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Review Paper

Blockchain as a Driver of Innovation in the Fintech Industry and Modern Financial Markets

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Abstract: *This paper aims to analyze the role of blockchain technology in the transformation of the financial sector, with particular emphasis on its application within FinTech solutions and its potential to drive structural changes in financial markets. Over the past decade, FinTech has experienced rapid growth, significantly reshaping traditional financial services through digital innovation. This evolution is characterized by the integration of technologies that enable novel forms of access to financial products and services, including online banking, mobile payments, and digital lending platforms. Concurrently, there has been a pronounced increase in investment in technological innovations within the financial sector, reflecting a high level of market and institutional interest in FinTech solutions. Within this ongoing digital transformation, blockchain technology stands out as a disruptive infrastructure with the capacity to redefine operational, security, and regulatory frameworks of current financial systems. Its core attributes: decentralization, immutability of records, and transparency, facilitate accelerated transaction processing, reduction of transaction costs, elimination of intermediaries, and enhanced security of*

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financial operations. Special attention in the analysis of modern FinTech innovations is given to smart contracts and decentralized finance (DeFi).

Keywords: *FinTech, blockchain, financial markets, innovation.*

Blockchain kao pokretač inovacija u FinTech industriji i savremenim finansijskim tržištima

Apstrakt: *Ovaj rad ima za cilj da analizira ulogu blockchain tehnologije u transformaciji finansijskog sektora, sa posebnim osvrtom na njenu primenu u okviru FinTech rešenja i njen potencijal da utiče na strukturne promene na finansijskim tržištima. Finansijsko-tehnološki sektor (FinTech) u poslednjoj deceniji beleži intenzivan rast, uz značajno preoblikovanje tradicionalnih finansijskih usluga putem digitalnih inovacija. Ovaj razvoj karakteriše integracija tehnologija koje omogućavaju nove oblike pristupa finansijskim proizvodima i uslugama, uključujući onlajn bankarstvo, mobilna plaćanja i digitalne platforme za kreditiranje. Paralelno sa tim, beleži se i snažan rast investicija u tehnološke inovacije unutar finansijskog sektora, što ukazuje na visok nivo tržišnog i institucionalnog interesa za FinTech rešenja. U okviru ovog procesa digitalne transformacije, blockchain tehnologija se izdvaja kao disruptivna infrastruktura sa potencijalom da redefiniše operativne, sigurnosne i regulatorne aspekte savremenih finansijskih sistema. Njene ključne karakteristike: decentralizacija, nepovratnost zapisa i transparentnost, omogućavaju ubrzanje transakcija, smanjenje transakcionih troškova, eliminaciju posrednika i unapređenje sigurnosti finansijskih operacija. Posebnu pažnju u analizi savremenih FinTech inovacija zaslužuju pametni ugovori i decentralizovane finansije (DeFi).*

Ključne reči: *FinTech, blockchain, finansijska tržišta, inovacije.*

1. Introduction

The development of the Financial Technology (FinTech) sector over the past decade has marked a significant shift in the paradigm of financial resource management and the provision of financial services. This period has been characterized by a profound transformation, enabled by innovative technologies such as blockchain and open banking interfaces. The expansion of digital payment systems and the entry of new market players have continuously redefined the possibilities for delivering financial solutions. Among these, blockchain technology stands out as a key element, enabling the creation of immutable and decentralized transaction records that eliminate the need for intermediaries in the process of automatic verification. This technological framework reduces transaction costs and increases efficiency, particularly in the context of international transfers and microtransactions. The

implementation of blockchain in financial operations enables service diversification, opening new possibilities ranging from cryptocurrencies to smart contracts. Smart contracts automate the execution of contractual obligations, thereby disrupting traditional business models, especially within the banking sector. However, challenges such as scalability, the high energy consumption associated with algorithms like Proof of Work (PoW), and regulatory uncertainty pose significant obstacles to broader adoption.

In parallel, the concept of open banking has emerged as a vital component of the financial sector's transformation through the implementation of standardized APIs, which facilitate secure and efficient data exchange between banks and third-party providers. This practice further stimulates market competition by granting FinTech companies access to user data, allowing them to offer personalized services. The use of platforms such as Wise, which reduces fees on international transactions, serves as a practical example of successful synergy between open banking and FinTech innovations.

