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A review of the impact of artificial intelligence (AI) trust concerns on digital Chinese Yuan (E-CNY) to promote Chinese economic low-carbon sustainable development

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Abstract: In April 2023, the government of Changshu City, in Jiangsu Province, China, announced that it would officially use digital Chinese Yuan (E-CNY) as a method of wage payment to the government and state-owned enterprises staff starting in May. With the gradual improvement and application of E-CNY technologies, such as no electricity, no internet payment (offline payment), and the programmability of smart contracts, E-CNY will be officially used in China. CNN said China is on the verge of a cashless society. The advantages of E-CNY have a positive role in promoting the Chinese government's implementation of the development goals of a low-carbon and sustainable economy. However, artificial intelligence (AI) trust concerns are the primary bottleneck in the current development based on intelligent algorithms and digital information technology. AI trust concerns are affecting the scope of use of E-CNY, and it may need to achieve effective scale-use, making it promote low-carbon and sustainable development. From the industry perspective, this article selects the housing rental enterprises, which are challenging to develop and energy-intensive, to analyze the theoretical approach and practical impact of E-CNY in promoting the low-carbon and sustainable development of China's rental housing economy. Meanwhile, from the perspective of Chinese consumers, the impact of AI trust concerns on E-CNY in promoting low-carbon and sustainable development is analyzed in this article.

Keywords: artificial intelligence (AI) trust concern; digital Chinese yuan (E-CNY); low-carbon and sustainable development; consumer; digital financial inclusion

1. Digital Chinese Yuan (E-CNY), legal digital currency, digital currency introduction

The essence of the digital Chinese Yuan (E-CNY) is electronic money (E-money). The paperless transaction began in the era of bank card payment. Electronic payment platforms such as PayPal, Alipay, Paytm, etc., have emerged globally and are recognized by consumers. People have become accustomed to using currencies without physical carriers. However, E-money is not the E-CNY; it is likely a unit of account for banknotes in online transactions. The true E-CNY is a virtual currency directly applied in the transaction environment. Xiong (2020) believes that E-CNY more accurately reflects the nature of money as debt, recording the relationship between bonds and debts with the support of technology.

According to the credit basis of digital currency issuance, the world's massive digital currencies can be divided into three categories, as shown in **Table 1** (Yao and Chen, 2018). As a representative of virtual currency, Bitcoin, due to insufficient

support of credit assets, scarcity, and other reasons, causes large value fluctuations, as shown in **Figure 1**. Combined with security issues, China and India have taken action to prohibit Bitcoin from becoming a mainstream currency (Baidu, 2021). However, the digital currency issued by trusted institutions represented by Libra has avoided the problems of large value fluctuations and low security to a certain extent. Nevertheless, from a state perspective, the right to issue currency and monetary policy is still considered fundamental sovereignty, and many countries can't accept institution-based digital currencies as mainstream currencies. Therefore, with national sovereignty endorsement and legal status, the E-CNY will likely become a major trend in China's finance market.

Table 1. Category of digital currencies.

Category	Representative currency	Credit basis	Features
Virtual currency	Bitcoin	No qualified and responsible entity, physical asset support, and insufficient credit endorsement.	Slow processing speed, value fluctuations greatly, insufficient circulation, and low security.
Trusted institution digital currency	Libra	Issued by trusted institutions (including financial institutions)	Fast processing speed, guaranteed by asset reserves, value fluctuation is slight, large user base, and high security.
E-CNY	DE/EP	It has legal status, is endorsed by national sovereignty, and is issued by the central bank.	Processing speed reaches retail levels. The circulation value is stable, high security, anonymity, and controllable.

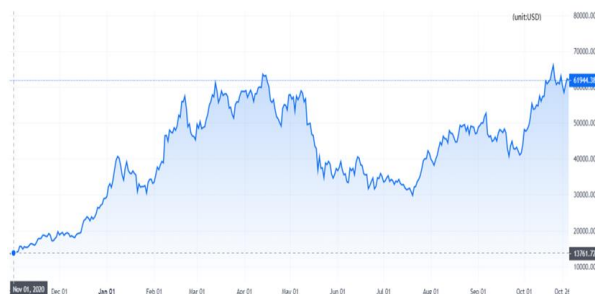


Figure 1. Bitcoin price trend from November 2020 to October 2021.

Data source: Blackchain.info.

