

# **Exporting technology to the Russian agriculture market**

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| Abstract<br><br><p>Agriculture at the current stage of development is experiencing a new rise. The developments of new technology can increase productivity, reduce production costs and improve product quality significantly. Furthermore, the advancements in IT technology are developing the connection between all of the parts and members in the agriculture, providing the opportunities for development, which could not be imagined two decades ago. With the popularisation of these technology, such solutions are available for all sectors of the agriculture technology market.</p> <p>The interconnecting link between all of the machines, devices, sensors, etc. and users is the concept of the Internet of Things. Applications of this concept provides an ultimate control tool for managers in the field of agriculture.</p> <p>A-Lab Oy is a Finnish engineering company, which have already developed some IoT concept –based applications for different markets. The company is currently looking for opportunities of emerging in the Russia and gaining a market share in the market of innovative technology in agriculture in Russia. The main aim of this study is the understanding of current state of Russian agriculture innovation market, following with the suggestion for emerging.</p> |  |                                     |
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## **Abbreviations and terms**

IoT – Internet of Things

IT – Information Technology

B2C – Business to customer

B2B – Business to business

M2M – Machine to machine

RFID - Radio Frequency Identification technology

# 1. INTRODUCTION

## 1.1. Modern agriculture technology

Agriculture at the current stage of development is experiencing a new rise. The developments of new technology can increase productivity, reduce production costs and improve product quality. In the modern agriculture, there are several areas of technology development and use of innovations:

- Tillage technology
- Technology of production of agricultural machinery and equipment
- Technology of breeding of cattle
- Technology of drainage and irrigation of the soil
- Technology of product collection and storing
- Technology of transportation and selling of products

In addition to these areas, there is still a wide range of innovative directions, applicable in agriculture.

Questions of environmental friendliness and purity are trending nowadays. In this connection, technology allowing the growth of product cleanness are becoming more popular and spread. Usage of modern machines, chemicals and production processes are the key factors for achieving better quality and environmental friendliness.

Furthermore, historically, one of the main priorities of agriculture is the growth of production effectiveness and capacity. Innovative technology, which allows to collect several harvests per year successfully complement non-waste production (lean) technology and technology of clever harvesting and storing of goods. Moreover, in the livestock sector there are developments forage harvesting technology, technology of breeding of fowl, livestock and animals previously considered to be exotic.

The possibilities of modern agriculture today are not less impressive than space and computer industries and from innovation in this field, the food supply of

people depends, especially on the background of the World's population growth. Effective methods of decreasing of environment's impact on the agricultural performance are developing gradually.

The advancements in IT technology are developing the connection between all of the parts and members in the agriculture, providing the opportunities for development, which could not be imagined two decades ago. With the popularisation of these technology, such solutions are available now even for common farmers. The interconnecting link between all of the machines, devices, sensors, etc. and users is the concept of the *Internet of Things*, which is described and discussed in the following chapters.

## **1.2. The case**

A-Lab Oy is primarily an agriculture technology focused company, providing different monitoring systems for businesses from all around the world. These systems include measuring and controlling technology. All of the involved processes include the information flow from different components of the systems and people. This brings up the concept of the Internet of Things to the case.

As it has been mentioned, the company is operating globally, but there is a strong interest in expansion of the operations in Russian market due to the variety of reasons ranging from geographical location to the potential of the growing economy. The main idea is expansion by introducing new services, specifically Internet of Things solutions.

The main aim of this research is the observation of the Russian agriculture market, mainly focusing on the technology and related services, looking for possibilities to get a share in this market.

### **Company's background and organization**

A-Lab Oy is a Finnish company, founded in 2000. The company is specialized in producing monitoring and controlling systems for different facilities both in

commercial and industrial sectors. Designed solutions are used in many spheres of business, mainly agriculture, transportation and production. Company's main idea behind all this is to design and provide a system, which will fulfil all of the customer's requirements. This means that every system is unique and designed by professional engineers to fully meet client's demands.

A-Lab's operations vary from country to country: a company is not big, yet it is very international, which makes it a very fascinating case. Company's network is very complex, first of all, because numerous operations and processes are outsourced. For example, engineering part of the system design process is usually outsourced, no matter from which part of the world the customer is. At the same time, distribution of the services in Scandinavian countries and Finland are done by company itself, but in other parts of the world this is a responsibility of the subcontractors and dealers. Speaking about production of the system components, there are several manufacturers in different countries who provide key components for systems, which are made with A-Lab's license. These are the items, which are designed by the company, playing the main roles in the designed systems. Less important and easily replaceable items are purchased in the home country of the particular contract. Such items and services range from various sensors and other related goods to web-services and maintenance.

Communication with members of the supply chain is done in traditional ways: telephone, email, fax. Such technology like Enterprise Resource Planning solutions are not used, first of all, because of the complexity and volume of the relationships and connections. Company is doing business by networking with people and companies involved in the same spheres of business. During these 15 years A-Lab has acquired numerous strong contacts all around the world, allowing successful global operations.

### **A-Lab's products**

A-Lab carries out the research and development of the systems' key components by themselves. Such items are control, measurement and alarming



devices. In 2014 they have spent ~20% of turnover in research and development. Improvement of the service and technology is essential for A-Lab.

The main value for customer is the design of a system, developed specifically for a particular customer. In order to fulfil such projects, company uses own solutions. Main products can be divided in two sections.

Environmental monitoring devices:

- a-Weather station – a device, measuring and transmitting weather data straight to the Internet.
- a-WS – an environment monitoring station, wirelessly transmitting data to the web-server.
- a-Water – a waterproof device, measuring different water properties and transmitting data wirelessly.

Measurement, controlling and alarming devices:

- Micro plus - a controlling unit for the fresh production storages, like vegetables and meat.
- Onestore – unit for control of the fresh production (e.g. food), that are stored in one cell.
- aCG-100 – a measuring and controlling multipurpose device, connected to the Internet.
- aWS-100 – waterproof measuring device, connected to the Internet.
- aSMU-100 – tank and container measuring device, connected to the internet wirelessly.

## **Business operations in Russia**

A-Lab Oy have entered the Russian market in the early 2000's with the introduction of some solutions in agriculture processes' monitoring. Main customers in Russia are engaged in the production of vegetables stored in bulk, like potatoes, carrots, onions, beetroots. Since the foundation, the company have already built a strong regular customer base and tries to get a bigger market share. The main problem of emerging in Russia is the overall low level

of development of Russian farms comparing to the European, American and Asian ones. Moreover, Russian agriculture market is currently quite dependent on the import of the vegetables and fruits from abroad, which results in low rate of development of the industry, meaning the low demand of such technical solutions. From another hand, current political and economic situation in Russia is very fruitful for the introduction of new solutions to the market, which can result in achievement of significant share of developing market in the future. A-Lab's idea is gaining a market share by introduction of new and approachable technology.

### **1.3. Research objectives**

A-Lab is not a big company, yet very international. Company has a strong aspiration of gaining a bigger market share both in the known and new markets. Russian market is one of the priorities, since it has a great potential of the developing country.

There are some economic complications nowadays in Russia. However, this fact should not terminate the interest in this market, since there are numerous opportunities. Russian agriculture market is underdeveloped now, but recent controversy in relationships with the US and Europe has made a non-obvious positive outcome of the stimulation for domestic industrial and production sectors. This and long-term relationships as long as wide network provide a good head start for gaining bigger market share and entering new regions of Russia.

The company is planning to introduce a range of new services for the customers. The main idea is implementation of the Internet of Things concept – connection of all system's parts and ultimate data flow between machines and users. New services are aimed at gaining a wider share of developing market. In order to be able to successfully do this, a deep and thoughtful research is required. In this thesis, the environment of the Russian agriculture market will be analysed and opportunities for importing of technology to the agricultural sector will be revealed.

In order to achieve a clear understanding of the situation and be able to see possible opportunities in the Russian market the following questions were needed to be answered:

1. How can principles of the Internet of Things be applied in agriculture?
2. What are the trends of agriculture industry in Russia?
3. How ready is the agriculture industry in Russia to the application of IoT-based systems?

The main question of this thesis work is: *Is there a potential share in the market of IoT applications in agriculture for the A-Lab Oy in Russia?* By answering to the three questions above, the answer to the main question can be gathered. As a result, a suggestion is formulated in the end of the thesis.

#### **1.4. Importance of the study**

The research tries to provide an inside view on the Russian agriculture market with a focus on the application on the innovative technology. This study is relevant for European providers of services and technology for agriculture, who are considering expansion to the developing markets. In this consideration, Russian market might be a great opportunity to develop larger international customer base, since agriculture in Russia is extremely important for the well-being of the country, especially in the current economic crisis conditions. Today, the importance of domestic vegetable growing in Russia is increasing gradually, due to the economic sanctions and economic issues in the country. However, stressful economic times provide great opportunities for enterprising private entrepreneurs, which is why this time is considered to be extremely fruitful for investments with a long-term orientation.

