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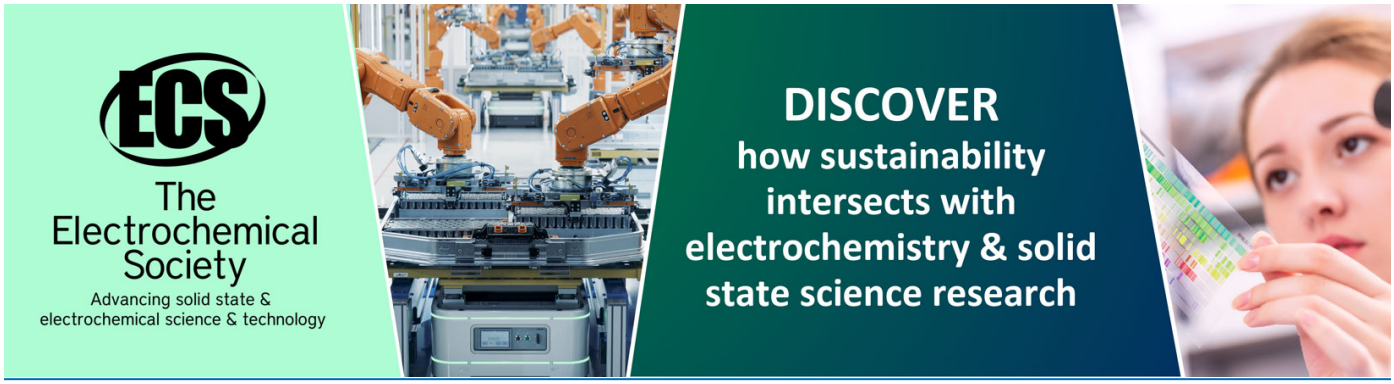

IOP Conf. Series: Materials Science and Engineering **618** (2019) 012041 doi:10.1088/1757-899X/618/1/012041

Assessment of the Internet of Things Projects on the Real Estate Market

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Abstract. This paper discusses the concept of the Internet of Things. It analyzes the existing definitions, and introduces a new definition of this concept. In this research study, the experience of the Internet of Things in the world has been analyzed, the possibilities of deflationary development of the economy have been identified with the use of the Internet of Things. The paper presents directions for important qualitative changes in economy and for organizational and technological transformations of production, which may be induced by the development of the Internet of Things. The "smart home" system market has been examined. Its potential has been identified for Russian companies that work in the field of information and telecommunication technology connected with the development of the Internet of Things. To justify the efficiency of money investments into the "smart home" system and services, the algorithm of cost estimation for such systems, which can be used in making a decision about investing, is proposed. The authors conducted the review of the typical projects offered with the "smart home" system. The power law dependence of the unit cost of the system installation from the floor space of the object has been received. The internal rate of return on investment for the introduction of the "smart home" system has been identified at the level of 50%.

1. Introduction

The Internet of Things (IoT) and the Internet technology (IT) as a whole, as well as other technologies of public use (for example, the electricity), make a transformational impact on various sectors of the national economy and the entire economy.
The result of the IoT technology is the reduced prime cost of transactions carried out by enterprises, growth of labor productivity, increase in efficient use of resources by enterprises and organizations. From the macroeconomic point of view, active development of the Internet services and introduction of IT mean transition to deflationary development of efficiency for all participants in the value chain, which in the IoT model is called “IoT ecosystem”, and includes end-users. This is unprecedented case in the history of the world economy. When the resources of extensive economic growth slow down due to growing production of new goods and services, better efficiency of production and marketing processes become the key focus of development.
For the public companies, increasing labor productivity, a higher level of resource utilization and reduced prime cost of transactions due to introduction of the IoT are accompanied by a growth in their shareholder value.
The research of the introduction of the IoT technologies and evaluation of its efficiency is a priority now. In this paper, an algorithm is proposed for evaluating the efficiency of introduction of the Internet of Things using an example of the “smart home” system.

2. Object and method of research

The concept of the Internet of Things (IoT) arose as a phenomenon of mass connection of various gadgets and equipment to the Internet, the growth of their functionality and autonomy of use. For the first time the term "Internet of Things" appeared in 1999 in the company "Procter & Gamble" as an idea that wireless sensors connected to each other can be built in everyday things [1].

