

## Prospects of Chinese «Smart Home» Technologies in The Russian Market

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### Abstract

This paper will focus on the prospects for the development of Chinese smart home technologies in the context of the digital transformation of the human environment. The aim of this work is to study the competitive possibilities of Chinese smart home technologies in the Russian market. Particular attention is paid to the Russian smart home market as the most attractive segment for international companies in this area. At the same time, the Russian market is characterized by high competition. When entering the Russian market, Chinese companies developing technological solutions for a smart home need to carefully consider positioning strategies. The relevance of this work lies in improving the mechanisms of Russian-Chinese cooperation in the field of technological solutions for the "smart home". The research methods were the secondary analysis of statistical data from official sources, works of international experts on the study of the state of the international and Russian markets for smart home technologies. The work resulted in recommendations for Chinese technology companies to improve their business strategies in the Russian smart home market. The novelty of the work lies in the current analysis of the state of the market for "smart home technologies", as well as predictive estimates of the prospects for the introduction of Chinese technologies into the Russian market.

**Keywords:** Digitalization, China, Smart Home Technologies, Digital Development, Smart Home, Chinese Companies, The Russian Market.

### Introduction

Today digital technologies have become the main driving force behind the socio-economic development of world society. They are rapidly transforming all spheres of human life. Under the influence of digital technologies, the human environment changes most pronouncedly. Digital technology is pervasive in everything from home appliances, cars, home spaces, entertainment, security to simple accessories (MP3s, headphones, keys, table lamps, and more). Global digitalization has changed the traditional way of life for people and the way they communicate.

This article will focus on Chinese smart home technologies, their role in the development of the global market and the specifics of positioning in the Russian market.

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Despite the crisis caused by the COVID-19 pandemic, China remains one of the fastest growing markets in the world. Its share in Asia accounts for more than 40% of all trade relations, its place in the world GDP ranking fluctuates between 1st and 2nd places. The main priorities of the current strategic development of the PRC in the field of technological development include reducing the country's dependence on foreign technologies to 30%, increasing R&D costs to 2.5% of GDP, and increasing the contribution of high-tech industries to economic development to more than 60%. The Chinese government is taking effective measures to achieve the country's leading position in the world economy. The developed state target programs for supporting the production of technically complex and innovative products are strategic guidelines for the country's economic development. There are also separate "end-to-end" state targeted programs to support innovative activities, the duration of which is designed for several five-year periods. [1] The main state programs of the PRC include:

- Program for scientific and technological development of key technologies (1982) The program is focused on the innovative development of key sectors of the national economy: energy, information sector, agriculture, transport, extractive industries, as well as the social sphere - health care, education, etc.
- Program "863" (1986). The program is aimed at developing scientific and technical potential as a basis for ensuring stable growth of the country's economy in the medium term.
- State program "Iskra" (1986). The main goal is the development of the rural economy based on the application of scientific and technological achievements. The program is funded mainly by bank loans and joint funds of members of agricultural communes with additional government support.
- General program "Torch" (1988). The goal is to develop science and technology for the fastest implementation of advanced domestic developments in production. Enterprises are assisted in the commercialization of innovative developments that contribute to the growth of production of goods based on high technologies.
- Program "973" (1997). The program is aimed at the development of fundamental research in the system of the PRC Academy of Sciences. The main source of funding is the state budget, the main subjects are academic research institutes and newly created scientific and technical laboratories and engineering centers.
- Medium and long-term state program of scientific and technological development (2006). The main goal is to increase the opportunities for independent innovative development of the country and build an innovative economy.

Separately, it should be said about the long-term strategy of industrial and scientific and technological development, designed to ensure the world technological leadership of the PRC. This strategy involves the sequential implementation of three stages:

1. The first stage (2015–2025). The main task is to achieve independence of the PRC in the field of key technologies. The government has identified ten leading areas of technological breakthrough and has set the task of increasing the share of national producers to an average of 70% in meeting domestic demand for high-tech goods and new materials.
2. The second stage (2025–2035). China will have to make a breakthrough in science and modernize its industry on a new technological basis, increase labor productivity and become one of the world's leading manufacturers.
3. The third stage (2035–2049). By the 100th anniversary of the founding of the PRC, the country should become the undisputed world industrial leader and gain a foothold in the leading positions in the field of key technologies of our time.