Central banks worldwide are currently studying their legal digital currencies (LDC). Such as the Jasper project in Canada, the Ubin project in Singapore, and the Stella project, jointly developed by the Bank of Japan and the European Central Bank (Sohu, 2020). Science 2014, China studied the legal digital currency (LDC) named DC/EP (Digital Currency and Electronic Payment). In January 2020, the People's Bank of China published an article, "Inventory of the Central Bank 2019: Financial Technology", claiming that the top-level design, standard formulation, functional studies, and joint commissioning test have been completed. China's LDC framework adopts the two-level structure of "Central Bank—Commercial Bank, Commercial Bank—Public". Individuals and enterprises open digital wallet accounts (e-wallets) in commercial banks, and commercial banks open their accounts in the central bank with payment of 100% reserve funds. Follow the four principles: Centralization, convenient

payment, easy portability, anonymity, and security. The legal digital currency (LDC) issued by the Central Bank is held by the Public as a debt of the Central Bank and is issued based on 100% reserves. Yi Gang, Governor of the People's Bank of China, stated that the goal of LDC is to replace part of M0, that is, to replace the amount of cash, rather than replace M1 or M2 (Sohu, 2019). In February 2020, the blockchain research group of the People's Bank of China Digital Currency Research Center proposed an article named "the development and management of blockchain technique", which pointed out that the decentralized property of blockchain has clashed with the centralized management requirement for the currency of China's central bank, E-CNY is still a system with centralized. Although E-CNY is not based on the blockchain technique, E-CNY, through methods of managing model and AI smart contract, achieves the Cryptocurrency's features of anonymity, security, integrity, and double-spending prevention based on ensuring centralized management (Cheng, 2020). The smart contract of E-CNY embodies the application of E-CNY AI technology (Huang and Li, 2022). As of March 2023, the E-CNY's pilots have reached 17 provinces and 26 areas from "4 + 1" until "10 + 1." As of May 31, 2022, cumulative transactions of pilot areas up to 264 million times; approximately 83 billion Chinese Yuan (CNY); supported merchants with E-CNY payment model up to 456.7 million; Active users of E-CNY application (trial version) reached 24.6 million people per month (Bai, 2022). Application scenario improves gradually, its development from dining and shopping to enterprise financing and across-board payments.

In April 2023, Changshu City, Jiangsu Province, China, announced that starting in May, it would use E-CNY to pay the wages of government and state-owned enterprises' employees. CNN said China is widely promoting E-CNY's application, and China is on the verge of a cashless society. Judging from the actions of the Changshu government, the results of E-CNY's pilot have met the needs of the government and achieved the original intention of financial inclusion and low-carbon sustainable development. In addition, Changshu is 100 kilometers away from Shanghai, China's economic center, which means that the results of the Chinese government's E-CNY pilot are successful and reliable. E-CNY will soon be officially used in Shanghai and even throughout China.

China's official paper, People's Daily, pointed out that E-CNY, with the natural features of low-carbon and eco-friendly, could reduce the cost of labor and operation and contribute to the goals of carbon peak and carbon neutrality (Dong, 2022). E-CNY is an integral part of green, low-carbon finance, whether in the issuance methods or operating mechanisms, all with the natural feature of environmental protection (Huang, 2021). The banknotes of China's official currency contain production costs (raw material), transportation, storage, destruction, and management. Some studies have pointed out that the leading way to control China's official currency's cost is to control the total production of cash and denomination optimization (Ma, 2009). Before E-CNY appeared, managing the total cash output with the economy's growth was unrealistic. However, the method of denomination optimization to reduce costs cannot be fully implemented because of comprehensive considerations of sovereign currency. For example, you cannot stop producing banknotes only because the total cost of coins is higher (Zheng et al., 2010). As early as 2012, since the cost of casting exceeded the face value, the Canadian government said they would stop circulating the dime.

Canadian Finance Minister Jim Flaherty said, “The cost of minting a dime is 1.5 cents. Stopping minting will save 11 million Canadian dollars.” It can be found from previous related studies that the application of E-CNY has dramatically reduced the production and operating costs of banknotes for China’s official currency and has led to very significant successes in low-carbon development.

2. Digital currency trust concern based on Artificial Intelligence (AI) technology

Some international celebrities, such as Stephen Hawking and Tesla, were legendary physicists. Even Elon Musk, a leader and an innovator in SpaceX and owner of the smart car Tesla, has said that AI is dangerous (Marr, 2018). In recent years, with the rapid development of AI technology, consumers’ trust concerns have become the primary obstacle to commercial applications of AI; intelligent products based on AI technology, such as digital currencies, have also encountered development bottlenecks. Meanwhile, energy-saving and efficient management based on AI technology, fair digital financial inclusion, and other means to promote low-carbon and sustainable economic development will have little effect because they have not yet formed large-scale consumer applications.

For E-CNY, Counterproductive Work Behaviors (CWB) may even occur if consumers feel supervised due to trust concerns (An and Wang, 2016) because the attributes of the E-CNY programmable contract can easily lead Chinese consumers to think that the E-CNY may have some degree of usage restrictions. Therefore, if the trust issue of E-CNY is not fully resolved, it is likely to affect the development of E-CNY in China seriously. It may result in China’s mainstream currency still being traditional banknotes and E-CNY not playing its due role. Nonetheless, driven by the government, it also repeatedly consumes large amounts of energy, increasing China’s total carbon emissions.

