enable the creation, storage, and retrieval of electronic documents. This includes project contracts, permits, design specifications, and other critical documentation, ensuring a transparent and organized record-keeping system.
- Real-time Reporting. Information technologies allow for real-time reporting of project progress, financial transactions, and any deviations from the initial plans. This instant visibility enables stakeholders to stay informed and respond promptly to any issues.
- Collaborative Platforms. Information systems provide collaborative platforms where various stakeholders, including investors, contractors, regulatory bodies, and project managers, can communicate and share information transparently. This promotes collaboration and reduces the risk of miscommunication.
- Integrated Project Management. Integrated information systems streamline project management by consolidating data from various sources. This integration enhances transparency by presenting a comprehensive view of project timelines, budgets, and milestones.
- Compliance Monitoring. Information systems can be programmed to monitor and track compliance with regulatory requirements. This ensures that the investment process adheres to legal standards, and any deviations are promptly identified and addressed.
- Visualization Tools. Information technologies provide visualization tools such as dashboards and graphical representations. These tools offer a clear and visual understanding of complex data, making it easier for stakeholders to comprehend and analyze information.
- Mobile Accessibility. With mobile applications and cloud-based systems, stakeholders can access project-related information anytime and anywhere. This accessibility enhances transparency by allowing real-time updates and collaboration, even when individuals are not physically present at the project site.
- Data Security Measures. Implementing robust data security measures within information systems ensures that sensitive project information is protected from unauthorized access. This enhances the integrity of the data and instills confidence among stakeholders.

By leveraging information technologies and robust information systems, the construction engineering industry can significantly improve transparency in the investment process. These tools empower stakeholders with timely and accurate information, fostering a culture of openness, accountability, and trust within construction projects.

Utilizing blockchain technology in information systems adds an additional layer of transparency. Blockchain ensures that data is secure, tamper-resistant, and provides an immutable record of transactions, fostering trust among stakeholders. Therefore, we can say that the blockchain technology has naturally emerged as an approach to address this issue (Pilkington, 2016; Polemitis & Ioannou, 2018), given its potential to modernize various aspects of industrial processes.

2.5. Visual Plasticity

Visualization involves tracking the investment process in real-time across all phases of the investment project through documentation that is created, completed, notarized, and verified in real-time by authorized platform users (e.g., Investor, Designer, Contractor, Supervisor, Supplier). This capability enables significant time savings and reduces additional service costs. All necessary documentation is covered, including attestations, logs, reports, work diaries, plan copies, authorizations, confirmations, transcripts, submissions, projects, project tasks, protocols, invoices, resolutions, consents, situations, contracts, terms, certifications, requests, minutes, and more.

We can say that plasticity of visualization plays one of the pivotal roles when it comes to the revolutionizing the investment process within construction engineering. In the last few decades this was done through the integration of modern information systems, particularly those based on BIM. The comprehensive

coverage of all necessary documentation is a hallmark of this approach. The system encompasses a diverse range of records, including but not limited to attestations, logs, reports, work diaries, plan copies, authorizations, confirmations, transcripts, submissions, projects, project tasks, protocols, invoices, resolutions, consents, situations, contracts, terms, certifications, requests, minutes, and more. This breadth ensures that every aspect of the investment process is meticulously captured, validated, and accessible to relevant stakeholders in real-time. The implementation of such an information system based on BIM not only enhances the visual plasticity of the investment process but also fosters efficiency, transparency, and collaboration throughout the construction project lifecycle.

This blockchain-driven capability yields significant time savings and cost reductions for additional services, establishing a foundation for more streamlined and efficient project management. The blockchain ledger ensures that all aforementioned documentation is covered comprehensively. Each piece of documentation becomes a securely linked and time-stamped block in the blockchain, forming an unalterable chain of trust.

3. Holistic Management: PIMCOD's Role in Structuring Investment Projects

Parts of the investment process (depending on the object's classification), covered by various software solutions on the integrated digital PIMCOD platform, include architecture, construction, electrical installations, and additional regulatory requirements. The types of work covered by the digital software solution on the integrated platform encompass all types of execution (Figure 2), including adaptation, remediation, reconstruction, expansion, new construction, and change of object use.

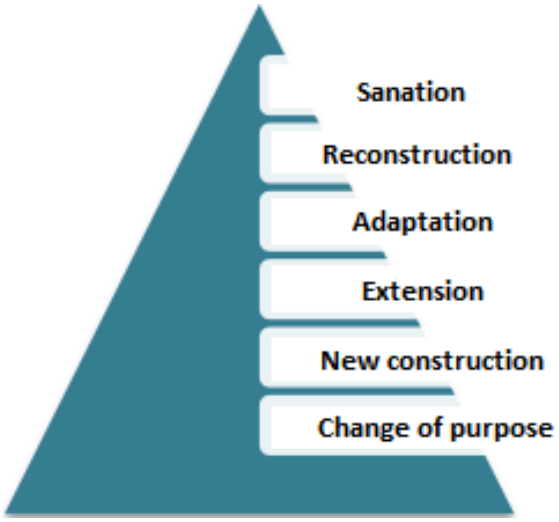

Figure 2. The "pyramid" of work types.