The digital economy is reshaping China's economic structure and emerging as a new driving force for economic growth. Today, China has made remarkable progress in creating global technology companies, innovating, and emerging business trends.

**Table 1. Chinese companies-leaders in the high-tech market [1]**

<b>№</b>	<b>Company</b>	<b>Activity</b>	<b>Capitalization</b>
1	Tencent	WeChat creator	\$ 631 billion
2	Alibaba	Taobao developer	\$ 579 billion
3	Ant Group	digital payment subsidiary of Alibaba	\$ 200 billion
4	Meituan Dianping	platform for group discounts and delivery of goods	\$ 134 billion
5	ByteDance	creator of TikTok	\$ 110 billion

Promoting innovation by the government and the business community is an essential factor in the dynamic development of China's competitive economy. Over the past two years, despite the COVID-19 pandemic, Chinese startups have managed to raise significant funding.

**Table 2. The largest IPOs carried out by Chinese startups for the period 2019-2020 [1]**

<b>№</b>	<b>Company</b>	<b>Activity</b>	<b>Raising funds</b>
1	Kingsoft Office	software	\$ 651 million
2	Kingsoft Cloud	cloud solutions	\$ 510 million
3	CR Micro	semiconductor manufacturing	\$ 484 million
4	Transsion	smartphone manufacturer	\$ 395 million
5	Agora Inc.	PaaS (Platform as a Service) service provider	\$ 350 million

If we talk about the key indicators of China's digital economy, then in 2019 its added value reached 35.8 trillion yuan, equivalent to 36.2% of GDP. By 2020, the online shopping volume reached 728 billion yuan. At the same time, mobile payments accounted for 8.5%. More than 35 trillion e-commerce transactions. Implemented 11.76 trillion online retail sales. China has 989 million Internet users. Digital technologies are actively used both in everyday life (shopping and consumption, home life, travel and recreation, transport trips, etc.), and for the creation of public services, solving social and social problems in areas such as urban planning, construction, management and service. Business practice has shown that the COVID-19 pandemic has become one of the drivers of growth in the share of e-commerce and online services around the world. The global crisis has become an opportunity for digital transformation of less developed regions of the PRC, as well as optimization of the current areas of the digital economy. Thus, China has tremendous potential for the development of its country, its brands and maintaining a leading position in the global market for innovative technologies.

This paper will focus on the prospects for the development of Chinese smart home technologies in the context of the digital transformation of the human environment. Particular attention is paid to the Russian smart home market as the most attractive segment for international companies in this area. At the same time, the Russian market is characterized by high competition. When entering the Russian market, Chinese companies developing technological solutions for a smart home need to carefully consider positioning strategies.

The relevance of this work lies in improving the mechanisms of Russian-Chinese cooperation in the field of technological solutions for the "smart home".

The problem considered in this article is stereotypes, technological imperfections and mistakes in the strategies of positioning Chinese companies in the Russian market.

The practical significance lies in the development of recommendations for Chinese technology companies to improve their business strategies in the Russian smart home market.

The novelty of the work lies in the current analysis of the state of the market for "smart home technologies", as well as predictive estimates of the prospects for the introduction of Chinese technologies into the Russian market.

## **Background and Methodology**

"Intelligent" is usually called a building equipped with automatic control over various life support systems. The term "smart building" ("smart home") was first used in the United States in the early 1980s. The main criteria for the concept of an intelligent building were:

- optimal environment for recreation and / or business
- ensuring comfortable living conditions
- reduction of operating costs, energy saving
- environmental friendliness

The basis of the basic concept is the principle of the most efficient use of space and its elements: structure, systems, services and management. This principle has become common for commercial and residential real estate. "Smart Home" is a set of software and hardware tools for managing the operation of a building. The traditional understanding of "Smart Home" includes the following components [2]

- a control system that allows you to manage all equipment from one place and mechanize all processes;
- communication system, which includes telephones, internet and internal communication;
- an air conditioning, heating and ventilation system that coordinates all these three
- process and providing fresh air inflow and heat saving due to the ambient temperature;
- power supply system providing uninterrupted power supply to the building;
- security system, which includes all systems for alarm, tracking, including remote, recognition of critical situations, protection against gas leaks.