This thesis work is studying the concept of IoT and its implementation in the agriculture. This study provides an analysis of agriculture in Russia and possibilities of using innovative IT technology for agriculture in the Russian domestic market.

## **2. THEORETICAL BACKGROUND**

In the theoretical chapter different relevant aspects describing Russian agriculture market are discussed. Development of a successful service requires careful and pervasive research of a market, revealing all of the factors and features. Russian agriculture market is huge and in order to support the research and be able to make justified assumptions and decisions, a strong theoretical background is required. Moreover, the core concept of Internet of Things is discussed.

### **2.1. Technology background**

The main aim of the thesis is to familiarize western European enterprises to the Russian agriculture technology market. The case company serves as an example for the research, since theoretical background of their developments and other possible applications are described to study the topic.

Furthermore, modern IT solutions are far beyond narrow-ranged application for specific needs, requiring excessive development and huge amount of investments. There are IT solutions available for any kind of business and private application. The concept of Internet of Things unites all these solutions in one system, allowing intercommunication of all its elements.

Agriculture is one of the developing industries in Russia. Climate in the most of the Russian regions is not favourable, but centuries-old knowledge and understanding of the environment combined with modern technology, allows successful growth of different kinds of crops in most of the regions. However, technology of crops growth is outdated and there are a lot of developments in this direction and IT solutions have a huge role in this process.

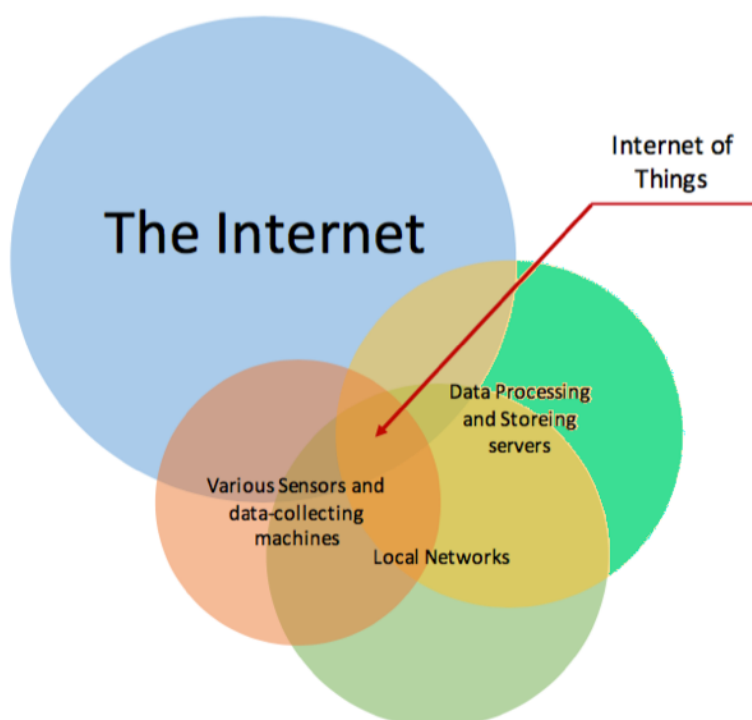
### **Internet of Things**

Internet of Things (IoT) – is a concept of computer-based networks of physical objects (things), equipped with built-in technology such as sensors, RFID, transmitters, etc., designed to communicate with local environment or each

other, aimed to the automation and rebuilding of economic and social processes, excluding human participation (Kevin Ashton, 2009).

Nowadays, IoT is used almost everywhere: in transport, sales, sport, medicine, construction, manufacturing, etc. Mobile devices or special sensors monitor movement of ships and trucks for transport companies, analyse layouts of products, providing better sales, change the modes of machines at factories depending on changing demand, monitoring of patients' conditions in medical institutions – the applications of IoT are endless.

There are several factors, that were prerequisites for the introduction of IoT. First of all, when the global application of barcodes and RFID has started, this has shown, that standardisation allows optimisation of data flow between different systems. First developments of these technologies took place during the 40's and 50's of XX century, but to the lack of suitable technological background, further advancements took place only a couple of decades later. Barcodes became widespread in the end of 70's, whereas RFID-based systems gained popularity in 2000's, on the background of the significant decrease of its cost. Another important factor before the introduction of IoT was cheapness of databases, needed for the collecting and processing of huge amounts of information. The last step was replacement of the IPv4 internet protocol to IPv6, which allowed connecting any device possessing software to the Internet (Pavel Trofimov, 2013).



*Figure 1 – A visualisation of IoT structure*

Thus, Internet of Things is a system, which involves barcodes, RFID, NFC, different sensors, IPv6. All of these technologies are very common and cheap nowadays. On the other hand, IoT is not just these components, IoT is something bigger - it is a global process, uniting objects around people, dramatically increasing the quality of the life and this process is inevitable. Internet of Things is considered to be the key trend of the world's economy in the coming decades.

Department Director for the Cloud IT cluster Skolkovo Ivan Kireev believes that today Russia is on the threshold of large-scale technological leap in the field of the Internet of things. "Large companies are showing a great interest in the various areas of the IoT, including the manufacturing industry, automation of large public facilities (airports, monitoring of urban traffic, the integration with GLONASS systems), building management, energy systems. Also, the private sector is waiting for new solutions in the area of the IoT, especially m-commerce and wearable electronics" - shares the opinion of Ivan Kireev (cnews.ru, M. Levkevich 2015).

According to the innovation director of the company "Intech" Ivan Phil, modern technology can cope with large-scale spreading of IoT technologies without breakthrough innovations such as quantum computers. "Hardware solutions' market share in the period 2014-2019 will reduce from 65% to 50%, while in Russia - from 70% to 60%. This occurs primarily due to lower cost hardware solutions while the number of applications and platforms is growing, - said Ivan Fil – "In my opinion, Russia has the potential to create competitive products in all segments of the IoT and it is the right time for us to begin creating international technology brands in this field."

There are already some examples of pioneers in IoT applications in Russia:

1. *GO+*

The project, which started in May 2013, allows combining different devices operating in the Internet of Things format. The platform provides users the ability to quickly deploy their own services and create new ones based on the provided API. Its main feature – control of absolutely any device with Internet access. In addition, the platform can serve as a good tool for business, because it provides an ability to create customized client services for device management.

2. *Virt2real*

It is a platform for creating Internet of things applications with a remote control and video surveillance via Wi-Fi, 3G / 4G or cable Internet. Distinctive feature is not just the compact size, but also easiness of connection of any external devices and possibility to work with video material. Full operating system provides ample opportunities to create devices with artificial intelligence.

3. *Black Swift*

It is one of the most recent startups, which is aimed at the reduction of cost of the existing Wi-Fi technology. The main product of the company is a coin-sized Wi-Fi module, which can be built into a computer device. It can be integrated into any machine in order to build a smart environment.

4. *Command Spot*

It is a service for active Internet users, which allows control of the web-

connected devices from anywhere in the world. Service is already running and is aimed in the direction of B2C. In the nearest future, Command Spot will be able to use various controllers, including the "smart city": the founders are considering options for working with lighting, electronic devices in the parking lots, alarms, etc.

All these and some other services are the evidence of the beginning of the significant development of information technology in Russia. Domestic entrepreneurs and startups have already realized the importance of IoT and its mission to unite all devices around people, leading to the incredible growth of the quality of life and performance of businesses, revealing endless opportunities both for customers and for service providers.

## **Cloud computing**

*'Cloud computing refers to the provision of computational resources on demand via a computer network. ... All of these services are presented to the users in a simple way that is easy to understand without users needing to know how the services are provided.'* ('An introduction to cloud computing' by Nan Berman 2012).

The idea of cloud computing was firstly introduced in 1960, when John McCarthy suggested that someday computer calculations will be made by the means of nation-wide utilities. It is believed that cloud-computing ideology has started gaining popularity in 2007 due to the rapid development of communication channels and the growing needs of users.

We are living in the time of the rapidly evolving computers and wireless technology and cloud computing plays a crucial role in the process of computerisation of life and business. Such technologies are affecting both private and commercial sectors of everyday life. Nowadays, there are more and more people, who cannot imagine their lives without internet-provided services, even without understanding how dense and sophisticated technology is. There are infinite examples of it: ranging from communication services (messaging, social networks) to remote data storages and different types of cloud



computing, which is carried out on remote servers. Internet is so much developed, that even gaming is now available without local machine's computation. People, who are not familiar with this kind of entertainment, should just understand how complicated and resource-demanding this process is.

Furthermore, in the first place, cloud computing has numerous applications in business and production. Nowadays, all kinds of operations can be automated and most of the processes can be carried out without human interaction. This provides great opportunities for cost reduction and optimisation. Common workers can have an instant access to any kind of information, related to the work processes and immediately make decisions and give orders to a machine, since a two-way communication between a machine and a user is now possible.