The platform itself serves to manage the entire investment project process by consolidating available information management data from the project's design phase to its completion, summarizing user experiences for further system development, as it is represented in Table 1.

Table 1. Project management phases.

I Project and Scope	II Permits	III Construction	IV Settlements	V Education
Design	Permits and Approvals for Construction	Procurement of Materials	Final Material Cost Calculations	Educational Module
Bill of Quantities and Construction Cost Estimate Document Archive	Monitoring Regulatory Requirements	Execution	Deviations from the Initial Cost Estimate	

This includes design (architecture, construction, electrical work), measurement and bill of quantities for construction works, collecting and archiving relevant documentation, obtaining necessary permits and approvals for construction, and tracking regulatory requirements. It also involves material procurement through a unified marketplace of interested suppliers, execution, including a work diary, and other necessary elements, final material cost calculations with differences from the initial estimate, and an educational module (through the sublimation of experiences and regulatory requirements). The project, in its development, consists of several engineering stages:

The rationale for digitization and optimization of an investment project in the construction industry can be broken down into the following components (Figure 1): cost reduction, sustainability, security, transparency, and visual plasticity.

- Development of the Content Management System (CMS) for the collaborative platform as a basis for managing various modules and tools implemented in the system.
- Identification of user profiles with the creation of roles for all types of user profiles through the validation of valid certificates and granting rights based on user profiles.
- Access, use, and integration of data from institutional databases (Geosrbija, Business Registers Agency for legal entities, chambers) in real-time.
- Development of standardized documents necessary for the implementation of the investment project, as well as a user model for developing custom forms.
- Development of application solutions for each phase of the investment process (measurement, calculator, CAD, main ledger, etc.).
- Involvement of a wide range of different users (educational institutions, regulatory agencies, legislators, interested market entities - material suppliers, the professional public) regarding further development of norms used for calculating material and other costs in the investment project.

The mind map of the PIMCOD development and its accompanying objects is available online. We provide the address in the Supplementary Material section. From the developmental point of view, the most important derived mind map is PIMCOD phase I, which is discussed in the following section.

4. Blockchain Technology Integration in the Platform Design

In the intricate landscape of information systems, our platform stands as a testament to the seamless integration of existing laws and regulations. This foundation, designed for both content and form compliance, is meticulously crafted to navigate the complexities of blockchain technology. Empowering users with verified identities, our platform embraces the ethos of decentralization in the blockchain realm. Every step of the process, from user participation to transaction tracking, is fortified by blockchain technology. This not only ensures transparency but also instills accountability for the resulting digital ecosystem.

The platform, viewed as an information system, is designed to implement existing laws and regulations, satisfying both content and form. No part of the process can proceed unless verified by certified participants, due to the use of blockchain technology.

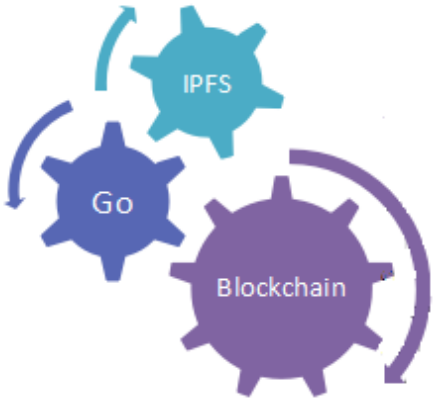

Figure 3. The conceptual basis of CMS.

At the heart of our information system lies a robust subsystem—CMS. This subsystem orchestrates the flow of information, process control, algorithms, and user interactions. The Go language was chosen for program/code implementation due to its suitability for systems programming, automatic memory management, and features for concurrent programming inspired by communicating sequential processes. Additionally, the Go language is popular in the blockchain community (Al Mazari et al. 2020), especially concerning the development of IPFS (Figure 3).

Regarding decentralization in the blockchain, system users have a wallet, so the tracking of work/transactions is tokenized. Users themselves are at the application level, representing a marketplace of people, companies, goods, energy, and services.

The platform consists of three different modules aimed at providing complete information about a specific business entity in the digital or material world:

1. The first module—"Timeline"—represents the past and records activities that have occurred.
2. The second module—"Locator"—pertains to the present and records the location of activities, i.e., the position on the digital map on Google services.
3. The third module—"Calculator"—allows for real-time calculation of the cost of specific construction work. The program provides prompt information on the budget for planned activities, i.e., materials and tools required to carry out the activity. Additionally, the program generates material and work specifications, norms and standards, technical data sheets, and work descriptions, providing complete information on how a particular activity is executed.

The interested reader is also referred to the textual outline of PIMCOD phase I mind map, which is given in the Apendix A. In this outline we also provide the code fragments regarding the basic structures and example implementations (in the Go programming language).

In the subsequent appendices B and C we provide the textual outlines of the mind maps for the investment process in construction engineering and object classification. These two documents are based on the Serbian juridical system regarding the construction engineering and construction industry, including our own engineering experience. In particular, they represent the formal documentary basis for the development of other modules.