Moreover, the integration of open banking with non-financial services, such as e-commerce and logistics, further underscores its relevance. Varying regulatory frameworks across the globe influence the pace of innovation as well as the degree of market fragmentation. The synergy between blockchain technologies and open banking is becoming increasingly evident, aiming to combine transparency with interoperability. For instance, automated credit approval processes based on data accessed via open banking platforms have reduced processing times from days to minutes.

Nevertheless, the success of these innovations largely depends on the ability of regulatory frameworks to strike a balance between consumer protection and support for technological advancement, especially considering growing concerns regarding data security and cyber threats. This paper aims to provide an analysis of the evolution of the FinTech sector over the past decade, highlighting key technologies, emerging trends, and the challenges shaping this dynamic segment of the financial market.

2. Materials and methods

To analyze the role of blockchain technology in transforming the financial sector, this study adopts qualitative research methodology as the primary approach for collecting and interpreting data. The use of secondary data sources provides a comprehensive understanding of the current state and prospects of blockchain within financial services. The research material includes relevant academic literature, reports from international financial

institutions, as well as case studies of successful FinTech solutions based on blockchain technology. These sources offer valuable insights into market trends, regulatory frameworks, and the technical characteristics of decentralized financial systems. The main research method applied is the descriptive-analytical approach, which enables an in-depth understanding of the functionalities and implications of blockchain technology. Combined with a comparative analysis, this method allows for the examination of differences between traditional financial models and innovative FinTech solutions that incorporate blockchain. Through this comparative perspective, the paper explores how blockchain is reshaping financial transactions, data management, and the protection of user identity. Additionally, this section explores key technological innovations and the related challenges within the FinTech sector, structuring the content into two thematic segments: (1) the development of digital financial models and (2) the ethical and regulatory framework.

Digital innovations, ranging from Decentralized Finance (DeFi) and Web3, to Embedded Finance and super-apps, are fundamentally reshaping access to financial services:

- Decentralized Finance (DeFi) and Web3: DeFi leverages blockchain and smart contracts to autonomously execute financial services (e.g., lending, derivative trading) without intermediaries, potentially reducing transaction costs and processing times by up to 80% (Tapscott, 2020). Decentralized exchanges (DEXs) such as Uniswap directly connect users, while Web3 platforms enable data ownership and decentralized applications (DApps), exemplified by projects like Decentraland and Brave Browser (Tapscott, 2020).
- Embedded Finance: The integration of banking services directly into non-financial platforms (e.g., Alipay, AWS Banking-as-a-Service) facilitates personalized financial offerings and micro-lending based on user data, reducing loan approval times from weeks to mere seconds (Bashir, 2020; Feyen et al. 2021).
- Super-Apps: These consolidate payment services, social networking, and other functionalities within a single ecosystem (e.g., WeChat Pay, India's UPI), resulting in over 4 billion monthly transactions and widespread QR payment adoption by 87% of merchants (Deloitte, 2018).

Despite these advancements, emerging technologies introduce numerous challenges that require a balance between innovation and consumer protection:

1. Algorithmic Bias and Financial Inclusion: AI-driven credit assessment tools (e.g., robo-advisors, Lending Club) may perpetuate bias based on alternative data sources (e.g., social media, mobile transactions), disproportionately affecting underrepresented groups (Feyen et al. 2023; Walker et. al, 2022).

2. Privacy and Security: The use of personal data for risk assessment must comply with GDPR, while energy-intensive Proof-of-Work networks are being replaced by more efficient consensus mechanisms (e.g., Proof-of-Stake), reducing energy consumption by up to 99% (Tapscott, 2020; Walker et al., 2022).
3. Regulatory Technology (RegTech) and Compliance: Automation of KYC (Know Your Customer) and AML (Anti-Money Laundering) processes through AI and blockchain (e.g., Aadhaar in India, regulatory sandboxes under the UK Financial Conduct Authority) lowers compliance costs and accelerates onboarding. However, fragmentation of standards across jurisdictions presents significant regulatory challenges (Vuković et al., 2022; Feyen et al., 2023).
4. Sustainability and ESG Integration: Solutions for tracking carbon footprints (e.g., IBM Food Trust), tokenization of green assets, and ESG rating systems (e.g., Sustainalytics) enhance transparency. Nevertheless, the lack of unified standards—such as the EU's Sustainable Finance Disclosure Regulation (SFDR) versus multiple frameworks in the U.S.—and the prevalence of greenwashing remain critical barriers (Walker et al. 2022; Vuković et al., 2022).