The official definition of the Internet of Things is proposed by ITU-T Recommendations Y.2060 (2012), "Overview of the Internet of Things", where the Internet of Things is defined as "a global infrastructure for the information society, enabling advanced services by interconnecting (physical and virtual) things based on existing and evolving interoperable information and communication technologies" [2].

"The Internet of Things as a new stage in the evolutionary development of the Internet, characterized by the fact that heterogeneous networks and a multitude of sensors have to unite for interaction under the management of unified standards, while stressing that it should not become technology for the sake of technology and, therefore, the task of the info-communication industry is to demonstrate its value for every person. The objects which have an incorporated sensor connected to the Internet are called "smart things" [3].

In reference [4], the following definition of the Internet of Things is presented: “The concept of a computer network of physical objects (“things”) with built-in technologies for interaction with each other or with the external environment and considering organization of such networks as a phenomenon capable of restoring economic and social processes, excluding from the part of actions and operations the necessity of human participation”.

The following definitions of this term can be found [5]:

- “a single network which connects the objects of the real world, which surround us, and virtual objects;
- closer integration of the real and virtual worlds, where communication occurs between people and devices;
- an innovative direction in the trade policy focused on creation of new goods and/or on giving goods new qualities based on their interaction with each other or with the external environment”.

In the publication [6] the Internet of Things is defined as “a network of interconnected “smart” devices, creation and access to which will provide greater awareness of all phases of the company's activities. In reference [7], it is a popular concept for development of computer networks, including technical devices equipped with technologies for interacting both with each other and with the environment without human participation”.

In Rob Van Kranenburg's opinion [5] “the Internet of Things is a “four-layer pie”, which combines four levels: the level is associated with the identification of each object; the level provides services to meet the needs of the consumer (a network of their own "things", for example – “smart home”); the level is connected with the urbanization. For example, the conception of a "smart city", where all information for residents of the city is structured with reference to a specific residential block, a particular house; the level is a sensory planet”.

Forrester Consulting notes that 85% of executives agree with the definition: "The Internet of Things is a network of interconnected "smart" devices, creation and access to which will provide greater awareness of all stages of the company's activities" [6].

In reference [8], the Internet of Things (IoT) is understood as the concept of constructing computer networks from physical objects (otherwise - "things") capable of interacting with the environment or with each other.

Gartner Company interprets the term "Internet of Things" as "a network of physical objects that have incorporated technology allowing these objects to measure the parameters of their own state or the state of the environment, to use and transfer this information" [9].

Thus, amongst modern researchers, there is no single point of view on the existing phenomenon. The term of the Internet of Things is understood as an idea, concept, network, infrastructure, direction, levels, integration and many other things. As this area of economic activity is developing, researchers

move away from the notion of an idea and concept, emphasizing that it is a matter of interconnection of things, practically without participation of man. At the same time, a new market segment is being formed, which, on the basis of new information opportunities, sets new requirements for goods and services in consumer and industrial markets.
Thus, the following definition of the Internet of Things (IoT) can be given: a system of integrated computer networks and connected physical objects (things) with built-in sensors and software for data collection and exchange, with the possibility of remote control and management in automated mode, creating not only new products and services but a whole infrastructure based on greater awareness.

3. The use of the internet of things

The analyzed experience of the IoT introduction in the world shows that the transition to the concept of the IoT happens due to the formation of cross-industrial open (horizontally and vertically) production and service ecosystems which unite many different information management systems of different enterprises and involve many different devices.
This approach allows implementing complex end-to-end business projects in the virtual space, with them being able to perform in an automated mode optimization administration (end-to-end engineering) of various types of resources through the entire product supply and value chain, starting from an idea, design, engineering and finishing with production, operation and utilization.
From the macroeconomic point of view, the increase in the efficiency of processes in the supply-consumer chain means a transition from an inflationary development consisting in shifting growing costs (a growth in the supplier's revenue is the growth of consumer costs) to the "next in the chain", and from the end user back to the producers (employers) through demands for bigger salaries – to deflationary development, based on better efficiency of all participants in the IoT ecosystem, including end users. A separate segment in the growth of national economies is not consumers of Internet services, but producers and providers of Internet services, products and solutions that capture traditional industry niches and reform them based on cloud technologies. Typical examples are online media, e-commerce and online taxi booking.
Increasing efficiency in the world economy leads to lower prices and, in prospect, less consumption of energy carriers and raw materials, whose supplies to the world market determine Russia's role in the global division of labor at the present time, which negatively affects the Russian economy. On the other hand, low labor productivity in Russia (figure 1) has an additional negative impact on the opportunities and resources for the development of the Russian economy. It negatively affects the volume of domestic production and consumption (the capacity of domestic markets). In figure 1, the data for productivity are taken according to [10].