Cloud is an IoT paradigm, which implies environment formed by a variety of communicating devices around us. Cloud collects data from different system's components, processes it and provides easily interpretable results for the end user. Namely, a cloud is the "brain" of the IoT. Cloud is a remote machine, which collects data from different devices of the system and performs calculations, providing relevant information to end user. The great advantage of cloud computing is that it allows end users to use low-end and cheap hardware in all parts of the system, because all of the resource-demanding calculations are outsourced. Moreover, such applications are extremely cheap nowadays and they are becoming very common in every sphere of life. The best part of cloud computing is that it is relatively cheap easy to setup, use and maintain.

This results in the development of service sphere. Most progressive entrepreneurs have already realized, that the most profitable and perspective area of business is related to services, since not the traditional selling of goods will generate the biggest shares of the revenue. Modern trends show, that most of the major members of the world's IT market, have been shifting to the provision of users with services, not devices. The development of hardware is coming to a stagnation and in order to continue the development of the IT market and to support the competition, new services are introduced both in the B2C and B2B segments of the IT market. The cloud is the core of this trend (Arif Mohamed, 2013).



*Figure 2 - An image of interconnectivity of devices in a Cloud*

From another hand, such applications can be considered to be unprofitable in the long-term, since by using an outsourced service, one has to pay for it during the whole time of using a service or the project lifetime. This means, that there might be a subscription fee, which in a long-term can overlap the cost of personal developments and devices. In addition to that, some people suppose, that clouds are not suitable for storing of private valuable data.

However, this opinion is not very popular nowadays, because there are some very important strengths of outsourced cloud computing. First of all, cloud presupposes a constant development of a service. This is extremely important for companies and organizations whose core competence is not IT. It allows to focus on their core business processes and take minimum efforts to maintain their IT department. Furthermore, clouds as any modern service are constantly developing, constantly developing old services and introducing new features. This model of use of IT applications allows constant development of organization with minimum efforts and time, human and financial resources. The whole industry is constantly developing and in order to keep customers, IT providers have to develop services, making them more and more affordable, safe, effective and cheap (Habrhabr.ru user @NickOlay, 2011).

All things considered, it can be surely said, that cloud is one of the most important advancements in the sphere of IT, which affects all spheres of modern life. For the next decades, IoT, in particular cloud computing is going to play the main role in the construction of new personal life and business performance quality standards. The main disadvantage of cloud computing and IoT is the fact, that there are still some significant limitations of such system, but constant development solves these problems and there almost no impossible solutions, there are only unprofitable ones (Vladimir Romanchenko, 2009).

### **Information technology and IoT in agriculture**

*It is quite surprising, that agriculture was the main catalyst of the development of the Internet of Things in a number of developed countries. Innovative technology is widely used to provide food for people. Internet of things ensures a more stable and efficient performance of a farm. There are many ways in which IoT supports agriculture: storing conditions control, water consumption control, pest control, processes optimization, etc.*

Nowadays, agriculture in Russia is not the main field for advanced technology unlike many other developed countries. The number of transactions between agricultural and technology companies in the developed countries is constantly growing. According to forecasts, by 2018 this market will grow to 3.7 billion dollars. Furthermore, application of low-cost sensors in agriculture has grown dramatically over the last decades. Specifically, commercial agriculture companies are developing and adopt different solutions based on the concept of the IoT, which makes a huge contribution in the overall industrialization of the agriculture in general. Modern technology gives an opportunity of remote control of all stages of the crops' growth, monitoring of the conditions, processing and storing of the relevant data and even automatic control of the conditions with an immediate decision-making. However, modern applications require extensive development, since there are different variables affecting the performance and overall value of the system.

The pioneer in using of IoT in agriculture is the USA. Such technology is used in different ways, for example, in arid regions the soil is moistened only where

sensors record the lack of moisture. Some other farmers have gone much further and gradually implement unmanned automatic machines. There is already evidence of IoT as an efficient tool in agriculture.

For example, IoT is already being implemented in vegetable production as a successful tool for pest control. It is obvious, that pests are extremely harmful for vegetable production – in developed countries pests destroy up to 10% of harvest, in developing up to 25%, while in some countries like Ghana this number reaches a 1/3 of the total crops. Pesticides are the main way of dealing with pests. Pesticides effectively cope with insects, weeds and plant diseases, but some of them are harmful for human health, environment and animals. Nevertheless, for decades, pesticides remain the main tool of saving harvest. Consumption of pesticides in the USA by 2008 has grown 5 times comparing to their amount in 1960, achieving a number of 500'000 tons of chemicals (Elmer L. Cooper,L., DeVere Burton). Some pesticides remain in the soil, which is why the task of farmers is dosing the consumption of pesticides in the safe and efficient way. There are IoT applications, which can solve this problem.

There are several companies in the American market, which have developed systems helping dosing the application of pesticides and make it maximally effective. A good example of successful application for private customers is Canadian company called *Semios*. They have developed a system of exhaustive farm control with a focus on the pesticide application. The following diagram shows the basic principles of their design:

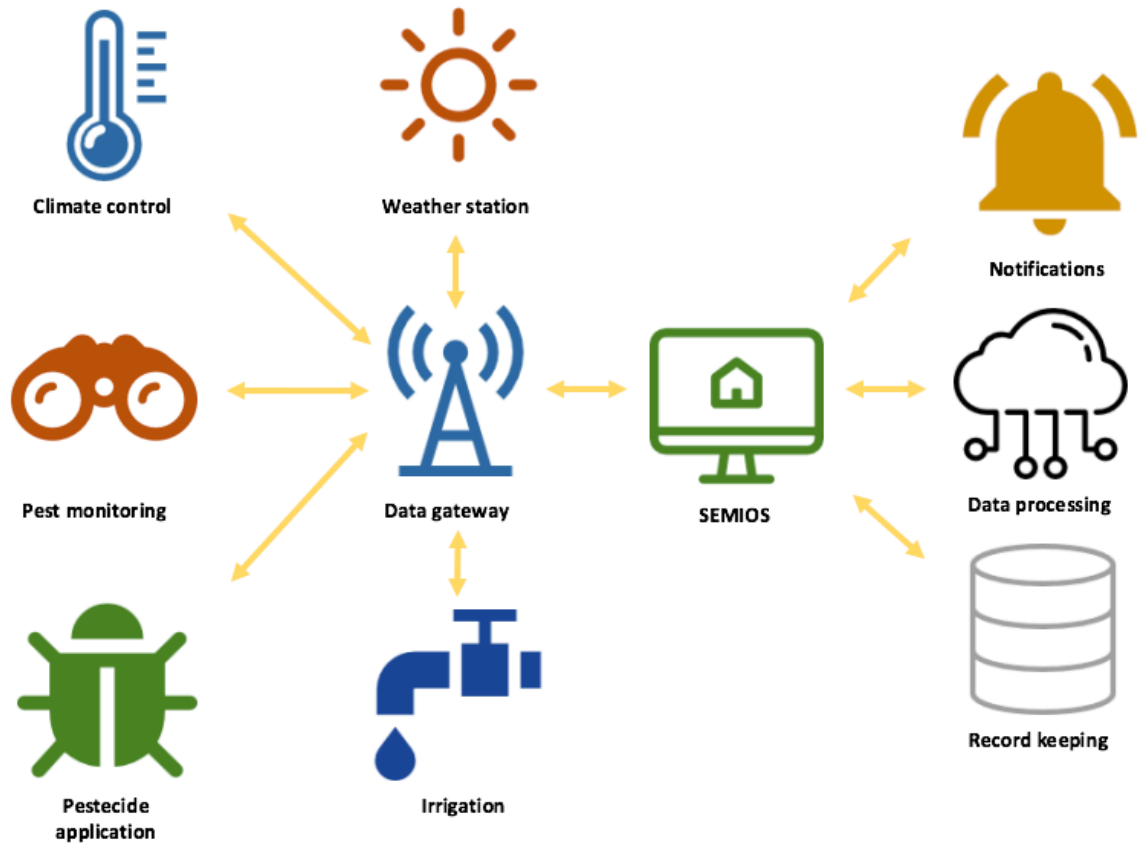


Figure 3 - The structure of Semios farm control system  
 Source: <http://semios.com/network/>

One of the biggest achievement of Semios is a system, which helps dosing the use of pesticides by processing the information from special insects' trap-sensors. These devices look like a bird feeder; it collects real-time information about the amount of insects in the trap. After processing on the remote server a total amount of pest on the specific area is calculated. When the number of insects becomes excessive, farmers get a notification. In order to check the situation, farmer can use the built-in camera and see by himself/herself the amount of insects in a trap and check whether there are harmless midges or dangerous pests. Moreover, the system can automatically spray special pesticides substances in the areas of high congestion of pests, which prevents their propagation.