3. Research and results

3.1. Transition from Traditional to Digital Business Models

The shift to digital business models has become essential in an era dominated by technological innovation and evolving customer expectations. This transition is driven by technological enablers such as cloud computing, the Internet of Things (IoT), blockchain, and artificial intelligence (AI), all of which facilitate faster, more efficient, and personalized services. For instance, cloud computing eliminates the need for costly infrastructure by offering flexible, pay-as-you-go resources—particularly beneficial for small and medium-sized enterprises. Blockchain technology, on the other hand, redefines trust through decentralized transactions, as demonstrated by examples such as Storj (decentralized data storage) and Airbnb (a cooperative accommodation rental platform) (Tapscott & Tapscott, 2018).

The COVID-19 pandemic was a key catalyst in accelerating this digital shift. The forced move to remote work revealed the advantages of digital tools such as video conferencing platforms and project management systems, resulting in sustained productivity gains and reduced operational costs. According to research by the McKinsey Global Institute, 70% of employees believe remote

work makes their job easier, while a report by the World Economic Forum notes that 50% of employers plan to retain hybrid work models. This transformation has also driven broader adoption of machine learning (ML) in business analytics, optimizing logistics, supply chain management, and customer engagement (Dedić & Ilić, 2020).

Despite its potential, digital transformation comes with challenges. Algorithmic bias and digital exclusion are major concerns, especially in low-income countries lacking infrastructure or digital skills. Organizations must balance efficiency with ethical responsibility, ensuring that systems do not discriminate against vulnerable groups and that human interaction remains an option (International Labour Organization, 2024). The application of blockchain in public services—such as transparent land management in Honduras—demonstrates its potential to reduce corruption, but also highlights the need for robust regulatory frameworks. Ultimately, successful transformation requires cultural change within organizations. Companies like Amazon and Google have become industry leaders by integrating AI and cloud computing into their business models. Blockchain-focused startups such as Verisart (used for verifying the authenticity of artworks) have shown the value of decentralization. Key conditions for sustainable transformation include continuous workforce education, interoperable digital strategies, and strong governance mechanisms that go beyond mere technical capacity.

3.2. Development of the FinTech market

The global FinTech market has been experiencing exponential growth, particularly in the digital payments sector, where 770 billion transactions were recorded in 2020, with mobile money transactions reaching a value of USD 767 billion across more than 300 million active accounts (Feyen et al. 2023). This trend is especially pronounced in Sub-Saharan Africa, where 274 billion transactions were registered during the same period, underscoring the region's dominant role in global digital transformation. The global FinTech market continues to expand, especially in digital payments. Data from 2023 shows that over 1,5 trillion transactions were recorded worldwide, while the total value of mobile money transactions reached approximately USD 1,5 trillion, with more than 600 million active accounts (African Development Bank, 2023). Sub-Saharan Africa stood out once again, with mobile money transactions reaching a value of USD 400 billion, further positioning the region as a key player in the global digital economy (Bloomberg, 2023).

The COVID-19 pandemic further accelerated the adoption of FinTech solutions. In 2020, the number of mobile money users increased by 13%, while the value of mobile transactions rose by 22% (Feyen et al. 2023). In the United States, FinTech usage grew from 36% to 42% among consumers, indicating a clear

behavioral shift toward digital platforms (Deloitte, 2022). By 2021, the number of mobile money users had grown by 18% compared to the previous year, with mobile transaction value increasing by 30% (Feyen et al., 2023). In the U.S., FinTech usage rose from 50% to 58% among consumers, reinforcing the trend of digital adoption (Deloitte, 2023).

