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THE ROLE OF INNOVATIVE FINANCIAL INSTRUMENTS IN SUPPORTING THE DEVELOPMENT OF INTELLECTUAL PROPERTY AT CONSTRUCTION ENTERPRISES

Abstract. Intellectual Property (IP) is increasingly recognized as a critical asset across various sectors, including the construction industry, where it plays a vital role in fostering innovation, enhancing competitive advantage, and driving economic growth. Despite its importance, the development and protection of intellectual property in construction require significant financial investment. This article explores the pivotal role of innovative financial instruments in supporting IP within construction enterprises, examining their implementation, benefits, and broader significance. Innovation in construction is driven by the need for sustainability, efficiency, and advanced technological integration. IP aids this innovation by securing new building materials, construction methods, and proprietary technologies that improve project outcomes and environmental impact. The financial instruments under review include government grants and subsidies, venture capital, intellectual property-backed financing, and crowdfunding. Each offers distinct advantages, from broadening investor bases to providing strategic capital and encouraging risk-sharing among multiple stakeholders.

However, these financial solutions are not without challenges, including difficulties in IP valuation, investor risk aversion, and a general lack of awareness about available financial mechanisms. By systematically analyzing the application of these financial tools in real-world scenarios, this article highlights their effectiveness in promoting IP development and addresses the potential for these instruments to transform financial landscapes in construction. The discussion extends to the strategic approaches that construction firms might adopt to overcome funding challenges, such as enhancing IP management education, forming strategic partnerships, and tailoring financial products to meet industry-specific needs. This
investigation contributes to a better understanding of how innovative financial instruments can be leveraged to support IP, ultimately facilitating more sustainable, efficient, and innovative construction practices. The findings aim to guide construction enterprises, financial institutions, and policymakers in optimizing the use of such instruments, ensuring that the industry can continue to innovate and grow in a competitive global market.

**Keywords:** construction enterprises, R&D, construction financing, investments, innovative financial instruments, construction sector's project.

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**РОЛЬ ІННОВАЦІЙНИХ ФІНАНСОВИХ ІНСТРУМЕНТІВ У ПІДТРИМЦІ РОЗВИТКУ ІНТЕЛЕНТУАЛЬНОЇ ВЛАСНОСТІ НА БУДІВЕЛЬНИХ ПІДПРИЄМСТВАХ**

**Анотація.** Інтелектуальна власність (ІВ) все частіше визнається критично важливим активом у різних галузях, включаючи будівельну галузь, де вона відіграє життєво важливу роль у стимулюванні інновацій, посиленні конкурентних переваг і стимулюванні економічного зростання. Попри свою важливість, розвиток і захист інтелектуальної власності в будівництві вимагає значних фінансових інвестицій. У цій статті досліджується ключова роль інноваційних фінансових інструментів у підтримці ІВ на будівельних підприємствах, розглядається їх впровадження, переваги та ширше значення. Інновації в будівництві зумовлені потребою у сталості, ефективності та передових технологічних інтеграціях. ІВ сприяє цим інноваціям, забезпечуючи нові будівельні матеріали, методи будівництва та запатентовані технології, які покращують результати проєктів та зменшують вплив на довкілля. Фінансові інструменти, що розглядаються, включають державні гранти та субсидії, венчурний капітал, фінансування під заставу інтелектуальної власності та краудфандинг. Кожен з них має свої переваги - від розширення кола інвесторів до забезпечення стратегічного капіталу та заохочення розподілу ризиків між різними зацікавленими сторонами. Однак ці фінансові рішення не позбавлені проблем, зокрема труднощів з оціною ІВ, несприйняття інвесторами ризиків та загальної необізнаності про наявні фінансові механізми. Систематично аналізуючи застосування цих фінансових інструментів у реальних ситуаціях, ця стаття висвітлює їхню ефективність у сприянні розвитку ІВ та розглядає потенціал цих інструментів для трансформації фінансового ландшафту в будівництві. Обговорення поширенняся на стратегічні підходи, які будівельні компанії можуть застосувати для подолання проблем фінансування, такі як
покращення освіти в галузі управління ІВ, формування стратегічних партнерств та адаптація фінансових продуктів до специфічних галузевих потреб. Це дослідження сприяє кращому розумінню того, як інноваційні фінансові інструменти можуть бути використані для підтримки ІВ, що в кінцевому підсумку сприятиме більш стабільному, ефективному та інноваційному будівництву. Висновки дослідження мають на меті допомогти будівельним підприємствам, фінансовим установам та політикам оптимізувати використання таких інструментів, що забезпечить подальше впровадження інновацій та розвиток галузі на конкурентному світовому ринку.

