



Prospects For the Use of Cryptocurrency Payments in The Retail Automotive Services Industry

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Abstract: The article presents a broad analysis of the prospects for using cryptocurrency payments in the retail automotive services industry. The study is conducted within an interdisciplinary paradigm that combines elements of digital economy, blockchain technologies, institutional regulation, and applied models of consumer behavior. Special attention is given to comparing empirical data on trust, intention, and user recommendations with the technical characteristics of consensus algorithms and peer-to-peer payment systems. Based on the analysis of recent studies, barriers and drivers of cryptocurrency adoption are examined, including issues of authentication security, network scalability, and resilience to fork risks. It is revealed that trust acts as the decisive factor for the acceptance of digital currencies, while technological reliability forms the foundation for institutional legitimacy and the scaling of payment practices. The study emphasizes the necessity of a comprehensive approach in which social attitudes and regulatory support strengthen the perception of reliability, while optimized blockchain mechanisms ensure transparency and transaction speed. The article offers an original interpretation of promising directions for the development of cryptocurrency payments in automotive services, including the integration of hybrid consensus solutions, institutional standardization, and adaptation to regional consumer behavior models. The material will be of interest to researchers in digital economy, transport innovations, financial technologies, and institutional governance, as well as practitioners working on the implementation of cryptocurrency payments in the automotive industry.

Keywords: Cryptocurrency payments, blockchain, automotive services, consumer trust, consensus algorithms, digital economy, retail services.

Introduction

The modern retail automotive services industry is undergoing a profound transformation driven by digital advancements. The growth of online services, the development of electronic platforms, and the implementation of financial technologies are shaping new interaction scenarios among consumers, automotive service companies, and manufacturers. Issues of payment convenience and security are coming to the forefront, directly linked to increasing demands for digital payment tools and transaction transparency.

The integration of cryptocurrency solutions, which enable payments without intermediaries or banking structures, is becoming particularly significant, offering global accessibility and high-speed transactions (de Anda-Suárez, 2025). At the same time, key challenges related to the volatility of digital currency exchange rates, consumer trust, and regulatory frameworks remain. These factors determine the pace and scale of cryptocurrency payment adoption in the daily practices of retail automotive services.

Interest in cryptocurrency payments is growing in the context of their technological advantages and as an element of strategic positioning for companies seeking to demonstrate innovation and customer focus (Akhter, 2022). Scientific and applied literature increasingly discusses consumer readiness to use cryptocurrencies for goods and services, the influence of trust and risk perception, and the potential for adapting existing blockchain platforms to the specifics of the automotive industry.

A comprehensive approach to studying the prospects of cryptocurrency payments requires examining the technical characteristics of the solutions used and analyzing the behavioral models of market participants. In this regard, research combining structural modeling methods, consensus algorithm testing, and an assessment of factors influencing the readiness to adopt innovations is of particular interest.

The purpose of this study is to conduct a systematic analysis of the prospects for using cryptocurrency payments in the retail automotive services industry, identify the key drivers and barriers to their implementation, and determine the development trends in technology and consumer behavior models that contribute to the formation of a sustainable digital infrastructure.

Methodology

The methodological foundation of this study is formed at the intersection of blockchain technologies, the digital economy, and applied models of consumer behavior analysis. The interdisciplinary nature of the topic necessitated a review of works dedicated to both the technological aspects of implementing

cryptocurrency payments and the socio-economic conditions for their adoption.

The study utilizes sources that reflect international experience in analyzing the implementation of digital solutions in the transport and automotive industry and related fields. Akhter (2022) proposed an edge-supported blockchain mechanism for authentication and cryptocurrency billing for electric vehicle charging, which established a link between distributed technologies and ensuring transaction transparency. Amamra (2025) revealed a hybrid consensus model combining Proof of Work and Proof of Stake, focusing on balancing computational load and energy efficiency in energy exchange networks. The analysis by de Anda-Suárez (2025) presented an integrated blockchain solution for autonomous transport systems, demonstrating the importance of secure communication in the automotive environment.