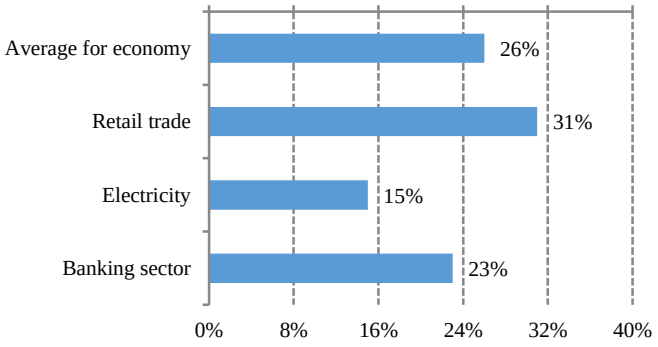

Figure 1. Labor productivity in the Russian Federation, in % from the USA (100%)

E.g., the five-fold difference in labor productivity in Russia and the USA determines the five-fold difference in housing provision, which largely determines the birth rate.

A number of factors affect the overall level of labor productivity in Russia. On the one hand, this is a level of equipment of Russian enterprises with modern means of production, including IT and Internet technologies. On the other hand, it is a relatively low level of development of modern high-tech

industries, including high-tech engineering, electronics, IT and Internet services, which have a high level of labor productivity in comparison with traditional and less technologically advanced industries [22]. Also, the level of labor productivity is affected by the issues of overall organization of business management and human resources management.

Thus, there is a kind of vicious circle: the Russian economy critically needs accelerated modernization to improve the quality of life in the country and the level of its competitiveness. One of the elements of modernization should be measures to improve the efficiency of organization of labor (figure 1) and creation of new markets and high-tech industries, including those on the grounds of new business models based on IoT [23]. However, low labor productivity, a high level of costs in the Russian economy and a relatively low level of development of modern high-tech industries are the main reasons for the low volume of domestic demand and inaccessibility of investment resources. This, in turn, leads to the impossibility of implementing measures to increase labor productivity and create new markets for services and industries in Russia.

For quantitative growth of the Internet of Things and organizational and technological transformation of production, important qualitative changes must happen in the economy, such as:

- the possibility of obtaining valuable information on the nature of the product and equipment usage for all participants in the production cycle as embedded devices are becoming increasingly common. These previously unavailable data were the basis for new business models and additional earnings from the supply of new services, such as, for example, the life cycle contract for industrial equipment, contract manufacturing as a service, transportation as a service, security as a service and others;
- virtualization of production functions is accompanied by the formation of "shared economy" characterized by significantly higher efficiency and productivity due to increasing the use of available resources, changing the functionality of devices without making changes to physical objects, by changing the technologies for managing them;
- modeling of technological processes, end-to-end engineering and, as a result, optimization of the value chain at all stages of the life cycle of the product in real time, allow producing a count or small-batch product at minimal cost for the customer and with a profit for the manufacturer, which in the traditional production is only possible in case of mass production;
- reference architecture, standardized networks and a rental model, instead of paying the full cost of ownership, make the joint production infrastructure accessible for small and medium businesses, which facilitates their efforts in managing production, makes it possible to respond faster to changing market requirements and reduction in the product life cycle, and entails development and appearance of new applications and services;
- analysis of data about the user, his production facilities (machines, buildings, equipment) and the nature of consumption open possibilities for the provider to improve the client's experience, create better convenience of use, better solutions and reduce customer costs, which leads to the increased satisfaction and loyalty from work with the given supplier;
- the functioning of various sectors of the economy will be continuously complicated under the influence of technology development and will be increasingly implemented through automatic decision making by the machines themselves based on the analysis of a large amount of data from the connected devices, which will lead to a gradual decrease in the role of production personnel, including well-qualified personnel. Qualitative vocational education will be required, including engineering, special learning programs for employees and trainings.

With the development of the IoT market in Russia, the cost-effectiveness factor in the introduction of new "smart" technologies is becoming more understandable and obvious to the consumer. Both commercial consumers and households are beginning to be interested in the possibility of increasing the efficiency of resource use through IoT solutions and services, in saving without compromising quality. This will contribute to the development of mass IoT segments, where the motive for end users

to use IoT solutions and services will be market incentives, rather than compulsory government programs [11, 12].

