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# STRATEGIES FOR THE PROTECTION OF INTELLECTUAL PROPERTY IN GEODESY AND THEIR IMPLEMENTATION IN THE ACTIVITIES OF CONSTRUCTION COMPANIES

# СТРАТЕГІЇ ЗАХИСТУ ІНТЕЛЕКТУАЛЬНОЇ ВЛАСНОСТІ В ГЕОДЕЗІЇ ТА ЇХНЄ ВПРОВАДЖЕННЯ В ДІЯЛЬНІСТЬ БУДІВЕЛЬНИХ КОМПАНІЙ

***Анотація.*** *Вступ. У сучасному світі стрімкого технологічного розвитку, захист інтелектуальної власності стає ключовим аспектом для підтримки інновацій та конкурентоспроможності у багатьох галузях, включаючи геодезію. Використання геодезичних даних та технологій у будівельній індустрії вимагає ефективних стратегій захисту IP, щоб забезпечити не тільки дотримання законодавства, але й зберегти ексклюзивність та комерційну вартість розробок. Враховуючи ризики неправомірного використання та копіювання, актуальність вдосконалення*

*механізмів захисту ІР в геодезії та їх застосування у будівництві є важливішою ніж будь-коли.*

*Мета. Дослідити стратегії захисту інтелектуальної власності (ІВ) у сфері геодезії та дослідити, як ці стратегії можуть бути ефективно реалізовані в операційній діяльності будівельних компаній.*

*Матеріали і методи. 1). Аналітичний метод. У контексті захисту інтелектуальної власності в геодезії аналітичний метод можна використовувати для аналізу різних стратегій захисту, оцінки їх ефективності та дослідження наслідків цих стратегій для бізнес-операцій у будівництві. 2). Порівняльний метод. Для захисту інтелектуальної власності в геодезії цей метод можна використовувати для порівняння різних регуляторних середовищ, розмірів компаній і галузей промисловості в будівництві. 3). Метод системної взаємодії. Вивчаючи захист ІВ у геодезії для будівельних компаній, цей метод може дослідити, як стратегії ІВ взаємодіють з іншими бізнес-процесами та технологічними досягненнями.*

*Результати. Дослідження виявило, що багато будівельних компаній часто недооцінюють значення інтелектуальної власності у своїх геодезичних операціях. В результаті, встановлено, що стратегії, такі як реєстрація патентів та авторських прав, ліцензування технологій, а також використання сучасних технологічних засобів (шифрування даних та блокчейн) можуть значно підвищити рівень захисту ІР. Також було підкреслено важливість правильної організації контрактної документації та необхідність навчання співробітників з питань інтелектуальної власності.*

*Перспективи. Перспективи подальших досліджень у галузі стратегій захисту інтелектуальної власності в геодезії і їх застосування у будівельній індустрії обіцяють бути масштабними та мультидисциплінарними. Важливо зосередитися на розробці нових технологічних рішень для захисту геодезичних даних, які будуть інтегровані з загальноприйнятими*

*практиками управління IP. Також перспективним є вивчення міжнародних випадків і адаптація успішних зарубіжних практик до місцевих умов.*

***Ключові слова:*** *будівельна компанія, геодезичні дані, інтелектуальна власність, стратегія захисту, будівельний проект, вартість захисту.*

***Summary.*** *Introduction. In today's world of rapid technological development, the protection of intellectual property is becoming a key aspect to support innovation and competitiveness in many industries, including geodesy. The use of geodetic data and technology in the construction industry requires effective IP protection strategies to ensure not only legal compliance but also the exclusivity and commercial value of developments. Given the risks of misuse and copying, the urgency of improving IP protection mechanisms in surveying and their application in construction is more important than ever.*

*Purpose. Explore strategies for protecting intellectual property (IP) in the field of geodesy and explore how these strategies can be effectively implemented in the operational activities of construction companies.*

*Materials and methods. 1). Analytical method. In the context of intellectual property protection in surveying, the analytical method can be used to analyze different protection strategies, evaluate their effectiveness, and investigate the implications of these strategies for business operations in construction. 2). Comparative method. To protect intellectual property in surveying, this method can be used to compare different regulatory environments, company sizes and industries in construction. 3). System interaction method. By studying IP protection in surveying for construction companies, this method can explore how IP strategies interact with other business processes and technological advances.*

*The results. The study found that many construction companies often underestimate the value of intellectual property in their surveying operations. As a result, it has been established that strategies such as patent and copyright registration, technology licensing, as well as the use of modern technological*