2.1. Current state of AI trust concerns

On October 23, 2019, the British magazine “Nature” published Google’s paper on achieving “quantum supremacy.” The article stated that the calculation amount of 200 seconds of Google’s quantum computer would take the most advanced traditional supercomputer 10,000 years (Xinhua News Agency, 2019). At the same time, a group of experts from Google and Canadian universities and research institutes are using graph neural networks to “train” AI’s sense of smell. Meanwhile, researchers are also trying to give robotic arms a sense of touch. All aspects of AI are developing rapidly, and AI algorithm-based autonomous decision-making systems have long been widely used in data mining, search engines, natural language processing, biometric identification, medical diagnosis, news, education, employment, insurance, and investment, advertising, security, and robotics, and other fields (Ru, 2018). According to a 2016 study by the American freelance website Time ETC, although AI has brought many conveniences to human life, and people are interacting with AI more and more frequently, many Americans do not trust them, with 54% of Americans even saying they have never had any contact with AI (DIIOT, 2016). Although China’s Internet and the digital economy have led the world, concerns about “intimate” push

advertising, the risks that AI may bring, and even the fear of the upcoming “singularity” (Boden, 2016) have made many consumers not trust AI or are wary of AI. Therefore, eliminating consumers’ trust concerns about AI has become a key core issue in applying digital currency based on AI techniques.

2.2. Consumer perception risks, control risks, and liability risks may trigger E-CNY Counterproductive Work Behavior (CWB)

The concept of perceived risk was introduced into marketing from psychology by Bauer of Harvard University. He defined perceived risk as the consequences of the consumer’s behavior, and he cannot predict (Feng et al., 2006). There are two types of effects of perceived risks: one is the uncertainty of the product’s performance attributes; the other is the adverse consequences of time, money, psychological, and other losses caused by purchasing the product. AI is both a product and an environment. Dual attributes enable consumers to perceive both. Consumers will reduce their trust in E-CNY because of the perceived risks.

The risk of being controlled. The primary manifestation of consumers being controlled by AI algorithms is that their privacy is recorded, and their consciousness is induced, which is the so-called “people who understand you hurt you the most” (Mao, 2018). Suppose the problem of the opacity of AI algorithms is only partially solved in the future; in that case, the risk of consumers being controlled may rise to the point where the consumer class is held, resulting in unprecedented social and political inequality (Herali, 2017). In the future, it may even evolve into the consumer population being controlled. Therefore, consumers generally show concern or even fear about the risk of being controlled (DIIOT, 2016), so at this stage, consumers have low trust in E-CNY with programmable smart contracts.

Liability risk. Although E-CNY does not need to face legal liability in the event of a traffic accident like a smart car, it also meets the issue of how to pursue legal liability when smart contract editing errors occur. Even if we blame designers and programmers for errors or inappropriate behaviors in AI, many people may jointly develop the program, and the program’s creation may not be traceable to a specific individual or organization (Wang, 2017). Therefore, the liability risks for consumers using E-CNY are relatively high, resulting in low consumer trust.

Counterproductive Work Behavior (CWB) originally represented work behaviors that would have the opposite effect as expected. The use of CWB here means that if the E-CNY is fully promoted without fully addressing the consumers’ trust concerns, it may cause consumers to feel perceived risk, control risk, and liability risk to varying degrees. AI trust concerns are affecting the scope of use of E-CNY, and it may not be able to achieve effective scale-use, making it unable to promote the low-carbon and sustainable development of the Chinese economy, even increase carbon emissions due to the simultaneous issuance of the traditional banknotes and E-CNY.

2.3. Manners and theoretical approach for E-CNY’s low-carbon development

In June 2021, China’s first carbon-inclusion platform, named the “carbon-efficient travel” application, settled in E-CNY was officially launched. The platform

is a green financial platform linking the Chinese government, banks, enterprises, groups, and individuals' social media. Through low-carbon operations and life, enterprises or individuals get a “carbon emission reduction value” on the application and get the corresponding E-CNY or financial bonus from the application to achieve a green financial platform (Huang, 2022). Meanwhile, the gradually improved programmability attribute of smart contracts is the most significant advantage of E-CNY that may promote the low-carbon development of China's urban economy. Firstly, 100% use of regulatory funds can be achieved in the future, which can save many regulatory personnel and processes from the government to banks and enterprises and reduce total carbon emissions. Secondly, it allows enterprises to obtain supporting financing simply and achieve low-carbon inclusive finance. Finally, the time appointment and category appointment functions will enable the government, enterprises, and organizations to implement their intervention measures efficiently and directly, and it significantly avoids ineffective and repeated management behaviors caused by uncertain times and types. The E-CNY will dramatically impact the low-carbon development of China's urban economy (as shown in **Figure 2**).