Simultaneously, digital banking has become increasingly dominant, with 90% of users regularly accessing online channels and 80% relying on mobile applications. Although traditional channels such as ATMs and physical branches still report high usage rates, digital interactions are steadily overtaking them in frequency (African Development Bank, 2023). Japan remains a notable exception, where only 12% of users engage in online banking, pointing to cultural and infrastructural differences in the pace of digital transformation (European Commission, 2022). Furthermore, interaction quality remains a challenge: research shows that a significant percentage of users still prefer traditional channels when dealing with complex issues, even though FinTech companies have long offered fast and efficient digital lending processes (CFA Institute, 2022).

The growth of the FinTech market is reflected not only in the number of transactions but also in the expansion of services and the deployment of innovative technologies. FinTech companies such as Wise and Square have expanded their ranges from international money transfers to debit cards and business loans. At the same time, Big Tech giants such as Alibaba and Amazon are integrating financial services into their platforms, leveraging massive data sets to deliver highly personalized financial products (Deloitte, 2022). In addition, High-Frequency Trading (HFT), which relies on algorithms to execute trades in milliseconds—contributes to long-term market liquidity, though it can create short-term arbitrage opportunities for privileged players. This technology, rooted in big data analytics, highlights the role of data-driven decision-making in modern finance, while also raising the need for stricter regulation to protect smaller investors.

Cryptocurrencies also play a key role in expanding the FinTech ecosystem. Bitcoin, despite its volatility, is becoming increasingly relevant as a tool for portfolio diversification and a form of digital asset, attracting growing interest from institutional investors. Real-time blockchain transaction monitoring, enabled by big data technologies, enhances transparency and trust, making it attractive to sectors such as healthcare and intellectual property (FinTech Global, 2023).

While the impact of FinTech is undeniable, regional disparities persist. Sub-Saharan Africa leads in mobile money adoption, whereas countries with more advanced financial infrastructure are seeing slower adoption due to regulatory

barriers and competition from traditional banks (Deloitte, 2022). On the other hand, mobile innovations have improved financial inclusion in 49 countries, demonstrating FinTech's capacity to overcome structural barriers. In 2023, mobile-based financial services continued to drive inclusion globally, with research indicating that this ubiquity of mobile platforms creates new opportunities for economic development by overcoming traditional limitations (Feyen et al., 2023).

3.3. Green Finance

Green finance refers to financial solutions aimed at sustainable development, combining environmental, social, and economic objectives. This field encompasses green financial institutions, instruments, and securities that support initiatives such as renewable energy, energy efficiency, and social inclusion. The concept of "green" in the financial sector is defined as the development of new products and services, or modifications to existing ones, with the primary goal of preserving the environment (Dimić & Paunović, 2019).

According to Dimić and Paunović (2019) There are three progressive levels of "greening" within the operations of financial institutions:

1. *Operational Impact Reduction*: This level involves improving the internal operations of financial institutions, such as offering online access to financial services. By digitizing customer interactions, institutions reduce time and operational costs—such as those related to office supplies and postal services—which can ultimately lead to more affordable financial products and services.
2. *Green Product and Service Innovation*: At this level, institutions develop and introduce new financial products aimed specifically at supporting environmental protection. These offerings not only contribute to sustainability efforts but also promote environmental awareness among clients by fostering a sense of participation in ecological preservation.
3. *Social and Environmental Risk Management Systems*: The highest level of greening involves integrating comprehensive systems that assess and manage the environmental and social impact of all stakeholders. This strategic approach ensures that financial institutions go beyond operational improvements and product development, actively monitoring and mitigating the broader sustainability effects of their business activities.

The European Union is a key player through projects such as smart cities and WiFi4EU (free public internet), which integrate digital infrastructure with sustainability, reducing reliance on physical resources and promoting energy efficiency. Through its digital agenda, the EU has enabled €425 billion in

savings for top manufacturers by leveraging cloud computing and big data technologies, leading to more efficient resource use and reduced energy footprints (Lazović & Đurković, 2018). Blockchain plays a role in ensuring transparency within these institutions. For example, decentralized platforms like LO3 Energy allow neighbors to trade renewable energy directly, eliminating intermediaries and lowering emissions (Tapscott & Tapscott, 2018).