This demand is now being formed in the "smart home" segment, which is one of the IoT technologies, including solutions for creating intelligent security services and intelligent services for optimizing the use of resources by households.

The use of smart house systems by households is in an embryonic state in Russia, the level of their penetration is extremely low – less than 0.1% of the total number of apartments and individual houses, according to J'son & Partners Consulting. However, there is a need for such systems, since about half of the commissioned housing in Russia falls on individual housing (data from Rosstat), where "smart home" systems, unlike apartment blocks, can be extremely efficient.

Nevertheless, it is already possible to talk about mass implementation of certain functions of “Smart Home/Building” systems in terms of security and fire alarms, video surveillance and monitoring of resource consumption (electricity, water, heat). Figure 2 below shows the dynamics of the number of connected IoT / M2M devices in the territory of Russia at immovable objects based on actual data for 2010-2014 with a forecast up to 2018. Figure 2 shows the number of devices introduced according to [10].

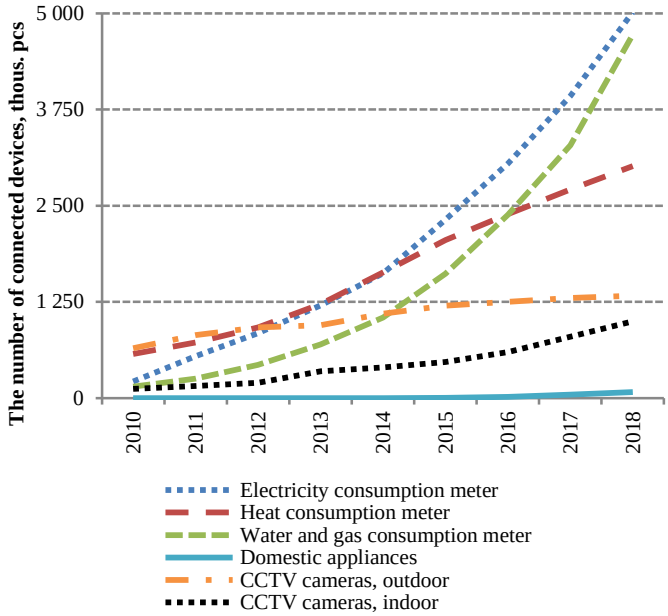

Figure 2. Installed and connected IoT/M2M devices at immovable objects.

Besides, the market of “Smart Home” systems and services has a significant growth potential in Russia due to the segment of connected home appliances (See Figure 2). Now, in those models where this feature is present, it is generally not used, inasmuch as in Russia the systems that are able to receive and process the data are absent. On the other hand, the appearance in the Russian Federation of services analogous to Amazon Dash Replenishment Service, which can reasonably be expected in the next 2-3 years, will lead to an explosive growth of connected home appliances in Russia starting from the year 2018.

As mentioned above, the segment of IoT-devices for accounting consumption of resources, which is closely connected to the segment of connected home appliances, is already developing in Russia, but specifically under the influence of governmental programs on installation of “smart meter” and connection of earlier installed meters to communication networks.

Russian companies that work in the sphere of info-communicational technologies, related to IoT

system's development, have ample opportunities for development on this market. All those below can be referred to as such companies: communication service providers and data-center service providers; system integrators and software and app engineers; developers and manufacturers of electronic devices; developers and providers of integrated solutions to service platforms on the Russian IoT market.

4. "Smart home" system and estimation of its cost

The term "smart home" is now associated with individual apartments, offices and detached houses. The offered technical solutions, examples of "smart" home introduction are mainly intended for an object's management by the very residents ("inside" the object) [18].

Based on the data [13, 18] in order to manage residential objects, devices can be used, which carry out the following functions:

1) air quality monitoring (sensors of temperature, humidity, pressure, air particles);

2) water quality monitoring (acidity, redox potential, amount of oxygen, conductivity, dissolved ions);

3) level control of waste, noise (ultrasound, noise, vibration, temperature, humidity);

4) detection of infiltrations, water leakages and presence of open doors and windows;

5) management of electricity and water in containers and tanks (current, ultrasound, water availability, water level);

6) management of lighting inside an apartment and on the facade, adjustment of brightness, traffic control for automatic management of lighting in passageways;

7) management of the "smart home" system by an app on smartphone (iPad, iPhone, Android, Windows);

8) detection of available places on a parking lot;

9) control of video surveillance, audio and document management at the object with a record on the server, and etc.