This technology appeared on the Russian market only at the end of the 20th century. The innovation did not find particular interest among the majority of the population of Russia, given the high cost of the information systems themselves and the complexity of operation. Since at that time energy resources were very inexpensive, a house with intelligence was not widely used in the post-Soviet space. Only in the early 2000s, the introduction of such a system began, since the information technology sphere, as well as the telecommunications industry, began to develop actively [3]. At the moment, there is a rapid development of technologies that can be used to automate the processes of housing and communal services, and there is also an increase in demand in the housing market with automated systems. These processes create a favorable environment for entrepreneurs and engineers, leading the development and distribution of various technical solutions of the "Smart Home" technology. [4]

Today, the modern "smart home" has embodied many innovative developments that have made it unique in terms of safety and comfort. An important feature and property of the "Smart Home" that distinguishes it from other ways of organizing living space is that it is the most progressive concept of human interaction with the living space, when a person sets the desired environment with one team, and already automation sets and monitors the operating modes of all engineering systems and electrical appliances. The main task of the Smart Home technology is to monitor and control life support systems. At the same time, the "Smart Home" system must be adapted to the specific rhythm of the user's life and his individual characteristics. It should not be designed as a stand-alone system. It is necessary to immediately lay in the possibilities for the interaction of the system with the outside world, which will provide additional quality of services provided to the user. Now "smart home" is one of the most advanced achievements in technology. The most important thing is that the main goal of such home automation is comfort [5].

Smart home control can be done in several ways. The simplest is the way of control using the keypad, where a certain button corresponds to a certain device, a group of devices, or indicates a sequence of actions required to perform. For clarity, the keypad may have a small display that displays information about the current state of the systems. The respectable and ergonomic control models include models with a touch screen. The console is a small monitor with buttons, command titles, explanatory pictures, and a demonstration of images from cameras. And finally, the most ergonomic is internet-based home control. The owners can find out about the condition of the house, about the presence of people in it, about the weather, etc.

Smart home is a new paradigm that allows people to consciously manage their home energy resources and minimize the waste of various energy resources. This concept, which can be a response to the challenges outlined above, has gained importance due to four factors [6]:

- Rapid progress and miniaturization observed in the field of semiconductor technology, leading to the proliferation of computing and electronic devices in everyday life;
- Exponential growth of the computing power of the microcontroller unit (MCU);
- Integration of advanced signal conditioning into very small sensor nodes that can measure and store data using sophisticated processing techniques;
- Rapid development and progress of wireless technologies, mainly short range and low power.

Due to China's rapid progress in information technology, artificial intelligence and other digital technologies, an expanding middle class and an excellent political environment, China's smart home market has entered a period of rapid development, becoming a center for innovative economic development. Today, Chinese IoT technologies are competitive in the global market. Further expansion of the geography of Chinese technologies will help strengthen global economic and political leadership.