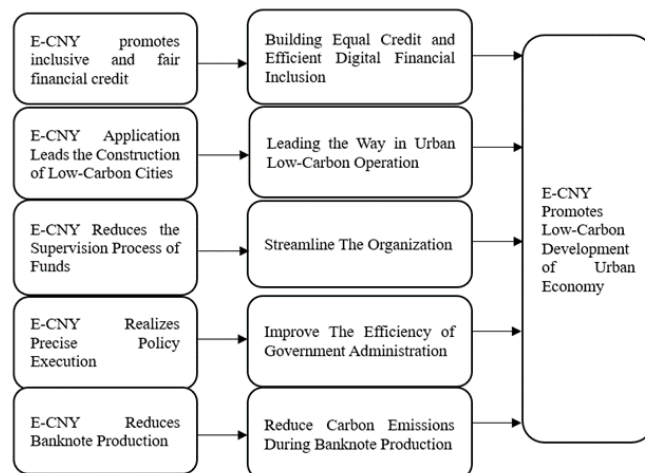


Figure 2. E-CNY promotes low-carbon development of China's urban economy. Data source: Made by the authors.

At present, many major economies worldwide promote the research and development of legal digital currencies (LDC). The “2021 China E-CNY Development Research Report” released by I-Research shows that China's LDC research process is at the forefront of the world. However, because global LDCs, including E-CNY, are still in the R&D stage, analysis and research on LDC based on actual application data are relatively rare not only in China but also in countries around the world.

3. The theoretical approach and practical impact of E-CNY to promote the low-carbon and sustainable development of China's rental housing economy

China's rental housing industry is highly energy-consuming and relatively backward. This article selects the rental housing industry as the research object for E-

CNY to explore low-carbon and sustainable development. Theoretically explore E-CNY to promote low-carbon development while improving the economy, win consumers' trust, and ultimately achieve sustainable development goals.

The rapid development of China's economy has caused part of the labor force to live intensively in some cities. The advancement of tourism and the exorbitant housing prices in some Chinese cities have led to a surge in rental demand for health preservation apartments, which has also brought substantial development opportunities to the rental housing market. In recent years, China's rental housing market system has been imperfect, unlike Europe and the United States (Long et al., 2021). Although the rental housing market has entered the fast lane of development with the government's promotion, in the entrepreneurial stage, companies generally need help with business models, financing growth, and other aspects.

3.1. The difficult development of China's rental housing industry

Under the influence of COVID-19, within one month in August 2020, seven Chinese rental housing enterprises experienced a severe financial crisis (Zhang, 2021). Danke Apartment, a rental housing company listed in the United States with a market capitalization of US\$2.7 billion, has encountered a severe funding crisis due to its rapid expansion. Its market value has shrunk by 90% in the short term (Li, 2018). With the epidemic restrictions in the rental housing industry, the complex business model and financing capabilities are the sources of the industry crisis.

3.1.1. Heavy asset economy, significant capital investment, returns slowly

The profit model of rental housing companies is mainly to earn cash by renting out rooms or apartments. However, this part of the income's recovery period is long and unrealistic relative to its investment cost. Firstly, rental housing companies seldom buy apartments directly, and the more apartments they rent from owners, the higher the cost. Secondly, rental housing companies rent apartments from owners into centralized and dispersed rent. Presently, the primary source of rent for Chinese rental housing companies is dispersed apartments, whose management costs are much higher than those of centralized apartments. Finally, companies must pay for labor, materials, transportation, renting, branding promotion, and other expenses during the house decoration stage. The decoration costs of an apartment are as high as more than 8,000 CNY (Chinese Yuan). Based on this, companies also undertake operation costs and taxes. According to the prospectus data of Danke apartment, the net loss in 2017 was 272 million CNY, and the net loss in 2018 was 1.363 billion CNY. In the first three quarters of 2019, its net loss was as high as 2.516 billion CNY, a year-on-year increase of 209%.

3.1.2. Difficulty of industry regulation

The government issued supportive policies to promote the rapid development of the rental housing industry. However, weak government regulation results in low barriers to entry for the industry. The lack of industry standards and detailed law rules makes supervision by the government more complex and lacks basis. In 2017, under the guidance of policies, various financial instruments were successively used in the rental housing industry. One of them is called a "financing loan," which means that when the tenant signs a contract with the rental housing enterprise, he also signs a

contract with the financial institution where the rental company cooperates. The financial institution makes a one-off payment to the rental housing company for the tenant, and the tenant pays the financial institution in installments. However, some rental housing companies regard “financing loans” as a fund pool and misappropriating funds arbitrarily and illegally (Zhang, 2021). Enterprises have been operating “sickly” for a long term and cannot resist risks, and after the epidemic, more and more rental housing enterprises have encountered financial crises.