Ключові слова: будівельні підприємства, НДДКР, фінансування будівництва, інвестиції, інноваційні фінансові інструменти, проєкт будівельного сектору.

**Formulation of the problem.** The relevance of the research is multifaceted and substantial, given the dynamic nature of both financial markets and the construction industry. This research is particularly important for several reasons. Construction enterprises increasingly rely on innovation to differentiate their services and products in a highly competitive market. Intellectual property (IP) such as patents, trademarks, designs, and proprietary technologies play a crucial role in safeguarding these innovations. The study explores how innovative financial instruments can support the development and protection of these assets, thus enhancing a firm's competitive edge.

Traditional funding methods may not adequately address the unique challenges of financing intellectual property, which is often intangible and does not provide immediate financial returns. Innovative financial instruments, such as intellectual property-backed securities, can provide necessary resources for research and development (R&D) activities in construction enterprises, enabling them to leverage their IP assets for growth. By focusing on the role of financial instruments in supporting IP, the research contributes to broader economic objectives, such as fostering innovation-led growth and sustainable development within the construction industry. These insights can guide policymakers and financial institutions in designing mechanisms that promote long-term investments in innovation. There is a relative scarcity of focused studies on the intersection of finance and intellectual property in the construction sector. This research addresses this gap by providing empirical data and theoretical analysis that can help in understanding the impact of financial instruments on IP development, offering valuable insights for academics, industry practitioners, and financial strategists. Overall, this research is relevant as it not only enhances the understanding of how innovative financial tools can be utilized to support IP in construction but also provides a foundational framework for future studies and policy-making that can have far-reaching effects on industry practices and economic policies.
Analysis of recent research and publications. The significance of innovative financial instruments in nurturing intellectual property (IP) within the construction industry has garnered increasing scholarly attention. This literature review synthesizes key contributions and insights from various studies, articles, and reports that explore this intersection, highlighting the evolving dynamics, effectiveness, and strategic importance of these financial tools.

One of the foundational texts in this area, Virchenko V. [1], provides an extensive theoretical framework on the role of financial instruments in IP development, asserting that financial innovation can accelerate the commercialization of new technologies and methodologies in construction. They argue that traditional financing methods are often inadequate for covering the costs associated with developing and protecting IP, necessitating more tailored financial solutions.

Chuvpylo V., Shevchuk S., Hapon S., Nahorna S., & Kuryshko R. [6] conducted an empirical analysis on the use of intellectual property bonds within large construction firms. Their findings indicate that these bonds significantly enhance a firm’s ability to invest in R&D, leading to a marked increase in patent filings and IP registrations. This study is pivotal in demonstrating the direct benefits of leveraging IP assets for financial gains. The growing trend of sustainability in construction has led to increased use of green bonds. Fan Su-Ling [9], Rohovyi S. & Yurchenko O. [13] explores how construction companies use green bonds to fund projects that adhere to environmental standards and contribute to sustainable development goals. They posit that green bonds not only provide capital but also enhance a firm's reputation and marketability by aligning with global sustainability trends.

Despite the optimistic outlook on innovative financial instruments, some literature highlights the challenges and limitations of these approaches. Adibfar A., Costin A., Issa R. [7] discuss the difficulties in valuing IP accurately, which can complicate the process of securing IP-backed financing. They recommend improved valuation methodologies and greater transparency in financial reporting to mitigate these issues. Zhosan H. & Kyrychenko N. [2] critiques the reliance on external financing and suggests that it may lead firms to prioritize short-term innovations at the expense of long-term R&D. He calls for a balanced approach that also considers internal funding mechanisms to sustain continuous innovation.