Installation of all of the above systems at one object in the company "Smart Home KNX Showroom" [13] is referred to the package of the "Lux +" system. The package "Lux" includes 1-5 elements of the "smart home" system from the list above. Let us consider the possibility of evaluating the efficiency of "smart home" systems.

The review of the standard projects proposed in the "smart home" system in St. Petersburg allowed the authors to derive a power law dependence of the specific cost of installation on the floor area of the object (see figure 3). Figure 3 takes the cost of the introduced "smart home" system, package "Lux +" for the standard projects of the company "Smart Home KNX Showroom" [13].

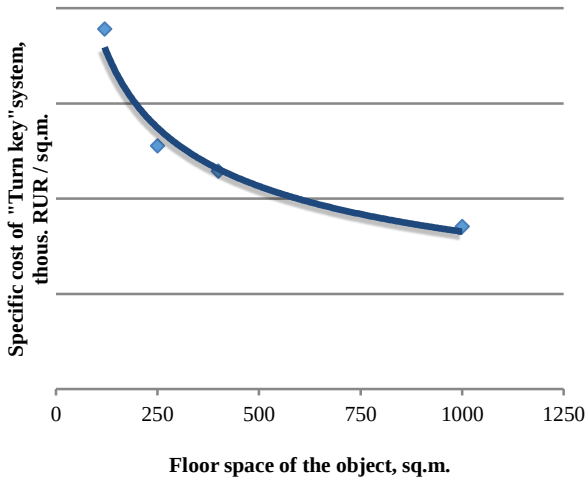

Figure 3. Dependence of the specific cost of a "smart home" system in standard projects on the floor space of an object.

Thus, for an apartment with a floor space of 180 sq. m., the cost of installation of the “smart home” system, which includes the whole list of the mentioned package of services “Lux +”, will be 20 thous. RUR. for a sq. m. of the total area or about 3.6 m. RUR for an object.

Installation and usage of the “smart home” systems allow increasing of the life quality of residents, which should be estimated by the latter in monetary value [19]. An additional factor, which increases earnings from the installation of “smart home” systems, is the economy of utility services. Nevertheless, installation and maintenance of such systems require additional capital and maintenance costs [20].

The calculation algorithm presented below is based on the principle of contribution of one or another production factor (resource) into the value of the object which takes into account that the economic value of a specific element in the content of the object is defined by the change of the value of the whole object when the stated element is added or removed from it [12, p. 206].

At the moment such systems can be used in Russia by residents of elite and business class apartments. Therefore, in the selection of analogical objects, it is necessary to constrict the used sample to the objects of these classes.

Since the right for a real estate object can be held on the basis of ownership or rent, two possible calculation algorithms are presented below. The choice of an algorithm will be justified by the availability of information on the properties offered on the market that can be used as analogs. The best option is to apply both calculation algorithms with subsequent analysis of the obtained results and their harmonization.

1. The algorithm of calculations in case there is information on the prices of offers for property rights can be as follows:

1.1. Selection of elite or business class apartments in order to define the price of their offer (or without negotiated discount — transaction price).

1.2. Determination of the specific cost of 1 sq. m. of the transaction price of the apartments in the analyzed segment in order to eliminate the influence of the apartment floor space factor on the calculations.

1.3. Clarification of the location characteristics of the apartment, view characteristics, specifics of the transfer of ownership rights and purchase financing, the date of the offer, the internal condition of the

apartment, rights for additional premises transferred with the apartment, for example, parking spaces for their further unification.

1.4. Calculation of the average values of unified prices for elite class apartments with installed "smart home" systems.

1.5. Calculation of the average values of unified prices for elite class apartments without "smart home" systems.

1.6. The difference between the last two values will give information on the cost of "smart home" systems.

2. *The algorithm of calculations in the presence of information on the offer to rent apartments can be as follows*:

2.1. Selection of elite or business class apartments for the purpose of determining the value of their rent under the conditions of full lease

2.2. Determination of the rental rate for 1 sq. m. of elite class apartments in order to exclude the influence of the apartment floor space factor on the calculations.

2.3. Clarification of the location characteristics of the apartment, view characteristics, specific conditions of the lease contract, the date of the offer, the internal condition of the apartment, the rights for additional premises transferred with the apartment, for example, parking spaces for their further unification.

2.4. Calculation of the average value of unified rental rates for elite class apartments with installed "smart home" systems.