3.1.3. Difficulty of enterprise financing

Rental companies have been rocked by the “financing loan”. After being affected by multiple factors, there are fewer and fewer financing opportunities within the industry, and external investment has also been decreasing year by year, making capital more cautious in entering the market. There were only 19 investments in 2019 and more reductions in 2020 (Tang and Zhang, 2021). Under the traditional credit system, most rental apartment enterprises have problems such as small scale, imperfect management system, single products, low profit, low market share, lack of core competitiveness, and inability to resist risk and loan repayment. Some small and medium-sized enterprises have problems such as the absence of data on the balance sheet, lost reality, inconsistent statements, and unclear ownership structure. As a result, the bank issued a low credit rating to the rental housing enterprises. Meanwhile, under the frequent financial crisis in recent years, investment opportunities in the industry are only given to those with a high rating (Tang and Zhang, 2021). Most rental housing enterprises see few avenues to improve their credit ratings and raise capital. At the same time, due to the pandemic’s impact, the pressure on the Chinese economic downturn has continued to increase, the living environment of rental housing enterprises has worsened, the ability to repay a loan has declined, and credit risk has expanded.

3.2. The theoretical approach and practical effect of E-CNY on low-carbon and sustainable development of China’s rental housing industry

In China’s carbon neutrality context (Kou and Ding, 2023), industries with high energy consumption and high returns have become sluggish. Rental housing companies have begun to receive the government’s attention after being ignored by capital for a long time. Meanwhile, due to the pandemic’s impact, domestic property prices slumped sharply. The operating costs pressure on rental housing companies has also eased, and good news from the outside boosted enterprises’ Confidence. China’s rental housing market is entering the information era under the government’s impetus (Sohu, 2021). The characteristics of E-CNY will provide strong support for information platforms to achieve stable operations, cost reduction, full supervision, raising earnings, improved credit ratings, and facilitating financing.

3.2.1. Intelligent application scenarios reduce the burden and improve enterprises’ profitability

Firstly, the application platform “carbon-efficient travel” based on E-CNY leads the low-carbon operation of enterprises to obtain “carbon emission reduction value,” and they can get rewards issued by banks in the form of E-CNY. Secondly, enterprises’ intelligent management platform based on E-CNY can reduce the operation cost of

rental housing companies through smart management. In particular, the management costs of dispersed apartment-type enterprises will be significantly reduced (as shown in **Table 2**). Finally, the E-CNY scenarios based on smart contracts developed by commercial banks can specifically connect with the sales business of rental housing companies, which can reduce sales costs while improving revenue efficiency.

As of January 2023, the number of users of E-CNY E-Wallets conducted by the six commercial banks, such as Bank of China, Industrial and Commercial Bank, Agricultural Bank, Construction Bank, Bank of Transportation, and Postal Savings Bank, has exceeded 20 million. At the same time, various banks are actively innovating E-CNY application scenarios. For example, the Bank of China joined hands with China Unicom to build China’s first E-CNY intelligence pension scenario; the Construction Bank joined with CITIC Bank to create an online cooperation scenario for the E-CNY financial industry (Wang et al., 2023).

Table 2. Operational changes and moral hazards in the rental housing industry before and after the use of E-CNY.

	Before using E-CNY	After using E-CNY	Moral hazard constraints
Enterprise	Business model difficult: Rental housing is a heavy asset, and when the credit system is imperfect, rental housing companies need to charge a high one-off deposit for the house.	The E-CNY smart contract guarantees the usage process of deposit and rent. Create a credible and auditable payment environment for transactions. Credit protection alleviates the business difficulties caused by companies needing to collect high deposits.	Smart contracts protect the deposit from abuse and the moral hazard of both parties.
	Difficulties in governance and auditing: A large part of the housing resources of rental companies are dispersed apartments, resulting in enormous contract review costs during operation.	E-CNY has the advantage of record traceability, with simple processes, default records, and the ability to recover amounts. Reduce company review costs and operating costs.	Smart contracts identify and completely record transaction information to ensure that both parties abide by contract ethics.
	Financing difficulties: The rental housing industry is an asset-heavy industry and has to seek financing during its operation. However, most rental housing companies are small and medium-sized enterprises and need more financing qualifications under the traditional financial system, causing operating difficulties.	E-CNY credit system differs from the traditional financial credit system. It is built based on network big data and enterprise data, which can allow small and medium-sized enterprises with good credit to get out of financing difficulties.	E-CNY credit system realizes the control of credit and is the basis for implementing inclusive finance.
	Unscrupulous companies provide rental houses with poor-quality decoration and default on consumers’ deposits.	Unscrupulous companies are eliminated or required to make corrections.	The more perfect the E-CNY credit system is, the more unscrupulous companies will naturally be eliminated by the market.
Consumer	Pay a high deposit.	Consumers no longer pay high deposits.	The system records tenant rental information, credit information, and expense details, allowing tenants to continuously improve their quality and protect both parties’ rights and interests in the transaction from an ethical perspective.
	It is challenging to defend rights regarding housing facility problems.	Consumers can recover the amount of E-CNY they have paid at any time.	
	Rental prices continue to rise.	Consumers rent an apartment and pay rent in a staff-free, smart, self-service environment while reducing rental costs.	
	If the tenant misbehaves, such as damaging the house and facilities, stealing, etc.	The tenant’s misbehavior will be recorded, and while the system is recovering the fees, it will also identify the tenant, causing its future consumption to be restricted.	