The reviewed literature collectively underscores the pivotal role of innovative financial instruments in supporting IP development in the construction industry. However, it also suggests that while these tools can provide significant benefits, they come with their own set of challenges that need careful management. Future research should explore the long-term impacts of these financial instruments on a firm's innovative output and competitive standing in the market. Additionally, further investigation into the integration of digital technologies with these financial tools could provide deeper insights into their evolving role in the construction industry.
The purpose of the article. The primary purpose of this research article is to explore how innovative financial instruments can be utilized to support the development and protection of intellectual property (IP) within the construction industry.

Objectives of the research:
– to identify and analyze innovative financial instruments used in the construction industry;
– to identify challenges and limitations associated with financial instruments in IP development;
– develop actionable recommendations for construction enterprises on effectively utilizing financial instruments to support IP and for policymakers to create conducive environments for such practices.

Presenting main material. Intellectual property (IP) is often thought of as a crucial asset in industries such as technology, entertainment, and pharmaceuticals, where patents and trademarks are vital for protecting innovations and maintaining competitive advantages. However, the importance of intellectual property in the construction industry is equally significant, albeit less highlighted. The construction industry is continually evolving, driven by demands for sustainability, efficiency, and advanced technological integration. Intellectual property plays a crucial role in this evolution by protecting the innovations that distinguish companies from their competitors. For instance, patents protect technical inventions, including new building materials, construction methods, or machinery, which can significantly reduce costs, improve efficiency, or enhance the environmental sustainability of construction projects. The assurance that these innovations are protected under intellectual property law encourages ongoing investment into research and development (R&D), fostering further innovation and technological advancement in the sector.

Intellectual property provides construction firms with a legal tool to safeguard their unique products and services, which can establish a significant competitive edge. Trademarks, for example, protect logos, names, and other brand identifiers that distinguish a company’s reputation for quality and reliability. This is particularly important in the construction industry, where reputation and trust are paramount. Similarly, copyrights can protect architectural designs and other creative works, ensuring that original designs are not used without permission or appropriate licensing, thus maintaining a firm’s uniqueness in the market [15].

Intellectual property not only protects individual businesses but also stimulates the broader economic environment of the construction industry. By securing exclusive rights to innovations, firms can capitalize on their investments in creativity and innovation through commercialization opportunities such as licensing or direct sales. This potential for monetization creates a robust economic incentive for companies to invest in new technologies and solutions, contributing to the overall growth and dynamism of the industry. Moreover, as construction firms innovate,
there is a multiplier effect throughout the economy, creating jobs, improving infrastructure, and enhancing productivity.

The existence of a strong legal framework for intellectual property rights (IPRs) is fundamental in providing the necessary security and stability for investment in new construction technologies and methodologies. Countries with robust IP laws see higher rates of innovation in the construction sector, as these laws ensure that inventors and creators can reap the rewards of their inventions without fear of infringement. This legal protection is critical in attracting both domestic and foreign direct investment into the construction industry.

Despite its benefits, managing intellectual property in the construction industry presents several challenges. The transient nature of many construction projects, along with the collaboration between multiple contractors and subcontractors, can lead to disputes over IP ownership and use. Construction companies must navigate these complexities by developing clear IP strategies, which include comprehensive IP clauses in contracts and proactive IP management throughout the project lifecycle. Furthermore, as the construction industry increasingly incorporates digital technologies like Building Information Modelling (BIM), 3D printing, and smart construction, the importance of intellectual property is set to increase, raising questions about data ownership, and the protection of digital designs and software [8].

However, the development and protection of intellectual property require substantial financial resources.

Developing and protecting intellectual property in the construction industry is an expensive and complex process. From the initial stages of researching and developing new materials or technologies to the legal costs associated with securing patents and trademarks, the financial burden can be substantial. Additionally, the construction sector's project-based nature often leads to high upfront costs and long payback periods, further complicating financial planning. Therefore, adequate financial support is crucial to nurture and safeguard innovations that can lead to more efficient, sustainable, and safe construction practices.

Sources of Financial Support:

1) Government grants and subsidies. Many governments recognize the importance of innovation in driving economic growth and offer grants and subsidies to support research and development in sectors like construction. These funds can help cover the costs of developing new technologies or processes that can be patented, as well as the legal costs of filing for and maintaining IP rights.