Farmers can monitor the situation online and gather all relevant processed data by means of a computer or a smartphone. This allows them to act timely and spread pesticides only where they are required and in the right amount. In

addition, from economy point of view, such technology provides a great saving for entrepreneurs, since pesticides are quite expensive.

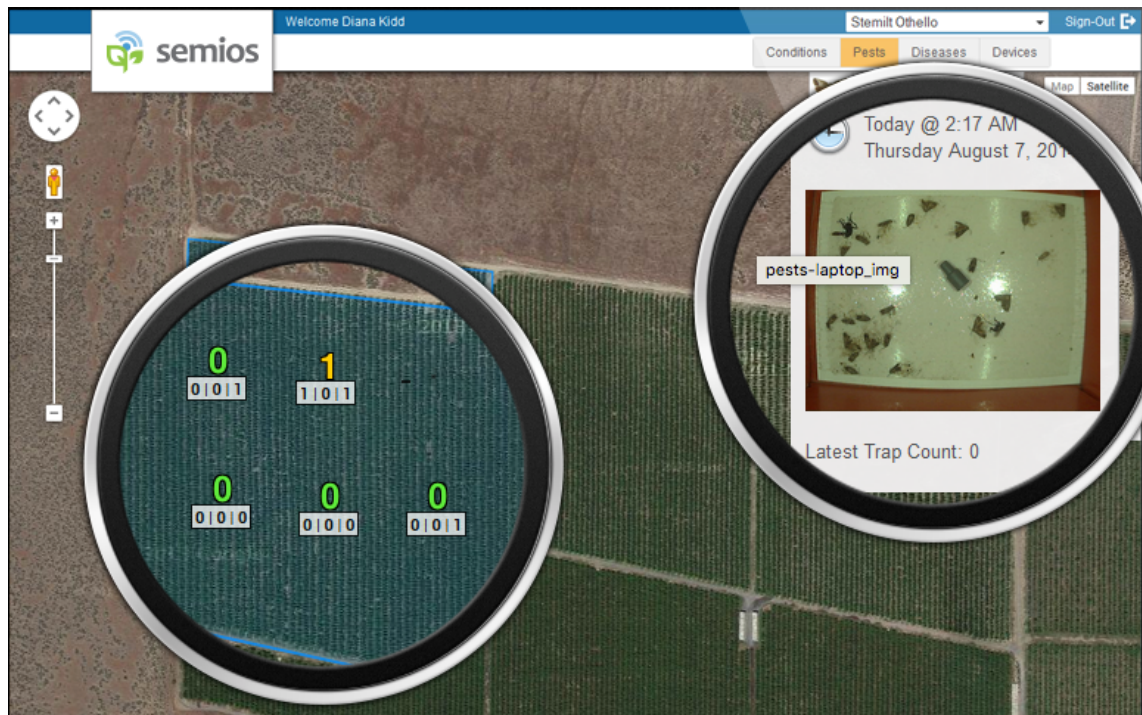


Figure 4 - Sample screen of the Semios application  
Resource: <http://semios.com/ipm/>

This information ensures an intelligent and efficient pest control process through the next great advantage: statistical data processing and collection. By collecting data, farmers can have quite accurate forecasts on the areas, which will need to be treated with pesticides. A program can calculate which areas are most endangered and it can also indicate areas to save pesticides and do not perform unnecessary harm to the environment.

Moreover, some companies are developing systems for controlling of rodents. For example, a company called Rentokill, which core competence is production of different kinds of mousetraps, state that application of the Internet of Things is the future of the industry. They are developing systems, consisted of sensors, which "see" a mouse or a rat and spread poison near it. Manufacturers claim that the sensors are fully capable to distinguish the size of the creature, so that the random casualties like squirrels are avoided.

## Environmental monitoring

Environmental monitoring is one of the major supportive measures of the agriculture, especially for crop growth. Historically, without modern developments of agriculture, like greenhouses, pesticides, fertilizers and advanced IT technology, environment was the major factor affecting the performance of agriculture. People were very dependent on the environmental factors and their food stock during the winter time was sprightly connected to the weather conditions and environment state. Recent advancements in agriculture were aimed to the decrease of weather impact and creation of fruitful environment for effective fruitfulness. Furthermore, nowadays there are other important objectives of environmental monitoring, such as: rational usage of natural resources, ensuring land protection, conservation, protection and improvement of soil fertility, protection of air and water, biological and landscape diversity, ecologic balance of environment, proper usage, storing and disposal of chemicals and wastes.

Besides pest control, there are much more applications of IoT in agriculture and one of the most popular is environmental monitoring. Environmental monitoring devices have a very wide range of application. Their applications usually include:

- Database and cloud computing services, which provide actual and statistical data and able to forecast different parameters of the system state (humidity, pests, illnesses, etc.) Such solutions usually unite different systems of forecasting and monitoring systems providing an ultimate management tool.
- Environment monitoring systems, including soil state, humidity level, pests, illnesses of plants measurement devices.
- Precision seeding devices and planning. Hardware systems, providing variable rate seeding and row management, enabling spacing of different hybrids.
- Fertility and diseases management, which allows rapid decision-making regarding plants' productivity.

- Yield monitoring is a crucial part for estimating the performance of an agricultural activities.

There are much more examples of monitoring devices, which can be implemented in the field of agriculture. Monitoring systems are usually developed to suit a particular customer's need, which provides a lot of variations. In the case of the A-Lab Oy, the company specializes in environmental monitoring systems. The company provides flexible engineering services to suit a particular customer's needs.

Special solutions are tailored to a customer, using existing set of technology. There are several examples of devices, which are usually used as a core to many monitoring systems, developed by A-Lab Oy:

- **A-Weather** – is a device, which is able to measure air temperature, humidity, air pressure, precipitation, wind speed and direction, soil temperature and moisture, solar radiation, water level and flow, air dust quantity, CO<sub>2</sub>, O<sub>2</sub>, Ph.  
The device is easy to install and use: it can be connected via GPRS or SMS and it is powered by built-in solar panels. Actual data is transferred directly from the weather station and can be accessed at any time. A weather station can send notifications to a mobile phone or email on the basis of pre-set events or thresholds.
- **ACG-100** is a wireless data gathering and alarming device. It is a measuring device, which can contain wireless (radio) and wired sensors. The device sends actual data to **a-log.net** in the real-time mode by means of GSM-networks. This device is commonly used for temperature control, but by installing special sensors it can be used as, for example, a fire signalization or safety system.
- **aWS-100** – is a measuring device with a built-in GSM-modem and UHF radio. It has four inputs for temperature sensors (PT1000 and NTC), four inputs for analog signals and four digital inputs (counter or state). It transfers data to **a-log.net**, where the information is available for users in real time.



Complex data collecting storing and processing devices like described above, are developed by the company and produced in Finland or China by a subcontractor, but in order to cut the costs for the international customers, more common devices like basic sensors for the monitoring systems are usually bought at the customer's domestic market. This model provides a lot of variations for different applications in environmental monitoring and cost-effectivity for the customer.

## **2.2. Russian market characteristic**

Russian agriculture market hides a lot of opportunities for international entrepreneurs. During last decades, situation in the country has changed significantly and it had introduced new market for all kinds of international businesses. However, there are many hidden obstacles and features imperceptible for foreigners, ranging from communication barrier to the common ways of working and interaction.

Importance of the agriculture for Russia could not be underestimated, since it is the main source of food products in the country. On the background of current political changes, importing of food products became unprofitable and government has developed a plan of import substitution for agriculture along with other industries. Current situation in the country is contradictory and crisis, but from another hand, it enables diverse opportunities for entrepreneurs.

In the following sub-chapters most relevant dimensions of Russian market are revealed and analysed.

### **Business environment in Russia**

#### **Hofstede's cultural dimensions**

To make a more precise and generalized characteristic of Russia's mentality Geert Hofstede's cultural dimensions are applicable, first of all, because this culture typology model provides an exhaustive information on the particular culture's mentality. Hofstede's model is widely used in the world to characterize

particular culture's features and allows comparison of different cultures. However, Russia is a very big country, which unites many nationalities and ethnicities, which affects Hofstede's study by introducing interferences caused by particular ethnicity's habits. Though, this study has already proven its solvency and most of the Russian people agree with and relate to this data.