*means (data encryption and blockchain) can significantly increase the level of IP protection. The importance of proper organization of contract documentation and the need to train employees on intellectual property issues were also emphasized.*

*Prospects. Prospects for further research in the field of intellectual property protection strategies in geodesy and their application in the construction industry promise to be large-scale and multidisciplinary. It is important to focus on the development of new technological solutions for the protection of geodetic data that will be integrated with common IP management practices. It is also promising to study international cases and adapt successful foreign practices to local conditions.*

***Key words:*** *construction company, geodetic data, intellectual property, protection strategy, construction project, cost of protection.*

**Formulation of the problem.** Geodesy, the science of measuring and understanding the earth's geometric shape, orientation in space, and gravity field, plays a critical role in construction projects. The accurate geospatial data it provides is indispensable for planning, executing, and managing construction activities efficiently and sustainably. As geodesy incorporates sophisticated technologies and methodologies, the creation of unique software, algorithms, and geospatial data sets increasingly raises intellectual property (IP) issues. Protecting these assets is crucial for maintaining competitive advantage and encouraging innovation within the geodesy community and the construction industry. The implementation of IP protection strategies in construction involves navigating complex legal, technological, and operational challenges. The article's focus on strategies for effectively managing IP rights can guide construction companies in safeguarding their geospatial data and related innovations. The rapid advancement of technology in geodesy, such as the development of drones and satellite imaging, has introduced new forms of data and methods that may be susceptible

to IP issues. Understanding how to protect these novel intellectual assets is increasingly relevant.

By providing a detailed analysis of current strategies and their implementation, the article aids companies in adopting best practices that enhance their IP management efforts. This is critical for fostering a culture of innovation and respect for IP rights within the industry. The relevance of this research lies in its potential to influence policy making, enhance operational efficiencies, and promote ethical practices in the construction industry, thereby contributing to the broader discussion on the importance of intellectual property rights in technological and scientific domains.

**Analysis of recent research and publications.** Geodesy's contribution to construction through advanced measuring techniques and technologies is well recognized. Masoud R., Basahel S. [11] underscore the importance of protecting technological innovations, which form the backbone of geodetic contributions to construction projects. The authors highlight that patents, copyrights, and trade secrets are pivotal in safeguarding these innovations from unauthorized use and replication. Further, Mamonov K., Hoy V., Kovalenko L., Dmytrenko A. [5] discuss the technological aspects of geodesy that are often subject to IP claims, including specialized software and unique methodological approaches in geospatial data processing.

The protection of IP in geodesy involves navigating complex challenges that are inherently technical and legal in nature. According to Adibfar A., Costin A., Issa R. [7], one of the main difficulties is the dual need to protect innovative geodetic instruments and methodologies while ensuring interoperability with existing systems. The authors argue that this necessitates a balanced approach to IP protection that does not stifle innovation. Additionally, Makedon V., Valikov V., Kurinnaya I., Koshlyak E. [10] addresses the economic challenges of IP protection, including the high costs associated with securing and enforcing IP rights, which can be prohibitive for smaller firms in the construction sector.

Strategies for IP protection in geodesy range from legal actions to more technical approaches. On the technical side, Singh N., & Chouhan S. [12] explore the use of encryption and blockchain technology to secure geospatial data, proposing that these technologies offer new ways to enforce IP rights and manage data securely.

The implementation of IP protection strategies within construction companies is detailed by Zhosan V. & Kyrychenko N. (2022). [2], who examine how construction companies integrate IP considerations into their project management frameworks. The authors emphasize the role of contractual safeguards, such as non-disclosure agreements and IP clauses in contracts, which help to mitigate risks associated with IP leakage. The literature presents a broad array of strategies for protecting intellectual property in geodesy as it applies to construction. While legal protections form the foundation of IP security, technological solutions such as encryption and blockchain also play an increasingly important role. However, the successful implementation of these strategies requires a holistic approach that includes legal, technical, and educational components.

**The purpose of the article** is to explore and elucidate the various strategies for protecting intellectual property (IP) within the field of geodesy and to examine how these strategies can be effectively implemented in the operational activities of construction companies.