2) Venture capital and private equity. For high-potential IP developments, especially those involving cutting-edge technology or revolutionary construction methodologies, venture capital (VC) or private equity (PE) can provide significant financial resources. These investors not only bring capital but also strategic guidance, market access, and business acumen that can accelerate the commercialization of IP assets.
3) Intellectual property-backed financing. This innovative financial model involves using IP rights as collateral to secure loans or other forms of financing. This approach can be particularly useful for construction firms whose tangible asset base may be limited but who have valuable patents or trademarks.

4) Crowdfunding. While more common in consumer products, crowdfunding platforms can also be a viable option for raising funds for construction-related IP, particularly for projects with a strong community impact or innovative appeal that resonates with the general public.

Despite these sources of funding, several challenges remain in securing adequate financial support for IP in construction [14]:

– Valuation difficulties. Unlike physical assets, valuing IP can be challenging due to its intangible nature and the uncertainty regarding its future economic benefits;
– Risk aversion. Construction typically involves large-scale projects with significant risks. Financial institutions may be hesitant to invest in IP, which is perceived as an additional risk layer;
– Lack of awareness. Many construction firms, particularly small to medium enterprises (SMEs), may not be fully aware of the potential benefits of IP or the financial mechanisms available to support it.

To overcome these challenges and effectively finance IP in construction, several strategic approaches can be adopted:

– Education and awareness. Increasing awareness about the importance of IP and the existing financial support mechanisms among construction firms is crucial. This includes educating firms on how to manage IP strategically and leverage it for financial gains;
– Partnerships and collaborations. Building partnerships between construction firms and financial institutions, universities, or government bodies can facilitate better understanding and management of IP-related financial risks;
– Tailored financial product. Developing financial products specifically designed for the construction industry's unique needs can help mitigate the risks associated with IP financing. This might include more flexible repayment terms or using hybrid financing models.

The construction industry, with its capital-intensive nature and long project life cycles, requires substantial financial support to foster growth, innovation, and sustainability. Traditional financing methods often fall short in meeting these demands, especially when it comes to funding innovative projects or intellectual property (IP) development. Each of these instruments offers unique benefits and challenges, contributing to the transformation of financial landscapes in construction.

1. Intellectual property bonds. Intellectual property bonds are a novel financial instrument that allows construction firms to leverage their IP assets to raise capital. These bonds are secured by IP rights, such as patents, trademarks, or copyrights, that
the issuing company holds. The concept is particularly appealing in the construction industry where innovative building materials, methods, or technologies can be patented. Benefits: a) access to capital, IP bonds provide an alternative source of funding that does not require the dilution of equity or the securing of traditional collateral, which can be advantageous for companies with significant intellectual property but fewer physical assets; b) market differentiation by issuing IP bonds, companies can highlight their commitment to innovation and intellectual property, enhancing their reputation in the marketplace.

Challenges: a) valuation issues, determining the value of IP can be complex and subjective, potentially leading to difficulties in pricing the bonds accurately; b) Market acceptance, given their novelty, IP bonds may face skepticism from investors unfamiliar with valuing intellectual property, potentially affecting the liquidity and market for these instruments.

2. Venture financing. Venture capital (VC) provides a crucial source of funding for high-risk, high-reward projects within the construction industry, especially for startups and companies developing cutting-edge technologies.

Benefits: a) risk-tolerant capital – venture financing is uniquely suited for innovative construction projects that traditional lenders may view as too risky; b) beyond capital, venture capitalists often provide strategic guidance, industry connections, and operational expertise to help companies grow. Challenges: a) loss of control, in exchange for funding, VCs typically require equity and significant influence over company decisions, which can lead to conflicts with original owners; b) performance pressure, venture-backed companies may face intense pressure to deliver rapid growth and quick returns, which can be challenging in the construction industry where projects have longer durations [4].

3. Partner construction financing. Partner construction financing involves collaboration between different stakeholders in a construction project—such as developers, contractors, and financial institutions—to share the risks and rewards of the project. This can take the form of joint ventures, partnerships, or other collaborative financial agreements. Benefits: a) risk sharing: by spreading the financial risk among multiple parties, each participant can undertake projects that might be too large or risky to handle individually; b) resource sharing – partners can also share resources, expertise, and networks, which can lead to more efficient project execution and innovation. Challenges: a) complex coordination, managing a partnership or joint venture can be complex, requiring alignment on project goals, risk management, and profit distribution; b) legal and regulatory hurdles, these arrangements can be subject to intense legal scrutiny and regulatory compliance, requiring detailed contracts and clear agreements (table 1).
Table 1.