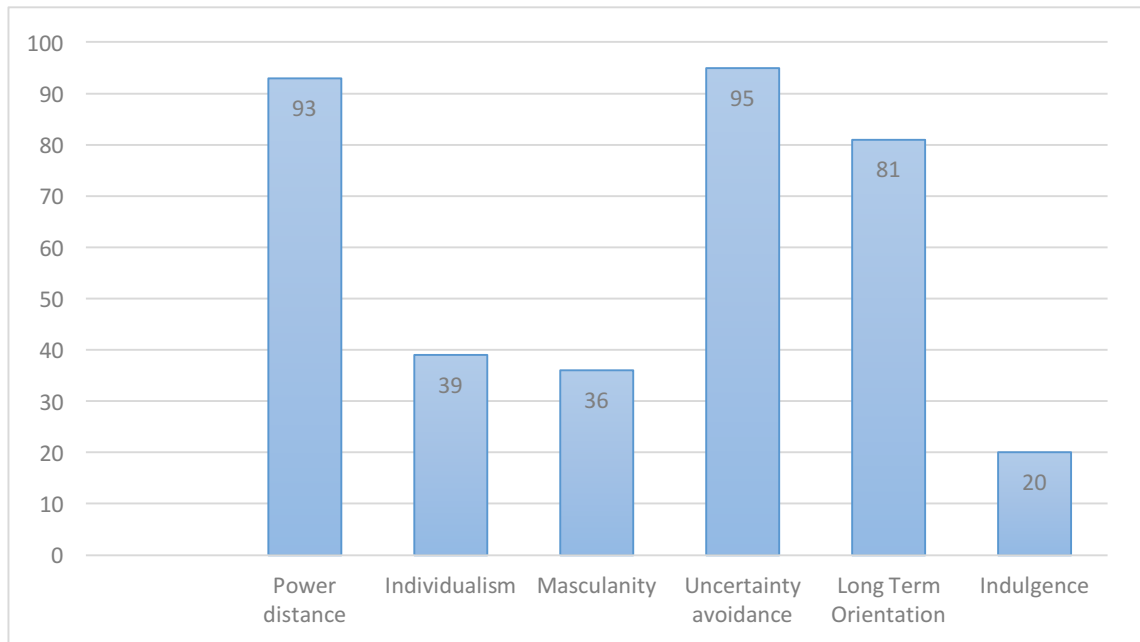


Figure 5 – Russia's mentality characteristics in Hofstede's system  
(source: <https://geert-hofstede.com/>)

### **Power distance**

A score of 93 in this characteristic, means that power holders in Russia are very distant from subordinates. Status symbols are extremely valuable in Russia. In business relations, status must be supported by a correct behaviour and symbols.

### **Individualism**

Despite relatively average score in this characteristic, relationships in Russia are extremely important. Nepotism and familiarity are very common for Russian people especially in business life. Relationships are crucial in obtaining information, getting introduced or performing successful negotiations.

### **Masculinity**

Caring for others and quality of life are driving the society. Commonly,

competition and achievements are not admirable by people, while heirlooms and comfort life are most attractive.

### ***Uncertainty avoidance***

Bureaucracy is very complex in Russia. Furthermore, Russians always prefer to know the context and have background information. Russian people always interact with strangers in a very formal and distant way.

### ***Long term orientation***

A high score of 81 characterizes Russia as a very pragmatic nation. People believe that truth depends very much on a situation, context or time. They show an ability to adapt traditions easily to changed conditions, a strong propensity to save and invest. Thriftiness and perseverance are essential for Russians.

### ***Indulgence***

Russians commonly show a very restrained nature, which is supported by a very low score in indulgence. Russians tend to be pessimistic and cynical. Russians usually believe, that their actions are restrained by social norms and that the violation of such norms is very wrong.

### **General characteristic**

Business environment in Russia is not very different comparing to most of the western cultures, but it has some features. There have been a lot of changes during the last decade, starting from the end of the 90's, which was the time of stagnation and adaptation to the new political system and market economy. More and more businesses in Russia try implementing western business principles and practices. This can be seen ubiquitously, especially in international corporations. Wide variety of companies apply principles of social responsibility, lean manufacturing, environmental care, nonviolent communication, etc. Successful international companies make a lot of efforts to conduct business with world-accepted standards and this have provided a very interesting result of influencing many industries, ranging from manufacturing to social media marketing and IT.

European part of the Russia is considered to be the most developed part of the country, while the situation in developing eastern regions remains quite adverse. There is not enough government's support to amend the situation, because the main focus of the federal government is the development of Moscow and St. Petersburg regions. From another point of view, this hides virtually limitless possibilities and resources for building a successful business both for locals and foreigners. However, there is a significant risk of failure due to the neglect or misunderstanding of a specific region's features and culture. Lack of knowledge and experience scares away a lot of potential investors, but with a correct approach, clear purpose and a little bit of luck opportunities are unthinkable (Russian Business Culture, 2016).

Negative aspects of doing business in Russia may be such things as: uneven power distribution, nepotism, corruption, kickbacks, etc. These issues are topical, but there were a lot of developments both from the side of the government, as well as from the entrepreneurs' side. Business culture is steadily shifting to world-accepted standards. Furthermore, this does not mean, that success is only achievable by fraudulent means. There are a lot of examples of both local and international companies operating in Russia. Most successful foreign businesses in Russia are usually related to automobile manufacturing, IT, consumer goods, while Russian companies are mostly known for extraction and processing of minerals and oil, metal industry, agriculture, weapons' production (Ilya Frankshteyn, 2015).

In general, there are no significant obstacles for building a strong business and private relationships with Russian people. Foreigners just have to keep in mind some features and remain open-minded. Basically, this is true to any business relations with any nation representatives.

## **International relations**

Russia is one of the key members of international relations, one of the permanent UN participants, sharing the responsibility for maintaining international peace and safety. Russia is also the part of the "Big Twenty" economically developed countries, previously was the part of the "Big Eight"

(membership is suspended in 2014). Russia is a member of a significant number of other international organizations, including the Council of Europe and OSCE. Russia is also a significant member of the former Soviet Union organizations: CIS, SCO, CSTO (Nadezhda Arbatova, 2014).

Controversy in relationships between Russia and the West has begun in the beginning of 2014 in consequence of conflict, caused by the disagreement regarding the Crimea peninsula situation and military collisions in the eastern part of the Ukraine. European Union and United States introduced a set of sanctions aimed at the Russian economy. In response, Russian government decided to embargo a wide range of EU food products, to Russian market.

Russian government embargoes "certain types" of agricultural products, raw materials and foods, if the country of origin is a country, which imposed economic sanctions against Russian legal entities and individuals in 2014. Embargo was introduced on 8<sup>th</sup> of August 2014 by president's decree. The list includes meat and dairy products, fish, vegetables, fruits and nuts. The estimated volume of annual import decreased by US \$ 9 billion. Embargo affects European Union, United States of America, Australia, Norway and Canada.

In order to overcome accompanying difficulties, the government has introduced a program of 'Import Substitution'. This program represents measures aimed to the growth of the domestic production. In April 2015, the Ministry of Production and Trade revealed the Import Substitution program for the key branches. *"We want to reduce dependence on those products and services, including innovative that we purchase from abroad"* - deputy prime minister Arkady Dvorkovich. This means, that Russian government tries to create a fruitful environment for development of industry and agriculture by creating benefits, adapting legislation, creating workplaces, stimulating entrepreneurs, etc.

Moreover, Russia is now developing relationships with Asian countries, especially with China. This cooperation might provide good results for many important economic sectors, including agriculture. The first sign of such tendency is the fact, that in May 2015 Russian Direct Investment Fund (RFPI), the Russian-Chinese Investment Fund (RKIF) and the Government of

Heilongjiang Province (China) signed an agreement on the establishment of an investment fund worth \$ 2 billion to finance projects in the field of agriculture in Russia and China. Besides, the parties have reached an agreement on cooperation in the production, supply and selling of agricultural products ([http://www.gazeta.ru/business/news/2015/05/08/n\\_7177117.shtml](http://www.gazeta.ru/business/news/2015/05/08/n_7177117.shtml)).

These measures were introduced recently and it is not possible to make precise assumptions concerning the results of this policy right now. There are different opinions regarding this issue, but it seems, that positive forecasts prevail. On the other hand, there is a widespread opinion, that because Russian embargo was planned to prohibit European production only for one year, there would be no enough time to stimulate domestic production. However, after the European Union extended the sanctions against Russia for six months on June 25, 2015, Russian Government decided to extend the embargo for at least a year, until August 6, 2016.

## **Agriculture industry in Russia**

Agriculture is one of the main branches of the economy in Russian Federation. Agricultural industry has been showing a great growth – agriculture's produced GDP share has almost tripled during the last decade. This indicates the development of the whole industry. Generally, starting from 2000s, agriculture in Russia is one of the most rapidly developing economic sectors. There was a slight decrease in the industry during the economic crisis of 2009 – 2010, but after that the growth continued. Nowadays, agriculture is profitable and supports country's food security and even allows exporting significant volume of some products abroad.