5. Conclusions

One of the most significant objectives of digitizing and optimizing an investment project in the construction industry is to enhance collaboration and accelerate data exchange among participants in the investment process with predefined roles and standardized functions. This includes interactions between investors (individuals and legal entities), project designers (architects, electrical installations, construction work), cooperatives, and collaborators (producers, traders, contractors), regulators, and other stakeholders (government authorities, educational institutions, regulatory agencies). Comprehensive and timely information about the status of any part of the project being implemented through the presented PIMCOD platform is updated in real-time, with all changes recorded on the blockchain. One of the key applications of the system is to deliver all the necessary documentation for the implementation of the investment process to the electronic government in real-time, without delays and unnecessary data manipulation, thereby avoiding unnecessary time loss.

The platform's further development plan includes creating a cryptocurrency monetary ecosystem tied to the platform, thus forming a feedback loop: the monetary system provides the value of the platform itself, while at the same time, the platform supports the aforementioned cryptocurrency monetary ecosystem.

In addition to this emerging financial aspect, one can consider specific case studies that encompass Internet of Things (IoT) integration, augmented (AR) and virtual (VR) reality, the integration of drones and aerial imagery, extending Building Information Modeling (BIM) capabilities within the PIMCOD platform, developing advanced analytic and reporting features, creating mobile applications, implementing supply chain visibility features, and enhancing platform security, among others.

IoT sensors integrated into construction sites and real estate properties can collect real-time data on environmental conditions, security, equipment performance, and resource utilization. This data can be used to automate alerts, monitor equipment health, and optimize resource allocation.

Regarding AR and VR, project stakeholders could interact with 3D models and observe project progress in a more immersive manner, facilitating remote collaboration and decision-making through AR/VR conferencing.

The use of drone-captured images and data allows for the generation of visual reports, which can be compared with project plans. Naturally, BIM data can be leveraged to optimize resource allocation and project scheduling.

Advanced analytic and reporting features can provide stakeholders with actionable insights derived from project data, enabling data-driven decision support for project managers and investors.

Tracking the movement of construction materials and equipment can be implemented to enhance supply chain visibility. Continuous enhancement of platform security is essential to protect sensitive project data from cybernetic threats. One area of focus could be the integration of encryption, access controls, and audit trails to safeguard user information.

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Supplementary Materials

Part of this research was presented at the SYMOPIS 2023 conference. The video presentation of some PIMCOD features is available at:
https://www.youtube.com/watch?v=FHCCd6PbrfA.

Mind Maps (in Serbian) for the particular software development are available at MindMeister website:

- PIMCOD project:
  https://www.mindmeister.com/app/map/2723174805?t=B0lTn4OCW7
- PIMCOD phase I:
  https://www.mindmeister.com/app/map/2950728879?t=NtKBENEiMJ
- Investment process in construction industry:
  https://www.mindmeister.com/app/map/2706205068?t=Uxs33A6aRr
- Object classification:
  https://www.mindmeister.com/app/map/2723171617?t=GPmoC5Ivu8

Textual outlines in English language for the last three are given in the appendices A, B, and C.

Apendix A

PIMCOD phase I

The textual outline of the PIMCOD phase I platworm development mind map is presented. The corresponding mind map (in Serbian language) itself is available at: https://www.mindmeister.com/app/map/2950728879?t=NtKBENEiMJ.

PIMCOD Phase I

Bases
Public Bases
Objects
Objects contain data about locations, projects on objects, and everything else that can be related to a particular object.
Model/Structure

```
type Object struct {
    ObjectNumber string
    ObjectCategory string
    ObjectClassification string
    Function string
    Construction string
    Floors string
    Location string
    Street string
    Number string
    PostalCode string
    CadastreNumber string
}
```

Links

```
[geosrbija.rs](https://geosrbija.rs/usluge/rest-api/)
```

Legal Entities
The internal database of legal entities is created using a data downloader from the Business Registers Agency (APR), which pulls all the data about a legal entity based on its identification number (PIB) or registration number and records it in the system. The system periodically checks the status of legal entities in the registry.
Model/Structure

```
type LegalEntity struct {
    Id int
    Name string
    Designer bool
    FullName string
    LicenseNumber string
    Address string
    City string
    Region string
    PIB string
    RegistrationNumber string
    FoundingDate string
    Activity string
    Accounts []BankAccount
    Email string
    PhoneNumber string
}
```

Links

```
[webservices.nbs.rs](https://webservices.nbs.rs/CommunicationOfficeSite/SerCyrl/About
Services.aspx)
[apr.gov.rs](https://pretraga2.apr.gov.rs/unifiedentitysearch)
```

Individuals
The database of individuals is essentially a database of platform users. Each individual has certificates that grant access to specific parts or levels of platform functionality. Individuals have roles in some processes

based on roles assigned to them. A content downloader is needed here as well, this time from the Chamber of Engineers' website or another authorized body that verifies the authenticity of an individual's certificates.