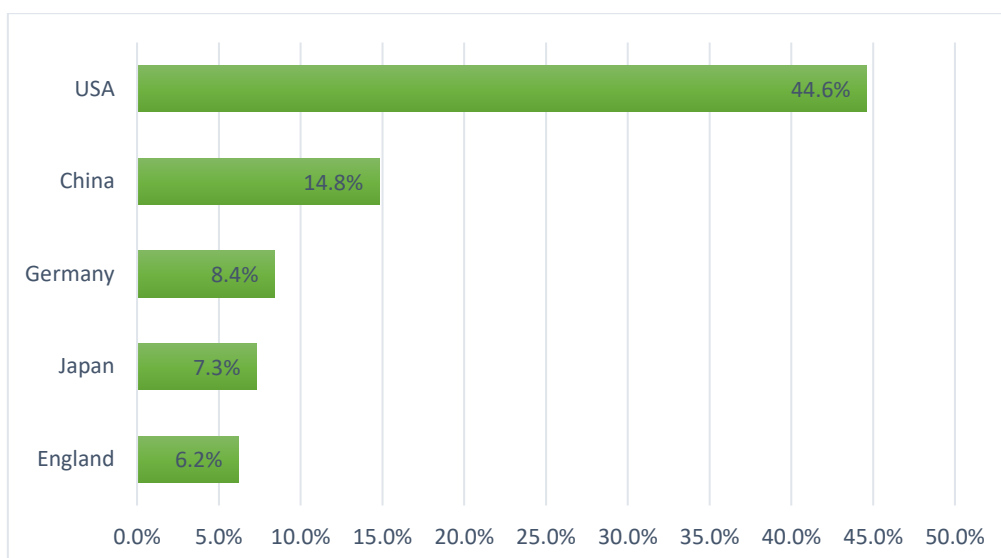
The purpose of this work is to study the prospects for the development of Chinese smart home technologies in the Russian market, as the most attractive in terms of the development of digital technologies. The research methods were the secondary analysis of statistical data from official sources, works of international experts on the study of the state of the international and Russian markets for smart home technologies.

## **Discussion and Results**

The research results of the global smart home market published by the analytical company MarketsandMarkets [7] predict a steady growth from 78.3 in 2020 to 135.3 billion dollars by 2025. It is expected that by the end of 2023 more than 6.4 billion of smart home devices. However, the COVID-19 pandemic and the ongoing trade war between China and the United States remain serious threats, which could seriously affect the growth of the global smart home industry.

Speaking of the smart home market in China, since 2017 it has been showing a steady growth of 21.4% annually and by 2020 amounted to 581.93 billion yuan [8]. Despite the impact of the pandemic, the global market for smart home solutions will continue to grow steadily, with an CAGR between 2020 and 2025. will amount to 17.9% [17]. Market

growth is predicted in all key segments of smart home solutions, with the highest growth rates expected in comfort and lighting, security, control and management systems.



**Figure 1: Top 5 countries in terms of market size for smart home solutions in 2020 (Share of the global market volume,%) [16]**

Russia is only in 6th place, with 0.8%.

The Russian market of "smart home" systems in the mass segment is at the stage of implementation, among the market drivers:

- expanding the offer of affordable solutions and smart home devices;
- increasing consumer experience in using smart home solutions, awareness of the possibilities for ensuring security, saving resources;
- implementation of government initiatives and projects as a generator of consumer experience in the use of "smart" devices for the home.

The main barriers to market development:

- high cost of smart home solutions;
- insufficient awareness of consumers about smart home solutions and devices, their characteristics, advantages of use, conditions of purchase;
- concerns regarding confidentiality, data protection;
- social barriers associated with changing the usual way of life, fears of using complex "smart" devices. In addition, the "critical mass" of the number of "smart home" users, which is necessary for the accelerated growth of the market, has not yet been reached, "Nice to have" has not yet become "Must have".

Local area networks for small residential areas are becoming increasingly important as advanced automation and energy management functions are added to household appliances. A smart home with home network support is a fundamental step for enabling information exchange and interaction between multiple smart home appliances connected to other devices or networks via multiple protocols such as Bluetooth, ZigBee, WiFi, Z-Wave, etc. inside or outside. The modern approach to local wireless networking is based on standards such as Local Area Network (LAN) and Body Area Network (BAN) or Personal Area Network (PAN), which are used to describe a smaller network in the range of 12 to 100 meters ... They usually target local area network applications based on low cost wireless technologies.