However, agriculture's share (4%) in overall country's GDP in 2014 is relatively small, comparing to such economy branches like manufacturing (16%), trade (17%), transport (9%) from total GDP of 71,4 trillion rubles (approx. 1,6 trillion US dollar), as it can be seen from the following chart:

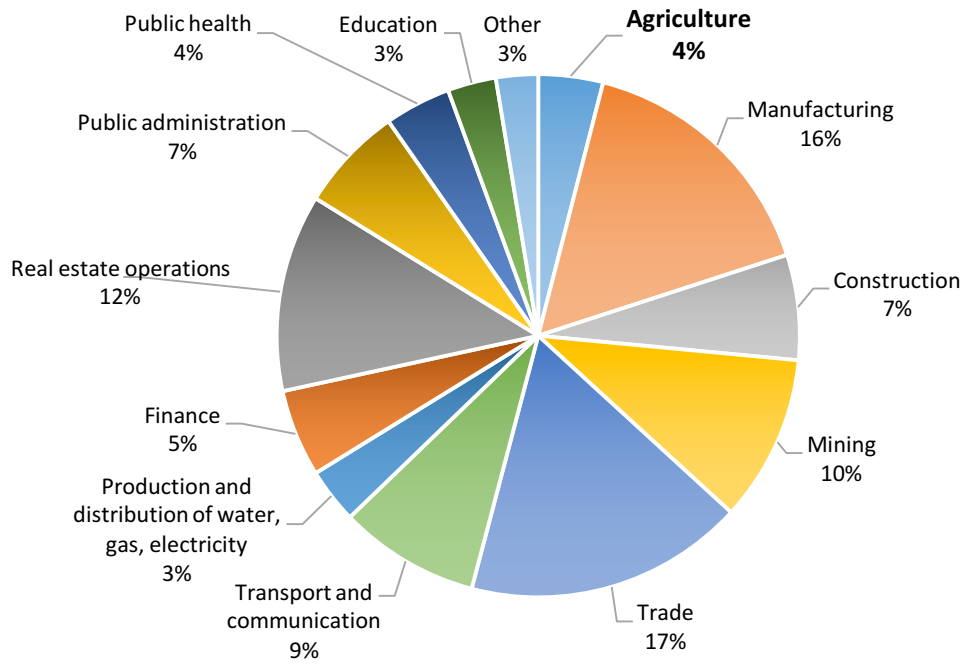


Figure 6 - The structure of Russia's GDP in 2014  
 Source: <http://knoema.ru/>

However, current situation in the industry is quite unclear. Against the background of complications in the Russia's international relations with Europe and the US, there are different opinions regarding the future of agriculture in

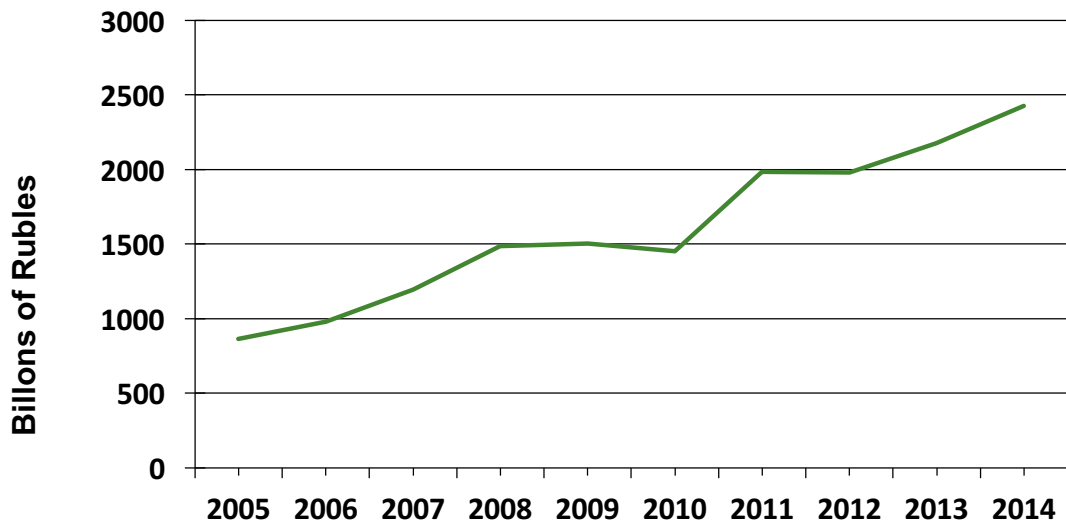


Figure 7 – Agriculture's GDP growth  
 Source: <http://knoema.ru/>

Russia. There are two opposite opinions on this situation: some people believe, that sanctions negatively affect domestic production, leading to stagnation and

degradation, while many people believe, that this situation will stimulate the development of the industry.

There is a myth, that agriculture in Russia is ineffective and unprofitable, due to the cold climate and economic reasons. One of the main reasons for this opinion was the failure of agricultural production in 1990s. However, in the early 2000s, the development of agricultural sector has begun and now agriculture is one of the fastest growing sectors of the economy.

Russia is geographically the biggest country in the world. It covers an area of more than 17 million square kilometres, which is almost two times more than Canada, the second largest country. Russia's territory is located in four climatic zones, ranging from arctic to subtropical. So much different environmental conditions result in a great variety of grown vegetables, fruits, crops, medicinal, berries, etc. Temperate climatic zone prevails, but Southern regions have subtropical climate, allowing growing exotic fruits, like watermelon, peaches, etc., and Northern regions provide fish products, meat and fur (CIA World Factbook: Russia, 2015).

In Russia natural conditions support a range of exclusive products: honey, mushrooms, berries and herbs. For example, Russia is one of the biggest exporters of honey and the leader in production of currants and raspberries. Russia is also known for the export of caviar and the rivers, lakes and sea of Russia, especially located in the Far East, contain significant reserves of fish, including unique kinds like the Baikal omul.

Nowadays, in Russia there are planned or already taken place events aimed at improving of the efficiency of information and consulting services in agriculture, promoting sustainable development on the basis of scientific and technological progress. There is a trend of creation of a fruitful environment aimed at meeting the needs of managers and specialists of agricultural businesses of all forms of property. Farmers receive knowledge about the latest achievements of domestic and world agricultural science, technology and engineering, as well as domestic and foreign experience and knowledge.



There are successful developments in the direction of provision of information, consulting, technical, organizational and managerial services and support in the processes of selection and application of the new technology, preparation, development and application of investment projects. Moreover, knowledge and data related to agriculture are being collected, processed and adapted for a wide variety of users. There are already some applied tools for increasing of the effectiveness of agriculture performance. This kind of data is available through regional rural informational centers.

| Name  | Description   | Developer                                  |
|---|---|--|
| Databases "Veterinary and Livestock"  | Information about animal nutrition, veterinary medicine, biological issues and public safety  | Agriculture Ministry of Russian Federation |
| The software package "Veterinary and Livestock"   | Calculation of feed rations animal breeding automation of accounting and analysis of breeding work at the enterprise level  | Agriculture Ministry of Russian Federation |
| Database "Mechanization"  | Details of agricultural machinery, equipment and processing industry enterprises producing and supplying this technique   | Agriculture Ministry of Russian Federation |
| Databases "Agrochemical service and plant quarantine"   | Information about: mineral, organic and organic-mineral fertilizers; crop protection chemicals; on plant quarantine, as well as the producer organizations            | Agriculture Ministry of Russian Federation |
| The software package "Traditional and emerging technologies of cultivation of agricultural crops" | Technological design in production of basic agricultural crops, taking into account regional, industrial, technical and financial conditions, the scale of production | Agriculture Ministry of Russian Federation |

*Table 1 – Sample databases for agriculture industry  
(Source: <http://www.mcx.ru>)*

In order to support the development of the agriculture industry, regional and national government implement exhibition and demonstrational activities regarding the promotion and spreading of new types of crops, technology and

machinery. There is a development of scientific-methodical and innovative activities in all spheres of agriculture. As a result, government create modern training centres for managers, specialists and agriculture workers. Main activities of these centres are organizing training courses and seminars, meetings for exchange of experience and knowledge.

## **Information technology in agriculture in Russia**

Technology-wise, agriculture industry in Russia currently is approximately at its level of 70's of the 20th century. The most acute problem of agriculture of the Russian Federation is the overall technical and technological underdevelopment. Innovative development of agro-industrial complex is inhibited, due to the low levels of development and application of technological equipment and lack of qualified personnel. While the global and European experience of agricultural work is already directly linked to information technology, this area is underdeveloped and not discovered in Russia.

Experience of countries with a developed agriculture shows that they all have experienced "technological revolution" in this industrial area. Classical extensive farming is being supplanted by accurate (precision) farming. Widely used GIS technology, energy-saving agricultural machinery, breeding high-yielding plant varieties and breeding of highly productive breeds of animals, the establishment of the biologically active food additives, new animal drugs, modern methods of dealing with epizootics, quarantine of animal and plant diseases.

The legacy of the USSR's agriculture is a variety of cost-ineffective technology, since back then the main focus was the employment of the country's population, not the overall effectiveness and optimization of the industry's processes. With the appearance of the market economy in 90's of 20<sup>th</sup> century, the priorities have changed towards the increase of the efficiency of the agricultural sector. Consequently, agriculture in Russia is now experiencing a technological revolution. Within the framework of the national project "Development of agriculture", developers take into account all possible obstacles and developed measures to overcome them.