Green financial instruments include green loans and green bonds. The issuance of the first green bonds began in 2007, led by the European Investment Bank and the World Bank. One year later, the European Bank for Reconstruction and Development (EBRD) joined this initiative. Since then, the EBRD has issued various types of green bonds aimed at promoting environmental sustainability, climate resilience, and the transition to a green economy (Dimić et al., 2023). In March 2013, the International Finance Corporation (IFC) issued green bonds worth one billion US dollars, which were sold within just one hour. Shortly after, the first corporate green bonds were introduced by Swedish real estate company Vasakronan. This was followed by major corporate issuers such as SNCF, Berlin Hyp, Apple, Engie, ICBC, and Crédit Agricole (Dimić et al., 2023).

As highlighted in the EU's smart cities strategy, digitization is crucial for optimizing energy consumption—deployment of 5G networks and IoT can significantly improve energy efficiency and reduce environmental impact by optimizing resource usage, aligning with the goals of the EU digital agenda. Similarly, cloud-based machine learning optimizes energy use in data centers through algorithms that dynamically adjust resources based on demand, indirectly reducing the energy footprint (Dedić & Ilić, 2022). However, digital exclusion, such as lack of internet access in poor regions, limits the benefits of these tools.

Green securities, tokenized projects, enable investments in sustainable financial instruments. Blockchain platforms like the Stellar Development Foundation facilitate microloans in developing countries—for instance, in Nicaragua, where fishermen create pooled loans for equipment—while LO3 Energy uses tokens for trading locally generated renewable energy. These models combine financial inclusion with environmental awareness. Nevertheless, technical infrastructure and low digital literacy remain barriers (International Labour Organization, 2024). Prospects lie in interoperable digital strategies that link public institutions, the private sector, and citizens. For instance, integrating blockchain into public administration can improve carbon footprint tracking and investment transparency. According to the International Labour Organization, it is essential that digital tools do not contribute to the exclusion of vulnerable groups but rather actively support the SDGs through ethically guided implementation, especially in the areas of social inclusion,

decent work, and institutional strengthening (International Labour Organization, 2024).

3.4. Practical Applications of Smart Contracts within the Decentralized Finance Ecosystem

Blockchain technology represents a revolutionary advancement in ensuring the integrity of financial transactions through a combination of decentralization, cryptography, and immutability of records. The distributed nature of the blockchain network eliminates the need for a central authority, as each transaction is stored across thousands of nodes worldwide, thereby preventing a single point of failure or hacking. This structure allows changes to the ledger to occur only through the consensus of all participants, effectively making unauthorized modifications virtually impossible (Tapscott & Tapscott, 2018). As an additional layer of security, blockchain employs asymmetric encryption using public and private keys, ensuring that only the holder of the private key can initiate a transaction, while the public key is used to verify its authenticity (Dorfleitner & Braun, 2019).

Transparency is another key aspect of this technology. Every participant in the network has access to the same data, eliminating discrepancies between financial institutions and regulators. For example, in traditional systems, transaction settlements can take days due to differing internal ledgers, whereas blockchain automatically synchronizes data in near real-time (Tapscott & Tapscott, 2018). This not only reduces operational costs but also prevents abuse such as double spending or falsification of transaction records. The immutability of blocks further enhances trust: once a transaction is confirmed, it becomes part of a chain that cannot be retroactively altered without leaving a detectable trace, which is especially critical in the context of audits and legal disputes.

Examples from green finance illustrate the practical application of these principles. Platforms such as IXO Foundation utilize blockchain to issue "Impact Tokens" that record reductions in CO₂ emissions, with each data point verified by independent evaluators before being added to the ledger. Similarly, *Climatecoin* tokenizes carbon credits, enabling users to track the origin of each ton of carbon dioxide through a transparent and immutable record. These applications demonstrate how technology not only enhances security but also creates standardized mechanisms for global collaboration in combating climate change.

Smart contracts and decentralized finance (DeFi) represent significant innovations within the blockchain ecosystem. Smart contracts are digital protocols that automatically execute obligations once certain conditions are met. These financial applications eliminate the need for intermediaries,

reducing costs and increasing efficiency. AI agents empowered by advanced large language models (LLMs), equipped with long-term memory and access to external tools such as code execution and market transaction processing, can autonomously analyze data, write code to create new agents, and iteratively update them, thus opening revolutionary possibilities for the application of smart contracts and DeFi protocols (Bashir, 2020; Aldasoro et al., 2024). These capabilities suggest that AI agents could automate the design, deployment, and management of DeFi projects with minimal human intervention, while also highlighting significant challenges regarding cybersecurity and the need for robust oversight mechanisms.