2.5. Calculation of the average value of unified rental rates for elite class apartments without "smart home" systems.

2.6. Determination of the average annual cost of the utility payments and operating costs to eliminate the influence of the seasonality factor for apartments with installed "smart home" systems.

2.7. Determination of the average annual cost of utility payments and operating costs to eliminate the influence of the seasonality factor for apartments without "smart home" systems.

2.8. Determination of the cost for installation of smart home systems.

2.9. Determination of the discount rate for alternative projects.

2.10. Determination of the discounting period.

2.11. Determination of the present value of the increment of value due to the "smart home" systems, reduced by the cost of installation of these systems. To implement the presented algorithm, the calculation is carried out according to the following formula:

$$V^{SH} = -E_0 + \sum_{i=0}^{n-1} \frac{\left[\left(A_i^{SH} - A_i\right) + \left(E_i - E_i^{SH}\right)\right] \times S^{SH}}{\left(1 + \frac{Y_o}{q}\right)^{i \times q}} \quad (1)$$

where V^{SH} — cost of the "smart home" system installed at the property object;

E_0 — initial costs for installation of the "smart home" system;

n — projection period in years;

A_i^{SH} — monthly rental rate per square meter of the floor space of the property with a "smart home" system;

A_i — monthly rental rate per square meter of the floor space of the property without a "smart home" system;

E_i — monthly service charges and maintenance costs per square meter of the property without a "smart home" system;

E_i^{SH} — monthly utility bills and maintenance costs per square meter of the property with a "smart home" system;

S^{SH} — the floor space of the property with a "smart house" system;

Y_0 — the annual real general rate of return on the entire invested capital determined on a project with alternative risks;

q — the regularity of rental charges paid during the year, in this case it equals 12.

Consider the implementation of the proposed algorithm through an example. To implement the presented algorithm for estimation with transferable property rights, two apartments located in the prestigious district of St. Petersburg were chosen. The characteristics of these apartments are very similar and differ by the presence of a "smart home" system. The characteristics of these apartments and their offer prices are presented in Table 1.

The analysis revealed that in addition to the "smart home" system, in the sale of apartment 1 the right to a place in the parking lot is being transferred too [21]. Further studies of the real estate market in the surrounding area showed that the cost of the parking place is approximately 3.6 million rubles, which was taken into account in the calculations presented in Table 2.

Table 1. Characteristics of the analogues objects with transferable ownership rights

Parameter	**Data for objects**	
	Apartment 1	***Apartment 2***
“Smart home” system	Yes	No
Price of the offer, m. RUR	182	174
Floor space of the apartment, sq. m.	186	190
Date of the offer	April, 2017	April, 2017
Accepted negotiated discount	0.2	0.2
Transferable rights	Ownership, without encumbrance	Ownership, without encumbrance
Financing conditions	One-time payment, mortgage is possible	One-time payment, mortgage is possible
View characteristics	Yard and street	Yard and street
Floor / Number of storeys	4 / 9	5 / 8
The condition of interior decoration	excellent	excellent
Furniture	Built-in kitchen	Built-in kitchen
Additional elements of service	With a parking place in the parking lot of the house	Absent

Table 2. Calculation of the cost of the "smart home" system by using analogues objects with transferable property rights

Parameter	**Data for objects**	
	Apartment 1	***Apartment 2***
Price of the offer, m. RUR	182	174
Price of the transaction, m. RUR	145.6	139.2
Floor space of the apartment, sq. m.	186	190
Price of the place in the parking lot, m. RUR	3.6	-
The cost of the apartment, adjusted for the place in the parking lot, m. RUR.	142	139.2
Cost of the apartment, RUR / sq. m.	0.76	0.73
Difference in the cost of the apartment, RUR / sq. m	0.03	
Cost of the “Smart home” system, m. RUR	5.7	

Thus, the cost of the "smart home" system with the usage analogues objects with the transferable property rights is determined in the amount of 5.7 million rubles.

To implement the presented calculation algorithm with transferable tenancy rights, two apartments were chosen located in a prestigious district of St. Petersburg, with the most similar characteristics and which differ in terms of the "smart home" system. The characteristics of these apartments and the size of their rent are presented in Table 3.