Agriculture establishments with adequate and forward-thinking governance who analyze the current situation and opportunities and plan in a timely manner, shift to resource-saving and innovative technology, start implementation of the various available information technology applications. Unfortunately, only a small percentage of managers presume to implement such technology due to the supposed amount of needed developments and required resources, while it is often much easier to implement, than it is imagined.

Currently, some Russian agro-industrial institutions successfully implement and use new technologies of farming and crops production. Many farms of the European part of Russia, especially of the Moscow region, are fully involved in the process of the renovation and reconstruction through implementation of new technology. For example, factory "Plemzavod "Zelenograd" (Moscow) is one of the pioneers of the conservation agriculture in Russia. Some farms in Tatarstan, Krasnodar, Rostov, Lipetsk, Belgorod, Kursk and other regions have succeeded in no-till agriculture and build world-class livestock facilities. However, most Russian farms currently neglect modern technology or do not have enough resources for R&D (Ermakova A.N., 2009).

Furthermore, consulting in farming is gaining more attention. The reason is the low level of overall development and availability of the IT solutions in the industry, meaning high level of nescience of available technology by entrepreneurs and managers. The growing trend of consulting in the agricultural industry gaining popularity is related to the emergence of the interest in the development of farming through the introduction of innovative technology on the background of necessity of theoretical basis and lack of experience. There are already examples of companies, which provide a wide variety of services in the field of lean farming, feed production, dairy animal husbandry, effective business management principles.

It is a very common issue, that by working on day-to-day tasks, small and medium agricultural facilities lose focus on the intensive growth by not having a possibility of following the progress in technology, such as: veterinary drugs, fertilizers, new types of crops, etc. In such case, a 3<sup>rd</sup>-party consultant frequently visiting a facility, gives professional recommendations regarding the

facility's issues, opportunities and introduces new tech to the client. Moreover, external independent analysis may be very useful in cases of the stagnated facility.

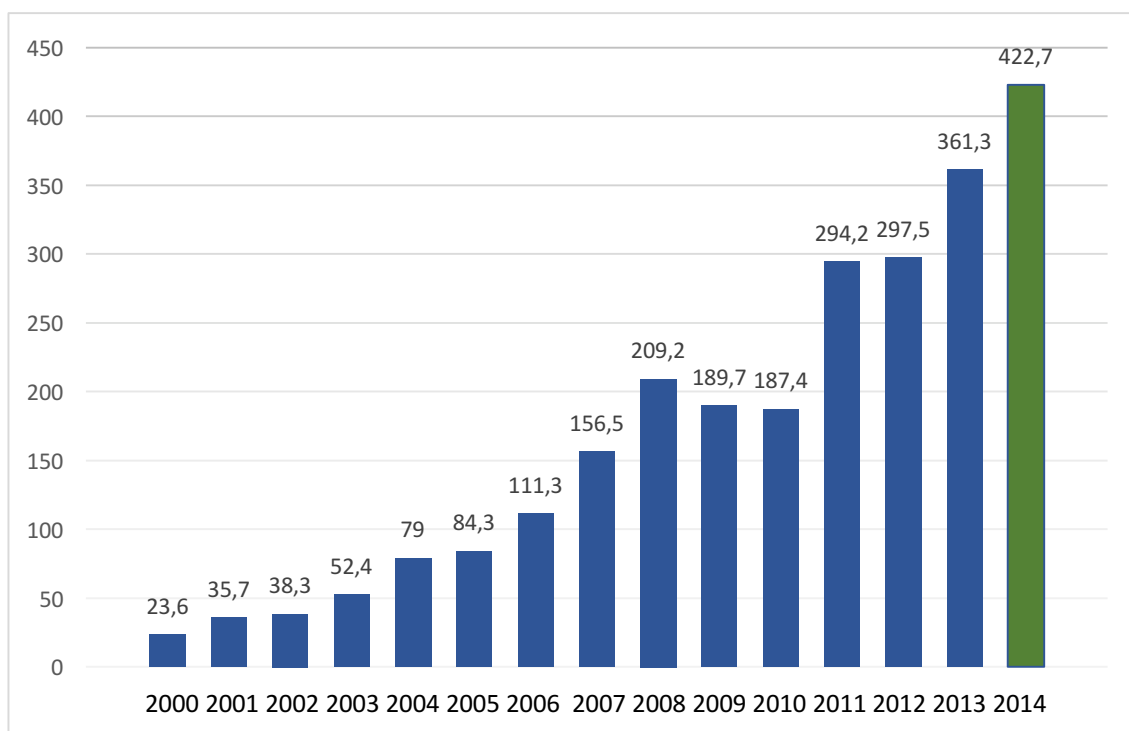
Input of the consulting companies is especially valuable nowadays, in the beginning of the implementation of prioritized national program "Razvitie APK (Development of agro-industrial complex)". It is necessary to spend special funds to the implementation not of the traditional cost-ineffective technology, but innovative resource-saving tech, aimed to the reduction of the production costs and optimization of the production and management processes. This is the only way to provide Russia with high-quality domestic foodstuffs.

## **Vegetables and crops production**

*In the Southern part of Russia, production of vegetables and crops is extremely profitable and fruitful, due to the great environmental conditions and warm climate. While in many parts of Southern Russia there is a continental climate with cold winters and hot summers, preventing a good harvest. Implementation of modern technology as well as long history and knowledge of the agricultural processes have a great input to the success of the whole industry. The foundation for successful growth of agriculture in Russia is developing with the support of the government and local structures. Furthermore, after European union and the US have introduced the economic sanctions to Russia, the need of development of agriculture industry became obvious and ineluctable. This resulted in governmental-level decision to plan and perform the restructuration of the whole industry.*

It can be fairly said, that agriculture in Russia is developing with a quite high rate: by acreage and gross harvest of vegetables Russia is among the top ten leading countries of the world. Agriculture in Russia is gradually increasing production volume: in the 1990 the amount of produced vegetables was 10 million tons of vegetables per year, in 2010 -12 million tons, in 2013 – 14 million tons, in 2015 – 16,1 tons. Moreover, the turnover of farms is gradually increasing year after year: in 2005 overall farms turnover in Russia was 84

billions of roubles, while in 2014 it has achieved 422,7 billion roubles (knoema.ru, 2016).



*Figure 8 – Overall farms' turnover in Russia (billions of Rubles)  
(Source: <http://knoema.ru/>)*

Volumes are growing, but the growth have not yet reached the demanded level. Russia consumes 100 kg of domestic vegetables per capita yearly, but the medical norm is 140-160 kilograms of vegetables per year. This means, that in order to fully cover the need of vegetables by domestic product, the level of 20 million tons of vegetables per year must be achieved. In the developed countries there is an exponential growth of vegetables production. Consumption in different developed countries is growing and reaches 220-450 kg per capita yearly.

In Russia, the deficit of vegetables is covered by imported vegetables. For example, in 2014 25% of consumed onion was imported from the Netherlands, 20% of cabbage from Poland, 50% of tomatoes from Turkey. The volume of purchases of vegetables are still growing and ranges from 2,5 to 4,5 million tons per year in the amount of \$5 billion.

It can be stated from the experience, that farms in the current market economy conditions, who are involved in large-scale vegetable growth, can produce vegetables with productivity of 100 tons/hectare of cabbage, 70 tons/hectare of carrots and 60 tons/hectare of beetroots, showing a great performance.

Examples of such productivity are: “Dmitrovskie Ovoshi” (“Дмитровские оововщи»), ЗАО “Kulikovo” («ЗАО Куликово»), ЗАО “Ozeri” (ЗАО «Озеры»).

It is obvious, that renovation and development of large-scale production in combination with small companies, who provide more diverse range of products, - is a main way of expansion of vegetable production, which is the modern model of functioning of the industry. An innovative way of development of vegetable growing - it is primarily the creation of a system of harvesting and marketing cooperatives, new clusters, the construction of large greenhouse complexes, logistics centers, warehouses, technical re-equipment of the industry, creation of factories for the processing of vegetables. Latest achievements of science and experience are needed to be implemented (Innograd, 2015).

A range of governmental and private companies provide scientific background for agriculture industry, specifically for vegetables production. The result of their work is the significant expansion of the range of vegetables' crops for the Russian people. Only two decades ago, there were only 12-15 vegetable crops cultivated on the territory of Russia, by today this number has reached more than 80 types. Radish Loba, daikon, Chinese cabbage and a wide variety of other green crops have been introduced to the Russian market by local producers. There has been a breakthrough in the creation of a new gene pool for vegetable crops: in 2000 in Russia there were only 500 varieties and hybrids of vegetables, when in 2013 there were more than 6500 grades. Monopolistic sorts are being displaced by new ones, because every 4-5 years a new assortment of vegetables is required by the market and technology. For example, nowadays, on the Russian market there is a demand for such types of crops like beef-tomatoes, cherry tomatoes, different coloured tomatoes and there are means to fulfil this demand (Jukov A.A., Portnov V.S.).