Smart contracts and decentralized finance (DeFi) represent some of the most innovative applications of blockchain technology, enabling the automation of complex processes and democratizing access to financial services. Smart contracts, as self-executing digital protocols, eliminate the need for intermediaries. For example, the *Airbnb platform* uses this technology to manage home rentals: upon payment confirmation, a smart contract automatically activates IoT devices such as smart locks, granting the user access to the property. The reputation of each participant is recorded on the blockchain, preventing data manipulation and increasing trust in the system. Similarly, *BOB 9000*, a decentralized autonomous organization (DAO), manages a network of temporal sensors via algorithms, where nodes automatically reward reliable data sources and penalize inaccurate ones, thereby maintaining the integrity of information (Tapscott & Tapscott, 2018).

In the decentralized finance (DeFi) sector, platforms such as *Abra* are redefining traditional financial services. This application leverages blockchain technology to enable microtransactions with fees as low as 0,25%, which is particularly beneficial in developing countries where banking costs are prohibitive. In the case of remittances, blockchain reduces transaction times from several days to mere hours, as exemplified by Analie Domingo's ability to send money from Canada to the Philippines without incurring high fees. Meanwhile, *Factom* offers a solution for land registries in Honduras, where ownership rights are securely stored on an immutable blockchain, preventing corruption and fraudulent alterations (Tapscott & Tapscott, 2018).

Examples from green finance further highlight the flexibility of this technology. The *Cryptoleaf* platform uses utility tokens (CLF) to finance environmental projects, giving investors voting rights over fund allocation. *Climatecoin* and *Poseidon* tokenize carbon credits, allowing users to directly offset their carbon footprint through transparent transactions. These models combine smart contracts with impact verification mechanisms, such as the IXO Foundation's use of "Impact Tokens" to track CO₂ emissions reductions, ensuring data reliability (Dorfleitner & Braun, 2019). Tokenization has a wide range of

applications. For example, *WePower* issues tokens representing future green energy production (1 kWh per token), while *Sun Contract* uses an auction system to determine energy prices in real time. However, this sector faces challenges such as a lack of regulation and high speculative activity, which can lead to token value volatility. Despite these issues, transparency and the reduction of intermediary costs make DeFi a key driver of innovation in finance.

4. Conclusion

Blockchain technology is a groundbreaking innovation that enhances the security and integrity of financial transactions by combining decentralization, cryptography, and immutable record-keeping. Unlike traditional systems, blockchain does not rely on central authority; instead, transactions are recorded across thousands of nodes worldwide, which prevents single points of failure and hacking. Changes to the ledger require agreement from all participants, making unauthorized alterations nearly impossible. Additionally, blockchain uses asymmetric encryption with public and private keys, so only the owner of the private key can authorize a transaction, while others can verify its authenticity with the public key.

Transparency is another vital feature, as all participants have access to the same data, eliminating discrepancies between institutions and regulators. Traditional financial settlements often take days due to inconsistent internal records, but blockchain synchronizes information almost instantly, reducing costs and preventing fraud like double spending. The permanent nature of blockchain records boosts trust, since once a transaction is confirmed, it cannot be altered without leaving a visible trace—critical for audits and legal matters.

Beyond finance, blockchain's principles benefit various industries. For example, it can improve supply chain traceability and compliance, and in healthcare, it enables patients to securely control their medical data while ensuring integrity. However, challenges such as scalability, high energy use (especially in Proof of Work systems), and regulatory concerns remain. Alternative consensus methods like Proof of Stake are being explored to address energy issues.

To support blockchain's growth, balanced regulatory frameworks are needed to protect consumers without hindering innovation. Cooperation between developers, regulators, and stakeholders can foster regulations that evolve with technology. Looking ahead, blockchain combined with technologies like AI and IoT promises to transform trust and efficiency in digital transactions. Ongoing research and collaboration will be key to unlocking its full potential and building a safer, fairer digital economy. Furthermore, as financial services and other sectors increasingly embrace blockchain solutions, it will be crucial to establish

comprehensive regulatory frameworks that safeguard consumers and foster innovation without stifling the rapid evolution of this technology.

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