Various innovative financial instruments can be utilized by construction enterprises to support and enhance their intellectual property development (composed by the author)

<table>
<thead>
<tr>
<th>Type of Financial Instrument</th>
<th>Possibility of Implementation</th>
<th>Advantages of Use</th>
<th>Significance for a Construction Enterprise</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intellectual Property Bonds</td>
<td>Moderate</td>
<td>- Raises capital based on the value of IP</td>
<td>- Facilitates investment in R&amp;D. Enhances the company's innovation capacity</td>
</tr>
<tr>
<td>Venture Financing</td>
<td>High</td>
<td>- Provides substantial capital. Offers expertise and networking opportunities</td>
<td>- Supports high-risk, innovative projects. Can accelerate growth and technological adoption</td>
</tr>
<tr>
<td>Partner Construction Financing</td>
<td>High</td>
<td>- Spreads financial risk. Allows resource sharing</td>
<td>- Enables undertaking of larger projects. Promotes collaborative innovation</td>
</tr>
<tr>
<td>Green Bonds</td>
<td>High</td>
<td>- Attracts eco-conscious investors. Funds sustainable projects</td>
<td>- Supports environmental sustainability initiatives. Improves public image and compliance with regulations</td>
</tr>
<tr>
<td>Crowdfunding</td>
<td>Moderate</td>
<td>- Broadens investor base. Engages community support</td>
<td>- Allows for smaller, innovative projects. Enhances market validation and community involvement</td>
</tr>
</tbody>
</table>

Each instrument offers distinct advantages and possibilities, influencing the strategic decisions of construction firms aiming to innovate and grow in a competitive market.

Innovative financial instruments have become increasingly vital for construction enterprises, enabling them to tackle the industry’s unique financial challenges, drive innovation, and facilitate sustainable growth. We investigate five specific examples of how construction companies globally have utilized innovative financial tools—ranging from intellectual property bonds and venture financing to partner construction financing, green bonds, and crowdfunding—to enhance their financial and operational capabilities.

1. Intellectual property bonds: Skanska’s green patent financing. In a pioneering move, Skanska, a Swedish construction giant, effectively utilized intellectual property bonds, securing funding based on the patents they hold for environmentally friendly building technologies. These bonds allowed Skanska to raise capital specifically tied to their portfolio of green patents, underlining the potential of IP bonds to support sector-specific innovations. This strategy not only provided Skanska with necessary funds but also highlighted their commitment to sustainability, attracting eco-conscious investors [11].

2. Venture Financing. “Katerra’s Technological Disruption”. “Katerra”, a U.S.-based tech-driven construction firm, received substantial venture capital to...
revolutionize building processes through technology. By integrating technology in construction—from 3D printing to modular construction methods—Katerra attracted over $1 billion in funding from venture capital firms like “SoftBank’s Vision Fund”. This influx of capital supported “Katerra’s” ambitious R&D efforts and expansion plans, although it’s noteworthy that despite this innovative approach, “Katerra” eventually faced operational challenges, underscoring the high-risk nature of venture capital investments in construction [3].

3. Partner Construction Financing. “Hudson Yards Development”. The “Hudson Yards” project in New York City is a prime example of partner construction financing, where multiple stakeholders, including developers like Related Companies and Oxford Properties, collaborated with financial institutions and public entities. This partnership facilitated the funding of one of the largest private real estate developments in the U.S., demonstrating how collaborative financial efforts can successfully manage the immense costs and risks associated with mega projects [15].

4. Green Bonds. Lendlease’s Sustainable Projects. Australian multinational company Lendlease issued green bonds to fund the construction of environmentally sustainable projects across their global operations. These bonds are designed to attract investors interested in eco-friendly developments, providing Lendlease with the capital to pursue projects with sustainable design, energy efficiency, and reduced carbon footprints. This use of green bonds not only supported Lendlease’s sustainability goals but also tapped into the growing market of green investment, showcasing a strong alignment between financial instruments and corporate environmental strategies.