The technological perspective of the problem was supplemented by the findings of Gao (2023), which examined scenarios for blockchain application in "Internet of Vehicles" ecosystems. Similar issues of scalability and trust in digital services are addressed by Kalbhor (2024), who proposed an AI-Blockchain integrated parking management system, demonstrating the potential for implementing such solutions in urban infrastructure. The study by Khan (2021) introduced a model for peer-to-peer energy trading and cryptocurrency payments, which highlighted the significance of decentralized schemes in the context of electric transport. The socio-economic aspects of cryptocurrency use were covered in the work of Mofokeng (2024), who, based on a survey of online shoppers, investigated the relationship between the intention to use Bitcoin and the levels of trust and willingness to recommend. In turn, Okere (2024) considers the prospects of combining blockchain and machine learning methods in the "Internet of Vehicles," opening a path for integrating analytical solutions into automotive services. The topic of decentralized platforms for data collection and monetization in the auto industry was explored in the study by Samuel (2024), which tested the Substrate Hybrid Consensus model. Issues of trust and the perception of cryptocurrency as a payment tool were examined in detail by Shahzad (2024), who showed that trust is the cornerstone factor in the adoption and spread of digital currencies.

Thus, the methodological strategy of the research is based on a comprehensive analysis of sources that allowed for the connection of the technological characteristics of blockchain solutions, the institutional conditions of digital transformation, and empirical data on consumer behavior. This approach ensures a thorough examination of the prospects for cryptocurrency payments in the retail automotive

services industry.

Results

An investigation into the factors determining the intention to use cryptocurrency as a means of payment in the retail automotive services industry revealed that the category of trust plays a key role. The study by Mofokeng (2024) found that the perception of reliability and predictability of a digital currency has a direct and statistically significant impact on consumers' readiness to conduct transactions and their inclination to recommend this tool to other users. This finding corroborates the conclusions of Shahzad (2024), where trust is identified as the cornerstone factor in the process of cryptocurrency adoption in the mass market segment.

To test the relationships between trust, intention, and willingness to recommend, Mofokeng (2024) employed a structural equation model, which made it possible to quantitatively establish the contribution of individual factors to the overall variation in consumer behavior. In this context, normative pressure, viewed as an element of the institutional and social environment, acquires special significance. Despite its weak influence on the intention to use cryptocurrency itself, normative pressure enhances the willingness to spread positive experiences through

recommendations, reflecting the complex nature of the interaction between individual and external attitudes.

The analysis demonstrates that fostering sustainable consumer behavior in the realm of cryptocurrency payments is impossible without combining individual confidence in the technology with supportive institutional conditions. The works of Khan (2021) and Amamra (2025) show that decentralized platforms and hybrid consensus mechanisms can enhance infrastructure reliability, which in turn strengthens end-user trust. Consequently, the link between technological innovations and consumer behavioral models is a key direction for future research.

A comparison of data from different regions indicates that the perception of cryptocurrency may depend on the level of the economy's digital maturity and institutional support. The study by Shahzad (2024) showed that in countries with developing financial infrastructure, the factor of trust becomes even more significant than in more mature markets. Trust emerges as a universal variable that connects the technical characteristics of blockchain systems (de Anda-Suárez, 2025) with practical solutions in the automotive services sector. Table 1 examines the quantitative expression of the relationships between trust, intention, and recommendations.

Table 1. The influence of trust, normative pressure, and behavioral outcomes in Bitcoin adoption (Compiled by the author based on the source: (Mofokeng, 2024))

Indicator	Value (β)	Significance	Context (South Africa, n = 521)
Trust → Intention to use	0.216	p < 0.001	Online shoppers
Trust → Word-of-Mouth (WOM)	0.214	p < 0.001	Online shoppers
Normative pressure → Intention	0.003	Not significant (ns)	Online shoppers
Normative pressure → WOM	0.205	p < 0.001	Online shoppers
Explained variance (R²) Intention	75 %	—	Online shoppers
Explained variance (R²) WOM	80 %	—	Online shoppers

The data obtained confirm that trust acts as a decisive predictor of intentions and recommendations. Despite the limited impact of normative pressure on the direct intention to use cryptocurrency, its role in stimulating WOM indicates that institutional and social factors can accelerate the spread of innovation if properly

institutionalized. Combined with technological research by Gao (2023) and Okere (2024), which demonstrates the potential of scalable blockchain solutions in the automotive industry, it can be concluded that user trust and technological reliability form the basis for the sustainable implementation of cryptocurrency

payments in the automotive services sphere.

The study of the technological aspects of implementing cryptocurrency payments in the retail automotive services industry shows that the reliability and scalability of consensus algorithms play a crucial role. The work by Samuel (2024) examines the Substrate Hybrid Consensus model, which combines the BABE + GRANDPA and AuRa + GRANDPA mechanisms and demonstrates stable performance indicators of around 300 transactions per second. This level of throughput meets the requirements of services where high-speed processing of micropayments is critical, including the automotive services sector.