Model/Structure

```
type Individual struct {
    Id int
    Name string
    Designer bool
    Admin bool
    FirstName string
    LastName string
    JMBG string
    LicenseNumber string
    Address string
    City string
    Region string
    Activity string
    Accounts []BankAccount
    Email string
    PhoneNumber string
}
```

Links

[ingkomora](http://www.ingkomora.org.rs/clanovi/pretraga.php)

Content Types

Content types are second-level databases whose content can be modified by individuals with specific licenses.

Estimates/Works

The works database is divided into types and subtypes of works, and in many cases, it is related to materials because works are generally categorized by the type of material used for execution. Simplified logic and the result of norm calculations.

Model/Structure

```
type WorkType struct {
    Id int `json:"id"`
    Name string `json:"name"`
    Description string `json:"description"`
    Calculation string `json:"calculation"`
    Unit string `json:"unit"`
    Price float64 `json:"price"`
    Slug string `json:"slug"`
    Enabled bool `json:"enabled"`
    Base bool `json:"base"`
    WorkSubtypes map[string]*WorkSubtype `json:"worksubtypes"`
    RequiredMaterial map[int]Material `json:"requiredmaterial"`
}
```

Materials

The materials database consists of a list of materials related to some of the works through recipes and consumption coefficients. In the future, this database should be filled by material manufacturers or suppliers.

Model/Structure

```
type Material struct {
    Id int `json:"id"`
    Name string `json:"name"`
    Description string `json:"description"`
    Calculation string `json:"calculation"`
    Manufacturer string `json:"manufacturer"`
    PropertiesUsage string `json:"propertiesusage"`
    WorkMethod string `json:"workmethod"`
    ConsumptionUnit string `json:"consumptionunit"`
    Consumption float64 `json:"consumption"`
    ShelfLife string `json:"shelflife"`
    Unit string `json:"unit"`
    Packaging int `json:"packaging"`
    Price float64 `json:"price"`
    Slug string `json:"slug"`
```

```
}
```

Object Classification

The object classification database contains a complete list of object classifications, with which we define the object category based on which we determine the documentation and procedures required for a specific project.

Model/Structure

```
type Structure struct {
    Text string
    Description string
    Submap map[int]Structure
}
```

System Databases

Projects

Projects consist of combinations of data from existing databases, defined procedures, and roles in the process.

Project Phases

Roles

Roles in the process are defined by the main designer who creates the project. Roles can be assigned to legal and physical entities, as well as public companies or institutions. Roles can include, for example:

- Main designer
- Investor
- Contractor
- Inspection
- Architect
- Etc.

API

Access System

The access system or "login system" should include standard ways of accessing a system. This involves a user's access to the platform using a username, password, two-factor authentication, OAuth, etc., as well as accessing the system using a card system or similar with a key.

Authorization of Process Execution

Confidential Data

Tool

PDF Generator

A module/interface that, based on input data from a model map of a specific document, returns a PDF document. The model map should contain a linear list of commands for preparing the document.

Process Execution Logic

Interface Structure

```
Type PDFgeneratorOptions struct {
    Font map[string]string
    Orientation bool
    PageSize string
    PageMargins map[string]int
    Header map[int]pdf.Maroto.Row
    Footer map[int]pdf.Maroto.Row
}

Entire Maroto Library Interface

type Maroto interface {
    // Grid System
    Row(height float64, closure func())
    Col(width uint, closure func())
    ColSpace(gridSize uint)
    // Registers
    RegisterHeader(closure func())
    RegisterFooter(closure func())
    // Outside Col/Row Components
```

```
        TableList(header []string, contents [][]string, prop ...props.TableList)
        Line(spaceHeight float64, prop ...props.Line)
        // Inside Col/Row Components
        Text(text string, prop ...props.Text)
        FileImage(filePathName string, prop ...props.Rect) (err error)
        Base64Image(base64 string, extension consts.Extension, prop ...props.Rect) (err
error)
        Barcode(code string, prop ...props.Barcode) error
        QrCode(code string, prop ...props.Rect)
        DataMatrixCode(code string, prop ...props.Rect)
        Signature(label string, prop ...props.Font)
        // File System
        OutputFileAndClose(filePathName string) error
        Output() (bytes.Buffer, error)
        // Helpers
        AddPage()
        SetBorder(on bool)
        SetBackgroundColor(color color.Color)
        SetAliasNbPages(alias string)
        SetFirstPageNb(number int)
        GetBorder() bool
        GetPageSize() (width float64, height float64)
        GetCurrentPage() int
        GetCurrentOffset() float64
        SetPageMargins(left, top, right float64)
        GetPageMargins() (left float64, top float64, right float64, bottom float64)
        // Fonts
        AddUTF8Font(familyStr string, styleStr consts.Style, fileStr string)
        SetFontLocation(fontDirStr string)
        SetDefaultFontFamily(fontFamily string)
        GetDefaultFontFamily() string
        // Metadata
        SetCompression(compress bool)
        SetProtection(actionFlag byte, userPassStr, ownerPassStr string)
        SetAuthor(author string, isUTF8 bool)
        SetCreator(creator string, isUTF8 bool)
        SetSubject(subject string, isUTF8 bool)
        SetTitle(title string, isUTF8 bool)
        SetCreationDate(time time.Time)
    }
```

Maroto Scheme

The process of generating a PDF document is based on entering basic data for the document layout, such as size, font, page orientation, etc. All other content is handled by a linear loop that records the rows of the PDF document based on an integer identification number in the "integer" format under the required functions.