**Materials and methods.** 1). Analytical research method. The analytical research method involves a detailed examination and breakdown of complex data or processes into simpler, more manageable components to understand their underlying principles. In the context of IP protection in geodesy, the analytical method can be used to dissect various protection strategies, assess their effectiveness, and explore the implications of these strategies for business operations in construction. 2). Comparative method. The comparative method involves comparing different cases, situations, or contexts to draw conclusions

about what works and what does not. For IP protection in geodesy, this method can be used to compare different regulatory environments, company sizes, and industry sectors within construction. 3). Method of system interaction. The method of system interaction examines the relationships and interdependencies among various components of a system. In studying IP protection in geodesy for construction companies, this method can explore how IP strategies interact with other business processes and technological advancements.

**Presenting main material.** Geodesy is the science of accurately measuring and understanding the Earth's geometric shape, orientation in space, and gravitational field. It involves the precise calculation of geographical coordinates and the creation of maps and charts. Geodesy's critical role in construction is to provide fundamental data for the planning and execution of construction projects, ensuring structures are built in the correct location and orientation, which is vital for both legal and practical reasons. Geodetic data is invaluable in the construction industry for several reasons [14]:

1. Precision and planning. Geodetic measurements allow for the precise planning of construction projects. This accuracy is crucial for laying out foundations, determining property boundaries, and integrating new construction into existing infrastructures without errors that could lead to costly legal disputes or structural failures.

2. Regulatory compliance. Construction projects often need to adhere to strict regulations regarding land use and environmental impact. Geodetic data ensures compliance with these regulations by providing accurate environmental assessments and other required reports.

3. Risk management. Accurate geodetic data helps in assessing potential risks like land subsidence, floods, or earthquakes. This information is critical for designing buildings that can withstand such events, thereby reducing the risk of catastrophic failures.

4. Resource management. Efficient use of resources in construction not only saves money but also minimizes environmental impact. Geodetic data aids in the optimal allocation and utilization of materials and land, ensuring sustainability in construction practices.

5. Future developments. Geodetic data is not only crucial for the initial phases of construction but also for any future expansions or developments. Accurate data recorded during initial construction can be invaluable in future modifications or enhancements to infrastructure.

Understanding intellectual property and geodesy in the context of the construction industry reveals their indispensable roles in driving innovation, ensuring compliance, and enhancing efficiency. Intellectual property protects the technological advancements and creative outputs in geodesy, while geodetic data provides the backbone for precise, safe, and efficient construction. The protection of these assets through IP rights is critical for several reasons [3, 9]:

– IP protection incentivizes companies and individuals to invest in research and development. Knowing that their inventions and creations can be protected legally provides a safety net that encourages ongoing innovation within the field.

– in a highly competitive industry like construction, possessing unique geodetic methods or technologies can significantly distinguish a company from its competitors. IP rights ensure that these innovations remain exclusive, thereby enhancing a company's market position.

– through licensing agreements, patents, and copyrights, companies can monetize their innovations. This not only provides an additional revenue stream but also spreads the technology across the industry under controlled and compensated conditions.

– IP protection helps prevent unauthorized use of proprietary technology, which can lead to financial and reputational damage. It also ensures that the original creators receive due credit for their work.

Implementing effective IP protection strategies within construction companies that utilize geodetic data and technologies involves several practical steps [13]:

1) Companies should regularly conduct IP audits to identify and catalog their IP assets. This helps in understanding what needs protection and the level of protection required;

2) Ensuring that employees understand the importance of IP and are trained in IP policy helps prevent inadvertent leaks and reinforces the culture of protection within the company;

3) Construction companies should employ non-disclosure agreements (NDAs), confidentiality agreements, and other legal tools to safeguard their IP. These agreements are essential when collaborating with external parties like contractors and consultants;

4) Registering patents and copyrights provides legal recognition and protection to the company's innovations. This not only deters infringement but also provides a robust legal recourse in case of violations;

5) Implementing strong IT security measures is crucial to protecting digital geodetic data and software. This includes encryption, secure data storage solutions, and regular security audits [2].

The protection of intellectual property in the realm of modern geodesy is indispensable for fostering innovation, securing competitive advantages, and ensuring the ethical use of technology in construction.

The geodesy sector, which is crucial for accurate data collection, processing, and the creation of unique software, plays a vital role in the construction industry. However, protecting the intellectual property (IP) associated with these innovations poses significant challenges. These challenges are not only technical but also economic, impacting the operational dynamics and financial health of construction companies (table 1).