The Russian market of professional automation equipment for home and building "Smart Home" has always been filled with European and American brands. European companies whose products can be found in hardware stores - ABB, Schneider Electric, Legrand, Gira, JUNG - and American companies whose logos are displayed on touch panels in class A offices - Crestron, AMX - have been working in this market for a long time, equipping expensive houses "Smart" capabilities. But the market is growing, a lot of equipment is needed and production has to be moved to China. It is not surprising that some of the Chinese companies that previously specialized in OEM production used the money they earned to create their own R&D division. And that means our own unique brand. [nine]

Today on the market for automation of processes that ensure the safety and comfort of life, there are many companies that offer various technological solutions of the "Smart Home". It is worth noting that in Russia and abroad initially

there were different approaches to the work of such a house - if in Russia all orders are strictly individual, and are aimed more at image and comfort, then, for example, in Europe, the main condition is energy saving and safety. It is also important that the use of the "Smart House" system at the present stage of its development is not available to everyone. This is due to the high pricing policy of the companies providing these services. Despite this, automated control systems do not lose their relevance, but, on the contrary, are gaining more and more popularity. According to domestic experts, in the next five years, the Russian market for Smart Home automation systems will grow by an average of 24% per year. The growth of the "Smart Home" market volume will, to a certain extent, be facilitated by the growth of electricity tariffs, which will amount to about 7.5–14% per year [10].

Currently, there are a relatively large number of companies representing and supplying Smart Home systems, such as SIMENS, SAIMON, Leviton, ABB, etc. It should be noted that these companies specialize mainly in the development and production of automation equipment for industrial control systems. As a result, the proposed solutions turn out to be quite expensive. Smart home modules:

- security system, which includes indoor and outdoor video surveillance, which helps to detect an intruder who entered the territory, convenient video registration of visitors.
- lighting and electricity control system
- climate control system
- multiroom - a system that allows you to control all the audio-video capabilities of your home

The devices are connected to each other through power lines. Information on such lines is transmitted by a high-frequency signal, which is not affected by the low-frequency supply current. The smart smart home is safer than usual. Smart home is currently one of the most demanded areas of development of the Internet of Things (IoT), in which a large number of companies work, which are beginning to actively include functions for managing consumer equipment and data exchange between devices in their solutions.

The main obstacle to the spread of smart home technologies throughout the Russian Federation is the high cost. Chinese technologies can be presented in a lower price segment, which, given the high quality of automated systems, will make them attractive to Russian consumers.

## **Recommendations and Conclusions**

The term "smart home" or "smart building" is used to refer to modern homes and buildings in which engineering, information and security systems are combined into a single and organized complex intelligent system. This intelligent system is designed to provide greater safety as well as the best comfort for the inhabitants of the house. Typically, the main reason for installing smart home systems is to improve home comfort by automating routine tasks such as controlling lighting, climate control, multimedia systems, etc. Smart home technologies are made up of two main components: hardware and software. Typical smart home hardware usually includes the following components: - a controller (often this role can be played by an ordinary personal computer), on which software is installed to control smart home systems; - expansion modules (boards) - special devices to which various sensors and controlled devices are connected; - terminal equipment - sensors for monitoring various parameters and devices, the control of which falls on the shoulders of a smart home [11].