Example "Handler" for "Endpoint"

```
func AuthorizedPersonStatement(c *fiber.Ctx) error {
    // Get data from the form
    var data model.AuthorizedPersonStatementForm
    if err := c.BodyParser(&data); err != nil {
        return err
    }

    var selectedIndividual model.Individual
    for _, p := range db.Individuals {
        if fmt.Sprintf(p.ID) == data.Individual {
            selectedIndividual = p
            break
        }
    }

    c.Set(fiber.HeaderContentType, "application/pdf")
```

```
    c.Set(fiber.HeaderContentDisposition, "attachment; filename=report.pdf")

    // Return the PDF document
    return c.SendStream(bytes.NewReader(pdfg.AuthorizedPersonStatement(
        data.DocumentType,
        data.ConstructionMethod,
        data.Phase,
        selectedIndividual.FirstName,
        selectedIndividual.LastName,
        selectedIndividual.ProfessionalTitle,
        selectedIndividual.LicenseNumber,
        data.Law,
        data.Area,
        data.Measures,
        data.Location,
        data.TechnicalDocumentationNumber,
        data.Date,
    )))
}
```

Forms

Form Logic

In most cases, the form, which is detailed by laws and regulations, is used to create document content by setting spaces for entering variables related to the document in the process. The first level of the form should be created using a Content Management System (CMS), while the second level is created when individuals enter data during the process.

Forms should have two levels of templates. The first level should be used to determine the document's content and variables that appear in the document. The second level should work with variables specified in the first-level template.

CRUD

CRUD, which stands for "Create, Read, Update, and Delete," is a system, as its name suggests, for creating, reading, updating, and deleting data from a database. It should be created as a command with a type from a type map, which will allow creating other parts of the application in a modular way based on these "slug" identifications from the map. This map should be of type map[string]interface{} because it will allow an infinite number of combinations of types and elements for an individual application, which can also be called from other applications using this identification name.

Example Code

```
package typeItem

import (
    "backend/database"
    "github.com/gofiber/fiber/v2"
    "gorm.io/gorm"
)

type TypeItem struct {
    gorm.Model
    Title    string `json:"title"`
    Author   string `json:"author`
    MainText string `json:"mainText"`
}

func GetItem(c *fiber.Ctx) error {
    db := database.DBConn
    var typeItem []TypeItem
    db.Find(&typeItem)
    return c.JSON(typeItem)
}

func GetPost(c *fiber.Ctx) error {
    id := c.Params("id")
    db := database.DBConn
    var typeItem TypeItem
    db.Find(&typeItem, id)
```

```
        return c.JSON(typeItem)
    }

    func NewPost(c *fiber.Ctx) error {
        db := database.DBConn
        typeItem := new(TypeItem)
        if err := c.BodyParser(typeItem); err != nil {
                return c.Status(503).Send([]byte("error"))
        }
        db.Create(typeItem)
        return c.JSON(typeItem)
    }

    func DeletePost(c *fiber.Ctx) error {
        id := c.Params("id")
        db := database.DBConn
        var typeItem TypeItem
        db.First(&typeItem, id)
        if typeItem.Title == "" {
                errMsg := []byte("No record matches the id")
                return c.Status(500).Send(errMsg)
        }
        db.Delete(typeItem)
        msg := []byte("item deleted successfully")
        return c.Send(msg)
    }
```

CMS

The Data Manager is the part of the system that manages the content of databases, which can only be accessed by certified individuals. This means, for example, that only people with a professor's certificate or higher have the right to change the content of estimates/works databases, i.e., define new or modify existing norms. Or, for example, only a company that produces certain materials can fill the material database, which can be used to generate items in estimates.

Content Type Management

Form Creation

APPS

Kum - Services and Materials Calculator

The goods and services calculator uses data from the estimates/works and material databases. The functionality is identical to that of a webshop, where users select specific items from the list of works to fill a "cart" from which a cost estimate for all works, as well as materials based on consumption coefficients from specific work items, is generated at the end.

Forms

Forms are the simplest templates into which data is automatically or manually entered after choosing specific information.

CAD

The result should be the same as with the calculator, with the difference that all items are plotted in the CAD program itself, resulting in a significantly accelerated process of creating estimates and cost estimates for construction works.

Organizational Cockpit

Profile

The profile page is very similar to most social networking profiles. Each user can edit certain data related to their private key in the system.

Contacts

Contacts are a kind of "friends" or other users of this platform with whom you have established contact, allowing you to assign roles in specific processes within the system in your future work.

Projects

Lists of projects in which the user has already participated, with access levels for specific projects based on their role in the process. A wizard for creating new projects with an automated process of completing documentation based on just a few selected options from the project initialization steps.