Data source: Formalized research of smart contract research for digital wallets (Cheng, 2022).

3.2.2. E-CNY can be traced to support efficient supervision

The advantage of the traceability of the E-CNY relies on the E-CNY intelligent system to detect issues in corporate operations, corporate finance, and the use of corporate funds while reducing the regulatory process, and it eliminates the impact of adverse companies on the industry. It also discovers new problems when companies and consumers use E-CNY scenarios. Regulatory departments not only guarantee the industry's healthy operation in a low-carbon and efficient manner but also make suggestions to help the industry develop better (as shown in **Table 2**).

In October 2021, Yunnan Province, China, issued the "Notice on the Implementation of Preferential Tax Policies for Housing Renting" to provide tax support for rental housing enterprises that meet the standards. In December 2021, the Shanghai government proposed the "Shanghai Financial Special Fund Management Measures," which proposed that to achieve comprehensive supervision, only one special fund should be set up in one department or one field, and through "information innovation," including E-CNY, comprehensive supervision of funds can be achieved.

3.2.3. E-CNY can support the construction of digital financial inclusion platform

Based on the security and retroactivity of E-CNY, there is evidence that the flow of funds between enterprises, investors, and institutional investors greatly avoids the situation where enterprises hide corresponding information. Meanwhile, the immutable feature of E-CNY plays a role in detecting money laundering offenses. Credit data must be kept complete and accurate, supporting institutional investors in building credit databases for rental housing enterprises. The corporate credit rating system based on E-CNY can improve credibility, especially under traditional finance where companies cannot obtain credit ratings equally due to small scale and other reasons. Now, these companies can increase their financing capabilities through equal credit rating opportunities (as shown in **Table 2**).

Qingdao City, Shandong Province, China, is a pilot city of low-carbon and E-CNY. Shujin Public Service (Qingdao) Co., Ltd. and the Industrial and Commercial Bank of China (ICBC) Qingdao Branch jointly developed the "carbon-efficient travel" carbon inclusive platform, which innovatively combines "carbon emission reduction," "healthy travel," and "fintech." In November 2020, Qingdao City was listed as the second batch of E-CNY pilot cities. At present, E-CNY has been widely used in the fields of wholesale and retail, public transport, dining, tourism, and other fields. Innovation pilots have also achieved multiple breakthroughs and successfully created several typical innovation scenarios with demonstration effects. June 24, 2022, the Qingdao Central Sub-branch of the People's Bank of China and the Qingdao Financial Supervision Bureau jointly issued the "Guiding Opinions on Supporting the Establishment of Fintech Pioneering Demonstration Zones." It can further enhance the innovation effectiveness of fintech, E-CNY, and digital financial inclusion in Qingdao City.

No internet connection is required, and E-CNY can be used in transactions like cash. Meanwhile, E-CNY could also be used in trading platforms or payment channels, achieving full credit coverage for rental housing companies, institutional investors, and consumption scenarios. At the same time, E-CNY can perform 7×24 h of real-

time service in the back-office system and achieve real-time coverage of transaction credit without delay. To sum up, the E-CNY can promote the low-carbon and sustainable development of the rental housing economy from multiple aspects, such as cost reduction, low-carbon efficient management, good supervision, equal credit, and inclusive finance.

3.3. The impact of AI trust concern on E-CNY to promote low-carbon and sustainable economic development in Beijing, China

The questionnaire referenced below shows that among the respondents, practitioners in the rental housing industry get a high percentage of use E-CNY, achieving 77.27% (as shown in **Table 3**).

Scholars from the school of statistics, Capital University of Economics and Business (CUEB) distributed E-CNY user satisfaction survey questionnaires in Beijing in 2022. A total of 203 questionnaires were distributed, and respondents were mainly between 20–50 years old. The industries of respondents include catering, tourism, rental housing, finance, education, and students. The questionnaire selected 11 variables: Policy publicity effect, awareness of policy content, information service, process experience, material goods, sense of urban belonging, complaint frequency, complaint content, public support, public Confidence, and public satisfaction.

As shown in **Table 3**, rental housing practitioners account for more than 70% of all respondents using E-CNY. The result of the data analysis could reflect to a certain extent that rental housing in Beijing is the main application scenario of E-CNY.

Table 3. Usage of E-CNY in various industries.

	Used	Never used	Total
Rental housing	17 (77.27%)	5 (22.73%)	22
Catering	12 (63.16%)	7 (36.84%)	19
Tourism	11 (55%)	9 (45%)	20
Education	46 (68.66%)	21 (31.34%)	67
Student	30 (68.18%)	14 (31.82%)	44
Finance	17 (54.84%)	14 (45.16%)	31

Data source: Public satisfaction survey on E-CNY pilot (Xie, 2023).