An analysis of the BABE + GRANDPA configuration revealed that this combination is effective under intensive network load, allowing for faster block finalization. However, with small time slots, an increased probability of forks was recorded, which creates additional risks for the stability of the payment infrastructure (Samuel, 2024). In contrast, the AuRa + GRANDPA pairing shows less sensitivity to such conditions, ensuring stability in managing data flows, although it is less flexible in adapting to dynamically changing loads.

These results should be interpreted within the broader context of the automotive industry's development. The study by Gao (2023) shows that blockchain is already being actively integrated into "Internet of

Vehicles" systems, facilitating data exchange between vehicles and infrastructure. At the same time, the work by Okere (2024) emphasizes the promise of combining blockchain platforms with machine learning algorithms to improve the quality of data flow analysis. Therefore, hybrid consensus mechanisms can be viewed not only as a technical solution for processing payments but also as the foundation of a digital ecosystem for automotive services, where transactions are linked with data transmission and monetization.

An important observation is that the development of cryptocurrency payments in automotive services is inextricably linked to the issue of user trust. As shown in the study by Shahzad (2024), trust becomes the determining factor in the adoption of digital currencies. This means that the stability and predictability of consensus algorithms, such as the Substrate Hybrid Consensus, directly affect the perceived reliability of the entire system. Similarly, the study by Akhter (2022) highlighted the role of distributed systems in enhancing transaction transparency for electric vehicle charging. The totality of these findings allows for the conclusion that technological aspects and behavioral factors must be considered as interconnected. Table 2 examines the comparative parameters of the Substrate Hybrid Consensus Blockchain, which allows for a more detailed analysis of the specifics of each algorithm.

Table 2. Parameters of Substrate Hybrid Consensus Blockchain for the automotive industry (Compiled by the author based on the source: (Samuel, 2024))

Consensus Algorithm	Application Features	Risk / Limitation	Performance
BABE + GRANDPA	Efficient for block finalization under high load	Increased risk of forks at small slots	~300 tps
AuRa + GRANDPA	Stable operation for crowdsourced data flows	Less flexible under rapidly changing load	~300 tps

The data obtained demonstrate that both mechanisms achieve comparable performance but differ in stability and adaptability. The choice of a specific configuration should depend on the operating conditions: for services with high transaction intensity, BABE + GRANDPA is preferable, whereas for scenarios involving long-term storage and processing of automotive data, AuRa + GRANDPA is the more reliable option. Thus, the technological basis for

cryptocurrency payments in automotive services must evolve towards optimizing consensus algorithms that account for the specifics of industry load and user expectations.

Discussion

The systemic development of cryptocurrency payments in the retail automotive services industry is shaped at the intersection of two blocks: consumer and technological. The study by Mofokeng (2024) shows

that user intentions are formed through trust and a willingness to share experiences, which indicates the social nature of the innovation adoption process. Trust, being a difficult asset to replicate, becomes the foundation for the adoption of any new financial practices.

The technological block provides the basis for strengthening this trust. Khan (2021) presents an architecture for peer-to-peer energy trading where cryptocurrency payments are integrated into the interaction process among participants. This model eliminates intermediaries and minimizes the risks of manipulation, which is directly related to increasing transaction transparency. Such solutions become a technological response to the challenges observed in consumer behavior, including concerns about reliability and control by third parties.

The study by Akhter (2022) emphasizes the security of authentication and the possibility of cryptocurrency billing. This indicates that technological innovations form a protective layer around processes that are perceived by consumers as having increased risks. A similar conclusion is found in de Anda-Suárez (2025), which examines the communication of autonomous transport systems where blockchain provides

protection against unauthorized interference. The technological aspect is not isolated but is embedded in the social dimension of trust. It is significant that even high technological maturity does not guarantee successful implementation without considering behavioral factors. The study by Shahzad (2024) notes that trust and the willingness to accept new forms of transactions remain decisive conditions for scaling cryptocurrency solutions. Therefore, technical reliability must be supported by social and institutional mechanisms that enhance user perception.

The contribution of technological innovations to consumer perception is also evident in the area of data management. Samuel (2024) showed that the choice of consensus algorithm affects the stability of the system and thereby the trust in the platform. Similarly, the study by Gao (2023) emphasizes that integrating blockchain into transport ecosystems increases the level of data exchange security and promotes the growth of trust. In these examples, trust acts as a bridge connecting technical indicators with behavioral expectations. Table 3 presents a comparative analysis of an empirical study on consumer factors and a technological analysis of blockchain consensus in the auto industry.