Apendix B

Investment Process in Construction Engineering

The reduced textual outline of the investment process representational mind map is presented. The corresponding mind map (in Serbian language) itself is available at:
https://www.mindmeister.com/app/map/2706205068?t=Uxs33A6aRr

Investment Process in the Construction Industry

Idea
Investor
Architect
Conditions
Obtaining Location Conditions
PGD (Preliminary Design)
Licences
100
Responsible Planner
200
Responsible Urbanist for Managing Urban Planning and Urban Projects
201
Responsible Urbanist for Managing Urban Planning
202
Responsible Urbanist for Managing Urban Planning for Roads
203
Responsible Urbanist for Managing Urban Planning for Infrastructure
300
Responsible Designer of Architectural Projects, Open Space Planning, and Internal Water Supply and Sewage Installations
301
Responsible Designer of High-rise Building Construction
302
Responsible Designer of Architectural Construction Projects
310
Responsible Designer of Civil Engineering Structures for High-rise, Low-rise, and Hydraulic Engineering Objects
311
Responsible Designer of Civil Engineering Structures for High-rise Objects
312
Responsible Designer of Civil Engineering Structures for Low-rise Objects
313
Responsible Designer of Hydraulic Engineering Objects
314
Responsible Designer of Hydraulic Structures and Water Supply and Sewage Installations
315
Responsible Traffic Engineer
316
Responsible Designer of Civil Geotechnical Objects
317
Responsible Designer of Civil Engineering Structures and Architectural Projects
318
Responsible Designer of Road Traffic Objects
330
Responsible Designer of Thermal Technology, Thermal Power Engineering, Process, and Gas Technology
332
Responsible Designer of Mechanical Installations for Water Supply Facilities and Industrial Waters, Hydraulic Engineering, and Hydro Power Engineering

333
Responsible Designer of Transport Vehicles, Warehouses, Mechanical Structures, and Technology
350
Responsible Designer of Low and Medium Voltage Electrical Installations
351
Responsible Designer of High and Medium Voltage Electrical Installations - Substations and Transmission of Electrical Energy
352
Responsible Designer of Electric Motor Drive Systems - Automation, Measurements, and Regulation
353
Responsible Designer of Telecommunication Networks and Systems
369
Responsible Designer of Telecommunication Traffic and Networks
370
Responsible Designer of Traffic and Traffic Signaling
371
Responsible Designer of Technological Processes
372
Responsible Designer of Geodetic Projects
373
Responsible Designer for Landscape Architecture of Open Spaces
375
Responsible Designer of Objects for Flood Control and Erosion Protection and Melioration of Forest and Agricultural Areas
376
Responsible Designer of Agricultural Projects - Hydromelioration Systems
377
Responsible Designer of Food Technology Processes
381
Responsible Engineer for Energy Efficiency of Buildings
385
Responsible Designer of Metallurgical Processes
391
Responsible Designer in the Preparation of Geotechnical and Engineering-Geological Submissions
392
Responsible Designer of Hydrogeological Submissions and Objects
393
Responsible Designer for the Preparation of Geophysical Submissions and Design of Geophysical Investigations
400
Responsible Construction Contractor for High-rise Building and Internal Water Supply and Sewage Installations
401
Responsible Construction Contractor for Architectural and Civil Engineering Structures and Construction-Craft Works on High-rise Objects
410
Responsible Construction Contractor for Civil Engineering Structures and Construction-Craft Works on High-rise, Low-rise, and Hydraulic Engineering Objects
411
Responsible Construction Contractor for Civil Engineering Structures and Construction-Craft Works on High-rise Objects
412
Responsible Construction Contractor for Civil Engineering Structures and Construction-Craft Works on Low-rise Objects
413
Responsible Construction Contractor for Civil Engineering Structures and Construction-Craft Works on Hydraulic Engineering Objects
Roles
Investor

Applicant
Competent Authority
Republic Geodetic Institute
Holders of Public Authorizations
Construction Inspection
Designer
Construction Contractor
Technical Supervision
Legend
Person
Document
Procedure
Request
Project
Works
Preparatory
Rough
Final
Company
Realization
Design PZI (Detailed Design)
Application
Construction
Project
Registration
Obtaining Use Permit
Cadastral Registration
Project
Central Registry of Unified Procedures

Apendix C

Object Classification

The reduced textual outline of the object classification mind map is presented. The mind map itself is derived from the legislative and juridical guidelines and our personal construction engineering experience. The map is available online at:
https://www.mindmeister.com/app/map/2723171617?t=GPmoC5Ivu8.