Table 3. Characteristics of analogues objects with transferable lease rights

Parameter	**Data for objects**	
	Apartment 1	***Apartment 2***
“Smart home” system	Yes	No
Price of the offer, m. RUR	540	315
Floor space of the apartment, sq. m.	181	173
Date of the offer	April, 2017	April, 2017
Transferable rights	Rent (use and possession), without the right of residence registration	Rent (use and possession), without the right of residence registration
Financing conditions	Monthly advance payments, deposit in the amount of 3 rent payments	Monthly advance payments, deposit in the amount of 3 rent payments
View characteristics	Yard and street	Yard and street
Floor / Number of storeys	8 / 9	5 / 7
The condition of interior decoration	Excellent	Excellent
Furniture	Fully furnished	Fully furnished
Additional elements of service	Absent	Absent

When performing the calculations, it was taken into account that the nominal overall return on all invested capital determined for an alternative risk project is 25% per year in accordance with the stage of exit from a venture project and in accordance with the classification presented in [15]. The real rate of return is determined by Fisher's formula given the projected rate of increment in rental rates and utility payments in St. Petersburg by 5% per year, on average.

Based on the experience of the authors, the projected period was adopted as equal to 6 years. It is the period of the economic effect [16, p. 172]. In the calculations, it was considered that the rent was received monthly, at the beginning of each month. The results of calculations are presented in Table 4.

Thus, the cost of the "smart home" system with the usage of analogues objects with transferable tenancy rights is determined in the amount of 5.8 million rubles. The calculations made allow us to conclude that the cost of the smart home system is 5.7 – 5.8 million rubles.

Then, the entrepreneurial profit of the project for introducing the "smart home" system will amount to 2 million rubles. As shown in [17, p. 205], the amount of the contribution of any of the technological or organizational innovations in increasing the value of a business depends on the financial efficiency of the innovation. The internal rate of return (IRR) was chosen as a relative criterion of efficiency. The IRR was calculated for the projected time of net earnings receipt from the implementation of the "smart home" system, equal to six years. Note that the internal rate of return on the investment project for the introduction of the "smart home" system will be 50% of the project.

Table 4. Calculation of the cost of the "smart home" system using analogues objects with the transferable rent rights

Parameter	**Data for objects**	
	Apartment 1	***Apartment 2***
“Smart home” system	Yes	No
Cost of the rent, thous. RUR / month	540	315
Floor space of the apartment, sq. m.	181	173
Cost of the rent, thous. RUR / sq. m. / year	35.8	21.85
Average utility bills, thous. RUR / month.	21	27
Average utility bills, thous, RUR / sq. m. / annum	1.39	1.87
The installation cost of the "smart home" systems, m. RUR	3.6	-
Nominal discount rate, % p.a.	25%	
Real discount rate, % p.a.	19%	
Period of the discount, year	6	
Annuity payments, m. RUR / year	2.6	
The present value of incremental cost due to "smart home" systems, m. RUR.	9.4	
The present value of incremental cost due to "smart home" systems, reduced by the installation cost of these systems, m. RUR	5.8	

5. Conclusion

The paper analyzes the term of the Internet of things, on the basis of which a new definition of this concept is given.

The analysis of the world experience of the IoT introduction is presented and a conclusion is made about the possibility of deflationary development of economic processes due to the growth in efficiency of all participants of the IoT ecosystem.

A conclusion is made about the possibility to modernize the Russian economy by creating new markets and high-tech industries, including on the grounds of new business models based on IoT, which will lead, among other things, to improved quality of population's life.

One of the segments of IoT technologies was considered the "smart home" system. As a result of the analysis, it was revealed that the specific feature of the Russian market is an extremely low level of penetration of intelligent control systems for managing engineering systems in buildings and facilities.

An algorithm for calculating the cost of "smart house" technology is proposed, which allows investors to make informed decisions about investing money in the Internet of Things. The review of standard projects of the "smart house" system offered in St. Petersburg was conducted and a power law dependence was obtained for the unit cost of installation on the floor space of the object. The internal rate of return on the investment project for the introduction of the smart house system will be 50%.

Acknowledgment
The research carried out with the financial support of the grant from the Program Competitiveness Enhancement of Peter the Great St. Petersburg Polytechnic University, Project 5-100-2020.

References

[1] O.Y. Andreeva, Y.K. Batueva (2014) “Leaders of Innovation: Consumers of the Internet of Things”. Shumperter readings. Vol. 1. Pp. 89-94.

[2] M. Samsonov, A.Roslyakov, S. Vanyashin (2013) “From the Internet of People to the Internet of Things” , IKS. No. 5, p. 62.