Table 3. Comparative results of cryptocurrency payment studies in automotive services (Compiled by the author based on the sources: [7, 9])

Focus	Methodology	Key Findings
Consumer behavior in online payments (Bitcoin)	Survey (n=384, South Africa)	Trust significantly predicts intention ($\beta=0.216$, $p<0.01$) and word-of-mouth recommendations ($\beta=0.214$, $p<0.01$). The model explains up to 80% variance.
Substrate Hybrid Consensus for automotive data monetization	Simulation of BABE + GRANDPA algorithms	Throughput ≈ 300 tps; finality time ~ 2 seconds; fork risk increases with short slots; fair monetization of crowd-sourced automotive data.

Comparing the data in Table 3 reveals the complementary nature of empirical and technological research. Mofokeng (2024) shows that consumer readiness to use cryptocurrency payments is formed through trust and social mechanisms of experience dissemination. This points to the key role of psychological factors that cannot be replaced by technological innovations alone. Simultaneously, Samuel (2024) focuses on consensus parameters that determine the technical stability of the platform. Here,

user trust is indirectly ensured by the network's stable operation and the minimization of fork risks.

The empirical and technological blocks merge into a single analytical system. Social attitudes create demand for reliable and transparent solutions, while technical parameters define the boundaries of their possible implementation. In this context, the conclusion of Khan (2021) is significant, where peer-to-peer payment models are seen as a tool for eliminating intermediaries,

which simultaneously reduces transaction costs and strengthens trust. A similar logic is evident in the study by Akhter (2022), where the emphasis on authentication security reinforces consumers' perception of transparency.

The integration of these findings indicates that the development of cryptocurrency payments in automotive services should be based on two interconnected strategies. The first is to support trust through institutional mechanisms and social factors, as confirmed by Shahzad (2024). The second is to ensure technological reliability by optimizing algorithms and structures, as demonstrated in the works of Amamra (2025) and Gao (2023). Both strategies are interdependent: a lack of trust negates technological achievements, while an unstable architecture diminishes value even with a high level of consumer readiness.

Regarding future development prospects, the following directions can be identified. Strengthening the link between technological transparency and the perception of security, as emphasized in the study by de Anda-Suárez (2025). Expanding the practice of integrating blockchain into transport ecosystems, where cryptocurrency payments become part of a broader infrastructure, as shown in the work of Okere (2024). Adapting solutions to local markets and consumer expectations. The example of Mofokeng (2024) demonstrates that even in developing countries, trust can catalyze the adoption of new models.

Thus, the synthesis of empirical and technological results confirms the need for a comprehensive approach. Cryptocurrency payments in the retail automotive services industry can only develop successfully with simultaneous reliance on social trust and technological stability. This conclusion defines the prospects for further research and practical implementation in the context of global digitalization.

Conclusion

This study provided a systematic analysis of the prospects for using cryptocurrency payments in the retail automotive services industry, identifying their key drivers and barriers, and substantiating the need for a comprehensive approach that combines consumer and technological factors. It was established that user trust is the determining condition for the adoption of cryptocurrencies as a means of payment, while the technological reliability of blockchain platforms forms the basis for institutional legitimacy and the scaling of these practices.

A comparative analysis of consumer models and consensus algorithms showed that social attitudes,

including readiness to use and make recommendations, cannot be sustained without the support of a reliable digital infrastructure. In this regard, hybrid solutions like the Substrate Hybrid Consensus demonstrate the potential to ensure high performance and predictability of transactions, which is critically important for the automotive services industry, where payments are associated with a high volume of microtransactions and data transfer.

Institutional and regulatory factors that enhance the perception of security are of particular importance. The study confirmed that even with high technological maturity, consumer adoption of cryptocurrency solutions is impossible without social legitimization and transparent rules. Consequently, technological innovations must develop in parallel with the formation of institutional trust mechanisms that facilitate user adaptation to new forms of transactions.

The practical significance of the obtained results lies in identifying the relationship between trust and technological reliability as two fundamental components of a digital payment infrastructure. This allows for the justification of a strategy for implementing cryptocurrency payments in automotive services as a process requiring the synchronous development of social and technological mechanisms. Trust creates demand for innovation, while the technological base sets the limits of their implementation, creating conditions for scalability and sustainability.

Thus, the key factor for the successful development of cryptocurrency payments in the retail automotive services industry is the balance between behavioral and technological aspects. The modern system requires the integration of user trust, institutional support, and high-performance blockchain solutions. Prospects for further research are related to adapting consensus algorithms to industry-specific loads, refining models of consumer behavior in the context of digital transformation, and developing regulatory standards that ensure participant protection and transaction transparency. This approach will allow for the formation of a sustainable digital ecosystem where cryptocurrency payments become not only a technological innovation but also a tool for improving the quality of interaction between consumers and automotive services.

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