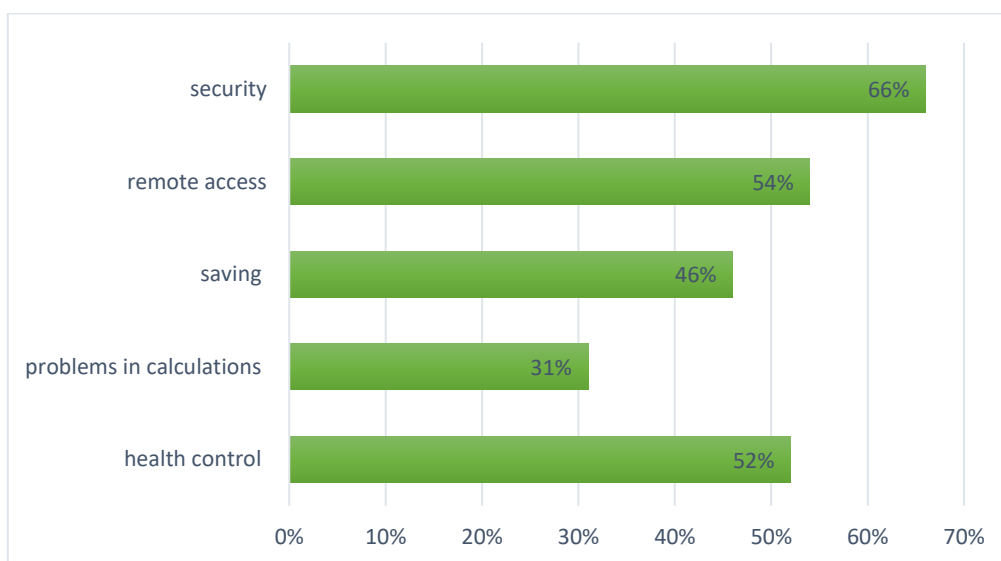
Experts predict a large increase in demand for complex systems. Global companies with the resources required for research are investing in smart home technologies. A lot of companies with smart meters of consumption objects enter the Russian market of smart home systems, but at the moment it is not possible to install them in the home of every resident of Russia. The main consumer fear is leakage or loss of personal information. The market for security systems for the Internet of Things is developing now. Smart devices are an attractive target for fraudsters today, since most users do not change the default security settings of devices, thereby providing an easy target for attackers [12]. Operators providing communication services have the greatest chances to conquer the Russian smart home market, since they are able to provide a full range of services, such as communication channels, special equipment, as well as a systematic payment for services. Among such companies participating in the market are large mobile operators. "The first M2M (Machine-to-Machine) solutions from Beeline in the category "Smart Home" and "Smart Office" for corporate clients and individuals appeared several years ago. The company "Caesar Satellite", offering services of satellite real estate security. Its mobile application Cesar Guard for iOS and Android allows you to remotely control and monitor what is happening at home in real time from anywhere in the world" [13]. Technological solutions of smart home systems based on wireless technologies served as another impetus for the development of the market. Initially, the most popular platforms were Smart-bus (open protocol based on RS-485 interface), X10 (electrical appliance control protocol), EIB / KNX (European Installation Bus), but over the past few years, several systems at once, based on wireless technologies have become the market leaders. These include RF, Bluetooth, WiFi, ZigBee, and Z-wave. One of the main factors that have a negative impact on the market is people's misunderstanding of the concept of this system. The experience of Morton Group can be called one of the examples of supporting smart technologies. This company, as a partner of the accelerator of technology startups Generation S, was looking for

solutions in the field of "Smart City". The Tesso project, offering consumers efficient air conditioning systems, is one of the company's most successful projects, and this technology has also been offered on the overseas market.

At the moment, there are not so many complex systems developers. Among the most famous are Rubetek and Megafon, which released Life Control last year, which allows you to remotely monitor the security of your home. According to IoT Analytics, Smart Homes are one of the main segments supported by IoT solution providers in the world. In Russia, transport, the industrial sector and the creation of "Smart Cities" are attractive for investments in the Internet of Things, which are now being actively discussed at the state level. The program of the Digital Economy project [14] included the development of this segment; this event is an important step in the formation of the legal framework for the use of the Smart House technology. In order for the smart home market in Russia to start developing more dynamically and attracting investors, companies trying to support such technologies need to understand their client and his goals. Basic elements of "Smart Homes", for example, remotely controlled video surveillance systems or underfloor heating, have already entered the life of the Russian consumer and are popular. In the future, this may increase the demand for full-fledged Smart Homes [15].

At the moment, Russians' interest in smart home technologies is focused on three categories: providing security (53%), allowing savings on utility bills (49%) and maintaining health (45%). The interest of Russians in these decisions is much higher than that of respondents from other countries of the world.