[3] L.M. Martynov, S.I. Syzdaltsev (2013) “Management Development Vector in Competitive Conditions of Information and Communication Business Environment. Contemporary scientific thought”., No. 6, pp. 112-119.

[4] M.B. Yanenko, M.E. Yanenko, “Communication Marketing in Information Economy: Development Problems and Prospects of the Internet of Things”, Bulletin of Yaroslav-the-Wise Novgorod State University, 2014, No. 82, pp. 77-81.

[5] Internet of Things of Rob Van Kranenburg. Lecture in the context of Futurdesignlab [Electronic resource]. URL: http://design-union.ru/authors/theory/1490-internet-of-things-futurodesignlab (date of visit 09.04.17).

[6] Shabanov S. The Internet of Things: Myth or Reality? [Electronic resource]. URL: http://www.logistikaprim.ru/unpublish/internet-veshchei-mif-ili-realnost (date of visit 09.04.17).

[7] O.Y. Nikiforov, “Basic Technologies of the Internet of Things”, The Symbol of Science, 2015, No. 9-1, pp. 105-107

[8] M.A. Elizarov, “Development Prospects and Problems of the Internet of Things”, Nauka-Rastudent.ru, 2015, No. 12, p. 35.

[9] M. Draganov, O. Andreev, “Innovation City Marketing – Development Prospects of Concepts”, Information Technologies and Systems: Management, Economics, Transport, Law, 2015, No. 2 (16), pp. 143-149.

[10] Shekhovtsev M. Technology Shifts, the Internet of Things and Digital Economy. Report of J’son & Partners Consulting. Moscow, 2016 [Electronic resource]. URL: http://json.tv/ict_telecom_analytics_view/tehnologicheskie-sdvigi-internet-veschey-i-

tsifrovaya-ekonomika-20161209060802 (date of visit 09.04.17).

[11] Bril, A., Kalinina, O., & Ilin, I. (2017). Small innovative company's valuation within venture capital financing of projects in the construction industry. Paper presented at the MATEC Web of Conferences, , 106 doi:10.1051/matecconf/201710608010.

[12] Iliashenko, O. Y., & Shirokova, S. V. (2014). Application of database technology to improve the efficiency of inventory management for small businesses. WSEAS Transactions on Business and Economics, 11, 810-818.

[13] Price-Lists for Standard Projects of the company “Smart home KNX Showroom» in SPb: http://pro-smarthome.ru/

[14] Ozerov E.S., Pupentsova S.V. Value and Investment Potential Management in Real Estate. SPb. : Publishing House of the Polytechnic University, 2016, 602 p.

[15] Rosnano. Practical guidelines on assessing assets in terms of projects implemented with participation of the State Corporation “Russian Corporation of Nanotechnologies”, part. 1. M., 2010.

[16] Bukharin N.A, Alekseeva N.S. Estimated Value of an Enterprise (Business). Assessment of Intangible Assets and Intellectual Property: Course Book. SPb.: Publishing House of the Polytechnic University, 2011, 301 p.

[17] Bukharin N.A., Ozerov E.S., Pupentsova S.V., Shabrova O.A. Estimation and Management of a Business’s Value: Course Book. SPb.: Publishing House of the Polytechnic University, 2011, 238 p.

[18] A.A. Popov, “Creation of an Information System for Managing an Apartment Block Based on the Internet of Things”, Bulletin of Plekhanov Russian University of Economics, 2015, No.2 (20), pp. 69-83

[19] Mokhireva, A., Loginova, P., Glebova, E., & Bespalov, V. (2018). Hardware base and experimental potential of a smart building prototype. Paper presented at the MATEC Web of Conferences

[20] Vavilov, D., Melezhik, A., & Platonov, I. (2015). Reference model for smart home user behavior analysis software module. Paper presented at the IEEE International Conference on Consumer Electronics - Berlin, ICCE-Berlin

[21] Nikolova, L. V., Kuporov, J. J., & Rodionov, D. G. (2015). Risk management of innovation projects in the context of globalization. International Journal of Economics and Financial Issues, 5(3S), 68-72.

[22] Gluhov, V., Leventsov, V., Radaev, A., & Nikolaevskiy, N. (2018). Analytical modeling of development and implementation of telecommunication technologies doi:10.1007/978-3-030-01168-0_39

[23] Glukhov, V. V., Ilin, I. V., & Lepekhin, A. A. (2018). Towards business optimization and development of telecommunication companies: Tools analysis and their adaptation opportunities doi:10.1007/978-3-030-01168-0_42