*Table 1*

**Technical and economic aspects of IP Protection in geodesy for construction companies**

| no | Main Aspects | Characteristic |
|---|---|---|
| | Technical Aspects | |
| 1. | Complexity of Geospatial Data | Geodesy involves the collection and processing of complex geospatial data. Protecting this data is challenging because it often requires the integration of various technologies and methodologies that may themselves be subject to IP claims or have compatibility issues. |
| 2. | Innovative Software Solutions | The creation of unique software for data analysis and visualization in geodesy is a cornerstone for many construction projects. Protecting this software involves securing copyright for code and potentially patenting innovative algorithms or unique functionalities. Ensuring comprehensive protection requires continuous updates to security measures against a backdrop of rapidly evolving technology, which can be technically demanding. |
| 3. | Interoperability and Standardization | Geodetic tools and software often need to interact with other systems, which can expose proprietary technologies to risk. Ensuring IP protection while maintaining interoperability with industry standards and other platforms is a complex balancing act. |
| | Economic Aspects | |
| 4. | Legal Expenses | The legal costs associated with securing and maintaining IP rights, including patenting, copyright registration, and potential litigation, can be substantial. For many construction companies, especially smaller firms, these costs may deter them from pursuing full IP protection. |
| 5. | Operational Delays and Costs | Implementing robust IP protection measures can lead to delays in project timelines and additional costs. For instance, ensuring that all aspects of a new geodetic software are patented or that data handling meets the latest security standards can slow down its deployment. |
| 6. | Revenue Loss | Unauthorized use or duplication of protected geodetic tools, technologies, or data can lead to significant revenue loss for the originators. This is particularly damaging when proprietary technologies or methodologies are central to a company's competitive advantage. |
| 7. | Market Position and Reputation | IP violations can also harm a company's market position and reputation. If a firm becomes known for weak IP protections or frequent violations, it may be perceived as less reliable or innovative, affecting partnerships and business opportunities. |

*Source:* developed by the authors based on [1; 7]

Protecting intellectual property in geodesy presents considerable technical and economic challenges that directly affect the viability and competitiveness of construction companies. These challenges necessitate a strategic approach to IP management, incorporating robust legal protections, advanced technical measures, and a corporate culture that prioritizes IP security [8].

In the increasingly competitive field of construction, safeguarding the intellectual property (IP) associated with geodesy is crucial. Geodesy, which provides essential data for construction projects, incorporates a variety of sophisticated technologies and methodologies that are susceptible to IP breaches [11].

Licensing allows construction companies to control how others while generating revenue use their geodesic innovations. By issuing licenses, companies can permit the use of their geospatial data, software, or methodologies under specific conditions, thus maintaining ownership and control over their intellectual property. There are various licensing arrangements available, such as exclusive, non-exclusive, and cross-licensing agreements. Each type offers different levels of control and financial benefit, allowing companies to choose the arrangement that best suits their business model and IP protection needs. Registering IP rights is a foundational step in protecting inventions and creations in geodesy. This includes obtaining patents for new devices or methods and copyrights for software and other creative works. Registered rights provide a legal basis to challenge any unauthorized use or infringement [8].

1. Contract Work:

1.1. Clear IP Clauses in Contracts. When engaging in contract work, especially with subcontractors or partners, it is critical to include explicit IP clauses that specify ownership rights and usage permissions. This helps prevent disputes and ensures that all parties understand their rights and obligations regarding IP.

1.2. Non-disclosure Agreements (NDAs). NDAs are essential in protecting sensitive information disclosed during the course of contract work. They legally bind parties to confidentiality, reducing the risk of IP leakage [15].

2. Technological Solutions:

2.1. Securing Data. Encryption is a critical security measure for protecting geospatial data integrity and confidentiality. By encrypting data, construction companies ensure that their valuable geodetic information is safeguarded against unauthorized access and breaches.

2.2. Advanced Encryption Standards. Employing advanced encryption standards is recommended to protect against sophisticated cyber threats. This includes using up-to-date encryption algorithms that comply with industry standards.

2.3. Immutable Records. Blockchain technology offers a way to maintain secure, immutable records of geospatial data transactions. Each transaction on a blockchain is timestamped and linked to previous transactions, creating a permanent record that is virtually impossible to alter [4].

2.4. Smart Contracts. Implementing smart contracts on blockchain platforms can automate the execution of agreements, such as licensing, in a secure and transparent manner. This reduces the administrative burden and enhances compliance with IP agreements.

3. Other Innovative Approaches [11]:

3.1. Digital Rights Management (DRM). DRM technologies can be used to control and monitor the distribution and use of digital geospatial datasets and software. This helps prevent unauthorized reproduction and distribution.

3.2. IP Management Software. Utilizing specialized software for IP management can help track the status of IP assets, manage renewals, and enforce compliance across various jurisdictions, which is particularly useful for companies with international operations.