CLASSIFICATION OF OBJECTS

BUILDINGS

RESIDENTIAL BUILDINGS
Residential buildings with one apartment
Detached houses for permanent or occasional residence, such as family houses, villas, cottages, summerhouses, mountain cabins, hunting lodges
Up to 400 m2 and G+1+Gf (Gc)
111011
A
Up to 2,000 m2 and G+4+Gf (Gc)
111012
B
Over 2,000 m2 or G+4+Gf (Gc)
111013
V
Row houses, connected by a wall, or a row of connected houses on a slope (terraces), where each apartment has its roof and its entrance directly from the ground
Up to 2,000 m2 and G+4+Gf (Gc)
111021
Б
Over 2,000 m2 or G+4+Gf (Gc)
111022
V
Residential buildings with two or more apartments
Residential buildings with two apartments
Detached houses with two apartments used for permanent or occasional residence (for leisure, etc.)
Up to 400 m2 and G+1+Gf/Gc
112111
A
Up to 2,000 m2 and G+4+Gf (Gc)
112112
B
Over 2,000 m2 or G+4+Gf (Gc)
112113
V
Row houses, connected by a wall, or a row of houses connected by terraces (on a slope), with two apartments
Up to 2,000 m2 and G+4+Gf (Gc)
112121
Б
Over 2,000 m2 or G+4+Gf (Gc)
112122
V
Residential buildings with three or more apartments
Detached residential buildings with three apartments, for permanent or occasional residence
Up to 400 m2 and G+1+Gf/Gc

112211
A
Up to 2,000 m2 and G+4+Gf (Gc)
112212
B
Over 2,000 m2 or G+4+Gf (Gc)
112213
V
Separated and other residential buildings with more than three apartments, such as residential blocks, apartment houses, etc., where apartments are intended for permanent or occasional residence
Up to 2,000 m2 and G+4+Gf (Gc)112221
B
Over 2,000 m2 or G+4+Gf (Gc)
112222
V
Community residential buildings
Buildings for communal living, including units with full maintenance and cleaning services for older persons, students, children, and other social groups, such as retirement homes, institutions and homes that provide care for the elderly and disabled persons, worker hostels, student dormitories, orphanages, shelters adjacent to dormitory buildings, homeless shelters, monasteries, etc.
Up to 400 m2 and G+2
113001
B
Over 400 m2 or G+2
113002
V
NON-RESIDENTIAL BUILDINGS
Hotels and similar buildings
Hotels
Hotels, motels, guesthouses with rooms, boarding houses, and similar buildings for guest accommodation, with or without a restaurant
Up to 400 m2 and G+2
121111
B
Over 400 m2 or G+2
121112
V
Restaurants, bars, and similar hospitality buildings - Separate restaurant, bar, cafeteria buildings
Up to 400 m2 and G+2
121113
B
Over 400 m2 or G+2
121114
V
Other buildings for short-term stays
Youth hostels, mountain lodges, children's and family camps, vacation bungalows, resorts, other recreational and excursionist accommodation buildings not classified elsewhere
Up to 400 m2 and G+2
121201
B
Over 400 m2 or G+2
121202
V
Business buildings
Buildings used for business purposes, for administrative and management purposes (banks, post offices, local government and state body office buildings, etc.)
Up to 400 m2 and G+2
122011
B

Over 400 m2 or G+2
122012
V
Conference and Congress Centers, Court and Parliament Buildings
Up to 400 m2 and G+2
122021
B
Over 400 m2 or G+2
122022
V
Buildings for Wholesale and Retail Trade
Shopping centers, buildings with stores, department stores, separate shops, pharmacies, and boutiques, exhibition halls, spaces for auctions and exhibitions, enclosed markets, service stations for motor vehicles, etc.
Up to 400 m2 and G+1
123001
B
Over 400 m2 or G+1
123002
V
Buildings for Transport and Communication
Communication buildings, stations, terminals, and similar buildings
Road Transport Buildings
Buildings with associated installations and equipment at bus stations
124110
V
Railway Transport Buildings
Buildings with associated installations and equipment at railway stations, cable car stations, chairlift stations, etc.
124121
V
Signal (watchman's) huts, storage sheds (locomotive sheds) for locomotives and wagons
124122
V
Air Transport Buildings
Buildings with associated installations and equipment at civilian and military airports
124131
V
Aircraft Hangars
124132
V
Air Traffic Control Buildings (control towers)
124133
V
Water Transport Buildings
Buildings with associated installations and equipment at port terminals
124141
V
Lighthouses
124142
V
Postal and Telecommunication Buildings
Buildings for postal services, telephone exchanges, and telecommunication centers
124151
V
Telephone Booths
124152
A
Buildings for Television and Radio Broadcasting

124160
V
Other Transport and Communication Buildings
124170
V
Garages
Freestanding garage buildings (above ground and underground) and parking lots
124210
V
Bicycle Shelters
124220
A
Industrial Buildings and Warehouses
Industrial Buildings
Covered buildings used for industrial production, e.g., factories, workshops, slaughterhouses, breweries, assembly halls, etc.
Workshops up to 400 m2
125101
Б
Workshops over 400 m2
125102
V
All except workshops
125103
V
Reservoirs, Silos, and Warehouses
Reservoirs and Silos
Tanks and cisterns
125211
Oil and Gas Tanks
125212
Cement and other dry aggregate silos
125213
Closed Warehouses
Specialized warehouses enclosed on at least three sides by walls or partitions
Up to 1,500 m2 and G+1
125221
Б
Over 1,500 m2 or G+1
125222
V
Cold Storage Facilities
125223
V
Covered Warehouses
Permanently covered warehouses (with a roof) in the open, with less than three walls or no walls
Up to 1,500 m2
125231
A
Over 1,500 m²
125232
Б
Buildings for Cultural and Artistic Activities, Entertainment, Education, Hospitals, and Other Health Care Buildings
Buildings for Cultural and Artistic Activities and Entertainment
Cinemas, concert halls, opera houses, theaters, etc.
126101
V
Meeting Halls and Multipurpose Halls mainly used for cultural and artistic activities and entertainment