5. Crowdfunding. Small-Scale Real Estate Developments. On a smaller scale, numerous real estate developers have turned to crowdfunding platforms to finance innovative construction projects. These platforms allow individuals to invest in real estate projects for as little as a few hundred dollars, democratizing access to real estate investment and providing developers with a broad base of small investors. An example is the use of platforms like “Fundrise” or “RealtyMogul”, which enable the funding of innovative projects, including eco-friendly buildings and community-focused developments, without the need for traditional lending or large capital outlays [10].

The system of anti-crisis financial management of the construction enterprise is a set of constantly IP, interdependent and interconnected elements within the management process, which aim not only to prevent financial crises and predict them, but also to overcome already existing crises or minimize their harmful impact on the company, using for this, all available managerial potential. The features of anti-crisis financial management can be summarized by two key provisions [5]. On the one hand, it is the implementation of preventive measures, which include a systematic analysis of the company’s strengths and weaknesses, assessment of bankruptcy risks, risk management (identification, assessment and minimization)
and implementation of a set of preventive actions. On the other hand, it is the management of finances with the aim of helping the enterprise to get out of a crisis state, in particular through rehabilitation or restructuring [6]. Therefore, the integral formation of the "objective tree" of anti-crisis management and the determination of its place in the general system of construction enterprise management objectives is an important step (Fig. 1).

<table>
<thead>
<tr>
<th>The main goal</th>
<th>Ensuring the financial balance of the construction enterprise in conditions of certainty, uncertainty and risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>The main goals</td>
<td>Maintain financial stability and stable development of the enterprise</td>
</tr>
<tr>
<td></td>
<td>Elimination of insolvency</td>
</tr>
<tr>
<td></td>
<td>Restoration of financial stability</td>
</tr>
<tr>
<td></td>
<td>Change in financial strategy</td>
</tr>
<tr>
<td>Auxiliary purposes</td>
<td>Structural</td>
</tr>
<tr>
<td>- formation of financial funds;</td>
<td>- formation of fixed capital;</td>
</tr>
<tr>
<td>- formation of working capital;</td>
<td>- the structure of own and loan sources.</td>
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<td>- the structure of own and loan sources.</td>
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**Fig. 1. Targeted provision of the anti-crisis financial management system at the construction enterprise (composed by the author)**

Thus, anti-crisis financial management should be considered as part of the overall construction enterprise management system, with the main mission of timely identification of financial problems before they turn into a crisis and the development of effective strategies to prevent such a crisis. It is worth noting that the development of anti-crisis financial management is determined by a detailed analysis of crisis phenomena, their scope, causes, risk factors and prevention strategies [12]. The goal tree is an important component in creating a system of anti-crisis financial management in the organization, representing a hierarchical structure where each lower level details the goals set at a higher level. In this system, primary,
secondary and auxiliary goals are considered part of a single integrated system, the purpose of which is the development and implementation of management decisions or actions to achieve the required behavior of the management object under the influence of various external factors to fulfill the tasks [5].

**Conclusions.** Innovative financial instruments like intellectual property bonds, venture financing, and partner construction financing offer promising alternatives to traditional construction financing methods. Each instrument provides unique mechanisms for supporting innovation, managing risks, and enhancing financial flexibility in the construction industry. However, the successful implementation of these instruments requires careful consideration of their challenges, particularly regarding valuation, market acceptance, and management of partnerships. As the construction industry continues to evolve, these financial instruments will play a critical role in enabling the development of new technologies and methodologies, ultimately contributing to the industry’s growth and sustainability. The construction industry’s landscape is evolving with the introduction of innovative financial instruments. From intellectual property bonds and venture capital to green bonds, partner financing, and crowdfunding, these tools provide construction enterprises with new ways to manage financial risks, fund innovation, and meet increasing demands for sustainability and efficiency. Each example demonstrates the potential and challenges of these instruments, reflecting a broader trend towards more diversified and strategic financial planning in construction. These innovations not only help companies achieve their operational goals but also attract a wider range of investors by aligning project financing with broader economic and social trends.

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