In the realm of construction, geodesy plays a critical role in ensuring the accuracy and reliability of projects. As technological advancements continue to enhance geodetic methods, protecting the intellectual property (IP) associated with these innovations becomes increasingly important. The first step in implementing IP protection strategies is the identification and cataloging of all IP assets related to geodesy. Construction companies need to conduct thorough IP audits to determine which technologies, processes, or data sets are proprietary and require protection. This includes [6]:

– any specialized software or unique algorithms developed for geodetic measurements or data processing;

– new methods or techniques used in the acquisition, analysis, or application of geodetic data;

– unique data sets that may have been collected for specific projects or uses.

Here is a structured table outlining the various strategies for intellectual property (IP) protection in geodesy for construction companies (table 2).

*Table 2*

**The various strategies for intellectual property (IP) protection in geodesy for construction companies**

| Category | Strategy | Description |
|---|---|---|
| 1. Legal Protection Mechanisms | | |
| 1.1 | Patents | Filing for patents to protect novel inventions or processes related to geodesy, ensuring exclusivity and commercial exploitation. |
| 1.2 | Copyrights | Registering copyrights for original works such as software programs and technical documentation. |
| 1.3 | Trademarks | Obtaining trademarks for the names, symbols, or logos distinguishing the geodetic services offered by the company. |
| 1.4 | Trade Secrets | Maintaining certain methodologies or software as trade secrets, implementing procedures to ensure confidentiality. |
| 2. Contractual Safeguards | | |
| 2.1 | Non-Disclosure Agreements (NDAs) | Enforcing NDAs with employees, contractors, and partners to protect sensitive geodetic information. |
| 2.2 | IP Clauses in Contracts | Including specific IP clauses in business contracts to clearly define ownership rights and usage permissions. |
| 3. Technological Measures | | |

| Category | Strategy | Description |
|---|---|---|
| 3.2 | Encryption | Utilizing strong encryption to protect geospatial data and communications from unauthorized access. |
| 3.2 | Digital Rights Management (DRM) | Implementing DRM systems to control and monitor the distribution and use of digital content and software. |
| 3.3 | Blockchain | Using blockchain technology to create immutable records of data transactions, enhancing data traceability and security. |
| 4. Training and Awareness Programs | | |
| 4.1 | Regular Training | Conducting regular training sessions for all employees to emphasize the importance of IP rights and company policies. |
| 4.2 | Awareness Campaigns | Launching awareness campaigns to keep IP protection a priority within the corporate culture. |
| 5. Monitoring and Enforcement | | |
| 5.1 | IP Management Team | Establishing a dedicated team responsible for overseeing all aspects of IP protection, from registration to enforcement. |
| 5.2 | Regular Audits | Performing regular audits to ensure compliance and identify any potential IP breaches or vulnerabilities. |

*Source:* author's development

Implementing robust IP protection strategies in geodesy is crucial for construction companies to protect their innovative assets, maintain their competitive edge, and foster an environment of continuous improvement. By combining legal, contractual, and technological measures with comprehensive training and strict enforcement protocols, companies can effectively secure their geodetic intellectual property, thereby enhancing their operational integrity and promoting sustainable business practices.

**Conclusions and prospects for further research.** Geodesy allows for the accurate laying of foundations, determination of property boundaries, and integration into existing infrastructure, which are critical to avoiding costly legal issues and structural failures. Geodetic data is vital for adhering to regulations related to land use and environmental impact, ensuring that construction projects meet legal standards and avoid penalties, by providing reliable data, geodesy helps in assessing risks such as land subsidence and seismic activities, which is essential for designing structures that can withstand such events. Regular IP audits are essential for identifying what needs protection and understanding the level of protection required.

Training employees on the importance of IP and ensuring they are familiar with the company's policies helps prevent inadvertent leaks and reinforces a protective culture. Utilizing NDAs, confidentiality agreements, and other legal instruments is crucial when collaborating with external parties to safeguard sensitive information. Registering patents and copyrights provides legal recognition and a basis for enforcing rights, acting as a deterrent against infringement, implementing strong IT security measures, such as encryption and secure data storage solutions, is critical for protecting digital geodetic data and software.

Future research should continue to explore innovative IP protection strategies while examining the impacts of these strategies on promoting sustainable business practices within the construction industry. Overall, protecting IP in geodesy not only secures the financial and competitive interests of companies but also encourages the advancement of the field as a whole.

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