The survey adopts a five-point scale, and the scores decrease to indicate that the satisfaction level decreases gradually: 5 = strongly satisfied, 4 = satisfied, 3 = general, 2 = dissatisfied, 1 = strongly dissatisfied. As shown in **Figure 3**, although users’ satisfaction with using E-CNY has achieved 61.08%, the survey also indicates 62.65% of respondents worried about their privacy when using E-CNY. As shown in **Figure 4**, among the respondents, the young and middle-aged groups of 21–40 have the highest rate of concerns about privacy and security. Therefore, AI trust concerns have a negative impact on users in Beijing. Users’ Confidence in a low-trust environment and the economic effect of the E-CNY to promote low-carbon and sustainable development in Beijing is not significant.

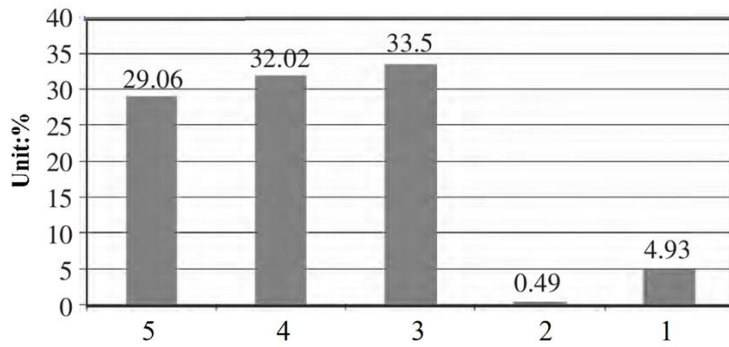


Figure 3. E-CNY consumer satisfaction.

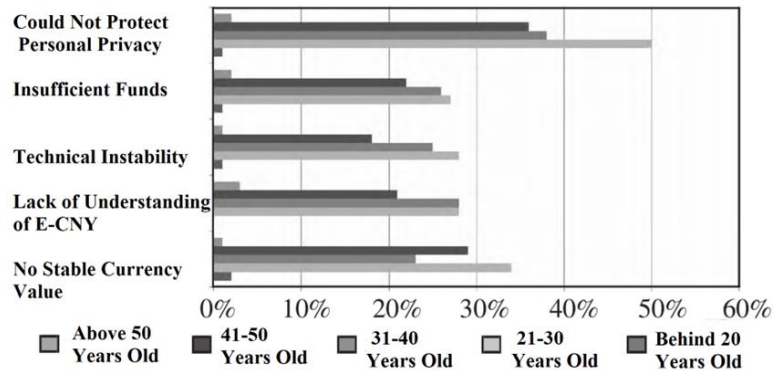


Figure 4. The proportion of E-CNY trust concerns.

Data source: Public satisfaction survey on E-CNY pilot (Xie, 2023).

In summary, from the perspective of theoretical approach and practical consequences, E-CNY has a stimulating effect on the development of China’s rental housing economy. Moreover, it positively promotes low-carbon and sustainable economic growth. At the same time, it can be seen from the questionnaire survey of Beijing of the E-CNY pilot that the rental housing economy is the main application scenario, and the users’ satisfaction reached 61%. But at the same time, as many as 62% of users expressed trust concerns. Therefore, the issue of AI trust concerns is the primary development obstacle for the E-CNY to promote the low-carbon and sustainable development of the rental housing economy in Beijing, China.

4. Questionnaire survey on Chinese users’ understanding and trust concerns about E-CNY

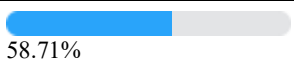

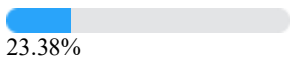
In April 2023, a researcher from the Business School of Shandong University (Weihai) and a researcher from the University Sains Malaysia cooperated to distribute questionnaires “Digital Currency and E-CNY”. Two hundred one valid questionnaires were collected on the WeChat group of international students from University Sains Malaysia. The questionnaire design involves 12 items, primarily related to the degree of understanding of digital currency and E-CNY, whether they have used E-CNY, and whether they think E-CNY is safe.

4.1. E-CNY, knowing more but using less

As shown in Table 4, it can be seen from the questionnaire that more than 50% of the respondents understand E-CNY. As shown in Table 5, only 1.04% of the

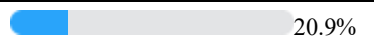
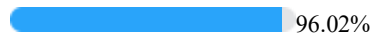
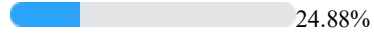
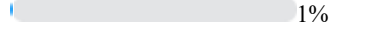

respondents showed they used E-CNY commonly. Meanwhile, as shown in **Table 6**, only 23.89% of respondents are currently piloting the E-CNY application. It can be seen from the data that E-CNY has a good publicity effect in China, and more than half of the respondents understand the E-CNY. However, the proportion of E-CNY currently used in China is still relatively low because E-CNY is still in the pilot stage. Therefore, the current E-CNY has a relatively minor role in promoting the sustainable development of China’s low-carbon economy.