Undoubtedly, the most attractive thing about a smart home is that it acts as an assistant who takes on some of the everyday issues: how to save money and personal time, how not to worry about the safety of your home and maintain your own health in the accelerating rhythm of a modern metropolis. In digital terms, it looks like this: 66% of Russians surveyed are worried about the safety of their home, while 54% would like to be able to monitor and manage the situation in it using remote access. In addition, current economic conditions are forcing another 46% to look for ways to save on utility bills. At the same time, 31% of the respondents noted that they find it difficult to accurately track the level of consumption of water, electricity, heat and gas. 52% of the respondents believe that it is difficult for them to maintain their health at the current pace of life, therefore they want the device to check their health (Figure 2) [16].



**Figure 2. Attractiveness in a "smart home" for Russians [16]**

In order for Chinese smart home technologies to take a leading position in the world market, it is necessary to carry out systemic improvements:

1. The fragmentation of the smart home industry is very serious, and it is difficult for various smart devices to be interconnected in the home environment. This is due to the lack of an industry standard. The country needs to formulate uniform industry standards to help the smart home industry move towards standardization.
2. The future trend in the development of "smart home" is not the improvement of a single product, but a smart solution for the whole house. For smart home suppliers of different brands, if they want to improve the user experience, they should seek to cooperate in the field of combining smart home products of different brands, such as setting standards for unified communication protocols, data exchange, etc.
3. To standardize market competition and improve product quality across the industry, the government should implement a smart home quality control system to create a good policy environment for smart home applications in terms of conceptual leadership, institutional innovation, data openness and dedicated support ... Smart home products are in the process of continuous innovation, and there must be some technical problems that infringe on the rights and

interests of consumers. During this time, government regulators must actively intervene to protect consumer rights and interests, helping companies continually improve product quality standards.

4. Users have high expectations for smart homes. However, the current fact is that smart technologies cannot meet user expectations, and the intelligence level is much lower than users' expectations. It is therefore necessary to increase investment in basic chips, algorithms and technologies such as biometrics, machine vision and speech recognition to advance product iteration to satisfy people's true dream of a smart home.

5. Regarding the problem of low consumer awareness of smart home furniture, the market should strengthen the promotion of the concept of smart home furniture, so that the majority of consumers can perceive products with an open mind and try new things to provide smart home products with more room for development.

6. It is worth developing projects for the construction of smart neighborhoods. The introduction of new technologies will increase the cost per square meter by 10-15%. They must be equipped with lighting control systems, video surveillance and fire safety, smart meters, smart heating, meteorological monitoring, an electric car charging station, etc. ;

7. With regard to the Russian smart home market, a thorough analysis of the macro-factors of the environment, market participants, regulatory legal acts, and the mentality of the Russian consumer is required. Also, the focus should be on the value for money offered by Chinese smart home technologies [Du Shuang, Liu Zhipeng. A New Generation of Artificial Intelligence Economic Risks and Prevention and Control Ideas [J]. *New Economy*, 2019, (05): 74- 78.]. The above proposals will help the Chinese smart home industry enter the broader consumer market, reform the traditional manufacturing industry with the support of national policies, and support the digital transformation of the Chinese economy. Professor Zhang Xiaoquan of China University of Hong Kong noted in *The Digital Leap* that digital technologies alone do not provide a competitive advantage, nor how they are used and combined with business strategies. German Industrial Strategy 4.0, US Industrial Internet, Japanese Intelligent Society 5.0, China Manufaufa 2025 and other national strategies show the importance of digital technology in industry, manufacturing, full use of the Industrial Internet of Things, big data, artificial intelligence, virtual / augmented reality and frontier computing and other digital cutting-edge technologies to help enterprises develop new industrial application scenarios, anticipate new industrial application trends, and develop new business models.

Summing up, it should be noted that the digitalization of the spheres of life of a modern person brings rapid changes. Home improvement, safety and comfort are key indicators of the success and well-being of society. The potential of the Russian smart home market is enormous, and it is of economic and political interest for Chinese technology companies specializing in this area. Further study of the specifics of the Russian market will allow Chinese technology companies to successfully compete with European manufacturers of smart home technologies.

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