126102
V
Casinos, circuses, music and dance halls, amateur dance schools, discos, pavilions for promenade concerts
126101
V
Buildings in zoological gardens and botanical gardens
126103
V
Museums and Libraries
Museums, art galleries, libraries, information and documentation centers
126201
V
Buildings for Archival Storage
126202
V
School Buildings and Buildings for Scientific Research Activities
Preschool Buildings
Buildings where preschool education is provided (nurseries, kindergartens)
126310
V
Elementary School Buildings
Buildings for primary education
126321
V
Buildings for Special Schools for Handicapped Children
126322
V
Buildings for Secondary and Other Schools
Buildings for secondary schools (e.g., gymnasiums, technical and vocational schools, industrial and other professional schools)
126331
V
Non-professional driving schools for motor vehicles, flight training, and navigation of watercraft
126332
V
Adult education schools and schools for which the educational level cannot be determined
126333
V
Faculty Buildings
University buildings, faculties, art academies, higher and advanced vocational schools
126340
V
Buildings for Scientific Research Activities
Buildings used for scientific research, research laboratories
126351
V
Meteorological stations, observatory buildings
126352
V
Hospitals and other Health Care Buildings
Hospital and Clinic Buildings
General and specialized hospitals and clinics where medical and surgical treatment and care of sick and injured persons are provided
126411
V
Sanatoriums and other hospitals for extended recovery and care of patients
126412
V

Psychiatric hospitals, maternity hospitals
126413
V
University hospitals, hospitals for persons under correction, inmates, and soldiers
126414
V
Buildings of hospitals and sanatoriums used for thermal treatment, balneotherapy, and functional rehabilitation
126415
V
Facilities with combined accommodation, food, care, and treatment services for older persons or handicapped individuals
126416
V
Other Health Care Buildings
Health centers, health stations, emergency aid stations, polyclinics, and medical practices
126421
V
Blood transfusion centers, human milk collection centers
126422
V
Mother and child protection centers
126423
V
Veterinary treatment buildings - Veterinary stations, hospitals, and private practices for animal treatment
126430
V
Sports Halls
Buildings for indoor sports (basketball and tennis courts, swimming pools, gymnastic halls, hockey, etc.) with spaces for spectators (bleachers, stands, terraces, etc.) and participants (showers, dressing rooms, etc.)
126500
V
Other Non-Residential Buildings
Agricultural Buildings
Livestock Stables and Poultry Houses - Stables for cows, sheep, and goats, horse stables, pigsties, chicken coops, and buildings for breeding other animals, industrial and other poultry houses
Up to 600 m2
127111
A
Up to 4,000 m2 and a height of up to 25 m
127112
Б
Over 4,000 m2 or a height over 25 m
127113
V
Buildings for Cultivation, Production, and Storage of Agricultural Products - Buildings for storing and cultivating agricultural products, e.g., warehouses for agricultural products, granaries, haylofts, traps, greenhouses, wineries, wine cellars, etc.
Up to 600 m2
127121
A
Up to 4,000 m2 and a height of up to 25 m
127122
Б
Over 4,000 m2 or a height over 25 m
127123
V
Agricultural Silos - Silos for agricultural production needs
Up to 4,000 m2 and a height of 25 m

127131
Б
Over 4,000 m2 or a height over 25 m
127132
V
Other Agricultural Buildings - Garages, hangars, and other buildings for storing agricultural machinery and tools, as well as other auxiliary agricultural buildings
Up to 600 m2
127141
A
Up to 4,000 m2 and a height of up to 25 m
127142
Б
Over 4,000 m2 or a height over 25 m
127143
V
Buildings for Religious and Other Ceremonies
Buildings for Religious Ceremonies - Churches, chapels, mosques, synagogues, cathedrals, etc.
127210
V
Buildings in Cemeteries
Mortuaries, crematoriums
127221
V
Funeral Service Facilities
Up to 200 m2
127222
Б
Over 200 m2
127223
V
Other Cemetery Structures - Tombs with or without monuments
127230
Historical or Protected Monuments
Historical or protected buildings of any kind not used for other purposes
127301
V
Protected Ruins, Archaeological Discoveries, and Prehistoric Sites
127302
V
Statues, commemorative, artistic, and decorative structures
127303
V
Other Unclassified Buildings
Barracks and other buildings for the military, police, or firefighters - Prisons, correctional facilities, etc.
127410
V
Other Unclassified Buildings - Shelters at bus stations, public toilets, laundromats, etc.
127420
B