Table 4. Which digital currencies do you know (multiple-choice).

Items	Summary	Proportions
A. Central bank legal digital currency, such as E-CNY	118	 58.71%
B. Cryptocurrencies, such as Bitcoin BTC, Ethereum ETH, Ripple XRP, etc.	103	 51.24%
C. Unknow	47	 23.38%
The number of people who effectively filled out these items	201	-

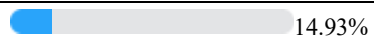
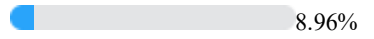
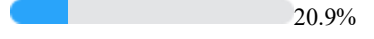
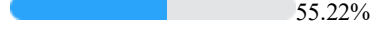
Data source: Made by the authors.

Table 5. Most commonly payment method (multiple-choice).

Items	Summary	Proportions
A. Cash (Banknote/coin)	42	 20.9%
B. WeChat/Alipay	193	 96.02%
C. Bank Card/Credit Card	50	 24.88%
D. E-CNY	2	 1%
E. Others	2	 1%
The number of people who effectively filled out these items	201	-

Data source: Made by the authors.

Table 6. Whether your region is an E-CNY pilot.

Items	Summary	Proportions
A. Yes, fully open	30	 14.93%
B. Only available in some areas	18	 8.96%
C. Not yet open for trial	42	 20.9%
D. Unknow	111	 55.22%
The number of people who effectively filled out these items	201	-

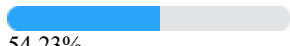
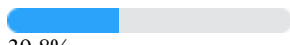

Data source: Made by the authors.

4.2. The problems of E-CNY trust concerns

In the questionnaire survey of Chinese users, E-CNY users’ trust concerns based on AI technology are significant. From the questionnaire result, as shown in **Table 7**, 54.23% of respondents believed E-CNY has enormous development potential. As shown in **Table 8**, 31.84% of respondents said that E-CNY is unsafe. As shown in


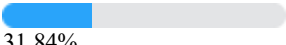
Table 9, 54.73% of respondents stated that they do not intend to use E-CNY as their main payment method and hope to continue using the original payment method. As shown in **Table 9**, 19.9% of respondents did not intend to use E-CNY. Data analysis shows that about half of Chinese users believe that the development potential of the E-CNY is vast. About 1/3 of users believe that E-CNY is unsafe, and about 3/4 of Chinese users do not plan to use E-CNY as their primary payment method. Therefore, it can be inferred that E-CNY AI trust concerns are critical in China, and AI trust concerns are affecting the use of E-CNY, and it may not be able to achieve effective large-scale use. It is challenging to promote the low-carbon and sustainable development of China’s economy.

Table 7. Potential development of E-CNY.

Items	Summary	Proportions
A. Huge potential for development	109	 54.23%
B. Development prospects are generally	80	 39.8%
C. Development prospects are slim	12	 5.97%
The number of people who effectively filled out these items	201	-

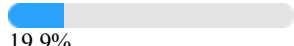
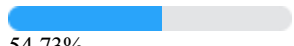


Data source: Made by the authors.

Table 8. The safety issues of digital currency and E-CNY.

Items	Summary	Proportions
A. Safe	137	 68.16%
B. Unsafe	64	 31.84%
The number of people who effectively filled out these items	201	-

Data source: Made by the authors.

Table 9. Which payment method do you want to use.

Items	Summary	Proportions
A. Completely maintain the existing payment method, do not want to use E-CNY	40	 19.9%
B. Allow existing payment methods to coexist with E-CNY, but mainly use existing ones	110	 54.73%
C. Allow existing payment methods to coexist with E-CNY, and hope to use E-CNY on more occasions	45	 22.39%
D. Hope to abandon the existing payment method and fully use the E-CNY	6	 2.99%
The number of people who effectively filled out these items	201	-

Data source: Made by the authors.

5. Conclusion

By analyzing the impact of E-CNY on the low-carbon and sustainable development of China's rental housing economy, this article believes that E-CNY can have a positive role in promoting low-carbon and sustainable development. However, AI trust concerns are affecting the scope of use of E-CNY, and it may not be able to achieve effective large-scale use and thus fail to promote the low-carbon and sustainable development of the Chinese economy. AI trust concerns have been the main obstacle and bottleneck to the development of E-CNY. If an effective solution cannot be found, vigorously promoting E-CNY may not have the desired effect and may even increase carbon emissions in China.

Some researchers have found that consumers are instinctively "sensitive" to errors in AI (Ni, 2018). They will amplify the risk factors with various "biases". Therefore, the Chinese government should focus on consumers' trust concerns from the risk of consumers' perception, control, and accountability. Through multiple means, such as psychological explanation, algorithm transparency, and clarifying legal responsibility, multiple guarantees reduce trust concerns. Only when consumers overcome their trust concerns about E-CNY can E-CNY push the economy onto a low-carbon path.

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