Western companies derive so-called "Tasty vegetables". Russian breeders are also working to improve the marketability and quality of vegetables. It is a very good sign, that nowadays there is a healthy competition as well as strategic partnerships on the vegetable market. Different institutions, companies and even farmers use common approaches to strategic partnership, joint use of selection achievements. For example, breeding company "Poisk" («Поиск») and the State Research Institute of Horticulture (VNIIO) establish joint laboratories, experimental facilities, training centres. This allowed these institutions creating together of up to 50 new vegetables sorts and hybrids each year, allowing their successful development in the domestic market. However, for the rational cooperation of scientists a major federal research institution is required for successful and centralized support of the whole industry. Such institution would unite the efforts of small experimental research facilities and private companies. This would allow forming the scientific program of agricultural development in different zones of the country aimed to meeting the modern market demand.

On the other hand, the bottleneck of the whole industry is the availability of seeds. Lean system of seed production was annihilated and today 60-70% of the seeds are imported from abroad. In order to solve this problem a new systematic and deliberate approach is required. Primary seed production, reproduction seeds, purification, refinement, packaging of seeds, seed organization facilities, creation of special organizational and economic conditions for the seed farms are steps to the building of a strong crop base. These issues require immediate resolution by the government with the assistance of research institutes and private companies. This will create a domestic seed base, minimizing the dependence on the West, resulting in the overall growth of the quality.

Thus, sustainable operation and development of the industry is impossible without its technical re-equipment, introduction of industrial ecological-safe technology of vegetable growth, cultivation, harvesting, storing, logistics and optimization of all structures. In this regard, the industry needs in a single management and organizational structure, like the Union of Russian vegetable growers and a full support of the state. High hopes are pinned on the private

business, whose development from year to year is gaining more and more powerful momentum. The record harvest of 16,1 tons of vegetables in 2015 is not the reason for the decrease in amount of efforts, but it is the good sign of development for possible investors and government, indicating the profitability and high potential of the industry.

## **Marketing strategy**

When newly appeared, such solutions are usually technically complicated and demand a lot of testing and tuning. Consequently, this requires funds, human resources and time, which means, that small agriculture businesses usually cannot afford such developments, when the perspective of the positive outcome remains obscure. Only research facilities, industrial companies or private technology companies are able to finance research and development of implementation of new technology in the field of agriculture. However, if the technology has proven its benefit, it may enter mass market, making it available for everyone.

On the other hand, small business sector of the agriculture, especially in Russia, is quite traditional, because it has been developing over the centuries and many entrepreneurs believe that the only right way of growing crops is the way their ancestries did. The huge problem of selling such solutions in Russia, is not even technology complexity, but finding and promoting the product to the right customer. Agricultural fairs and special events are the best to promote products, aimed at a specific market. Such events are a great way to show the production and development of a company and also get to know current trends in the industry, in order to be updated and develop correct range of products.



## 3. METHODOLOGY

### 3.1. Research methods

Generally, there are two main research methods: qualitative and quantitative. These methods are distinguished to be different, but they are usually used together.

- Quantitative research – is the systematic empirical investigation of observable phenomena via statistical, mathematical or computational techniques.
- Qualitative research –is an umbrella term for a wide variety of approaches to and methods for the study of natural social life. The information or data collected and analysed is primarily (but not exclusively) nonquantitative in character, consisting of textual materials such as interview transcripts, field notes, and documents, and/ or visual materials such as artefacts, photographs, video recordings, and Internet sites, that document human experiences about others and/or one's self in social action and reflexive states (Saldana, Johnny 2011, 3).

In case of this particular research, qualitative methods were chosen to be the most suitable, since Russian agriculture market is undiscovered for selling of IoT applications and the current situation in the market is inconstant. Qualitative methods are used to sufficiently supplement the theory study and reveal the readiness and willingness of market to start implementation of such solutions. Interviews and surveys are the main tools for a mixed qualitative research method in this case.

## Qualitative research

### Genres of qualitative research

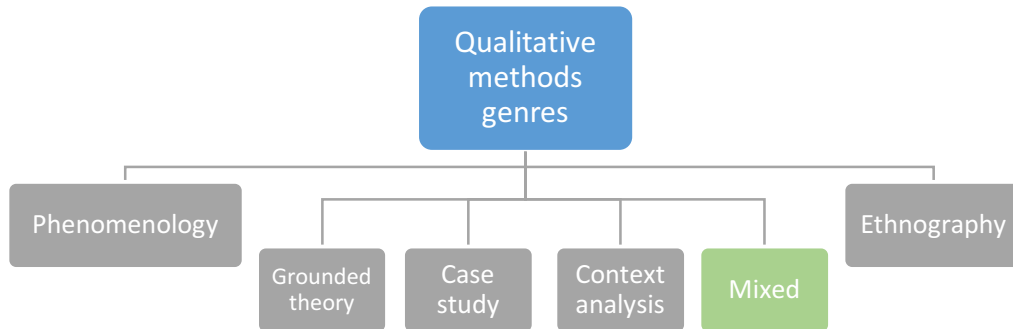


Figure 9 – Qualitative methods genres (Saldana, Johnny, 2011)

- Phenomenology method is aimed at the understanding of core meanings of a phenomenon by interpretations of texts and data. Phenomenology is focused on the human experience, events and concepts.
- Grounded theory is a methodology for understanding of human processes through analysing of small bits of qualitative data. “Classic grounded theory works toward achieving a core or central category that conceptually represents what the study is all about. This core or central category becomes the foundation for generating a theory about the processes observed.” (Saldana, Johnny 2011, 6)
- Case study is focused on analysing a single specific group, company, event, etc. and creating a theory to describe the reasons which have led to an observed conclusion.
- Context analysis is a set of tools for systematic examination and interpretation of different kinds of qualitative data, mainly texts and media, material culture to realise the latent motives.
- Ethnography refers to the process of long-term fieldwork, resulting in a written product. This method was used originally for studying of foreign ethnicities, but nowadays it can be used to explore cultures in business and other organisations, even in cyberspace (Saldana, Johnny 2011,5).

- Mixed methods are used for a strategic implementation of variable qualitative methods, aimed at the creation of exhaustive theory, using different relevant sources of information. Advantages of other qualitative methods are combined. However, mixed methods should be implemented carefully, because improper use of them can lead to the losing of focus on the research object.

### **3.2. Research approach**

The main purpose of the study was understanding of the current situation and trends on the market of IT applications in agriculture in Russia, in order to be able to make a precise forecast on market's development and estimate the rationality of investing in the research of IoT applications for Russian agriculture market. In order to be able to give an exhaustive characterization and make a precise suggestion, a deep literature research and market trends realisation through news and social media are required along with qualitative study. This should give enough theoretical and qualitative data to make accurate suggestions.

Qualitative research is aimed at obtaining deep motivation of the consumer and detailed information about the subject. Qualitative methods involve the collection of information in a free form; they focus not on statistical measurements, but they are based on the understanding, explanation and interpretation of empirical data, being the source of hypotheses and ideas. This means, that qualitative approach reveals patterns, when a sufficient amount of data is collected. After processing patterns, a theory, which explains these patterns, is developed. In general, qualitative methods allow understanding of the core meaning of a social phenomenon, while quantitative – understanding of how frequent is a social phenomenon and how much it is important for the society.



*Diagram 1 – Main steps of the qualitative research*

Basically, qualitative research does not respond to the question "how much?", but the questions: "what?" "how?" and "why?". Qualitative research methods operate through projective and stimulating techniques: unstructured, non-legislative means of questioning, which help revealing the motives, preferences, relation, values, satisfaction and problems of respondents. Projective techniques help to overcome such difficulties of communication, as the verbalization of feelings, attitudes, etc., as well as the identification of latent motives, displaced senses, etc. Most commonly, qualitative methods are used for understanding of:

- Consumption patterns, consumer behaviour and factors, which determine the choices.
- Attitudes towards the product, brands and companies.
- Degree of satisfaction with existing solutions and products.
- Consumers intents and needs.

Qualitative research is also important in cases of development of new products, allowing:

- Understanding of whether there is a niche for a new product.
- Revealing customer's attitude to the new product or concept.

Use of qualitative methods on the stage of strategic product development, enables:

- Creation of ideas complex about the concept of the positioning of the product.
- Evaluation of the brand concept.
- Generation of ideas for creative implementation of strategic concepts.
- Evaluation of the marketing communication elements.

### 3.3. Data gathering

As the main source of primary data, author has chosen managers and directors of small and medium sized agricultural organizations from different regions of Russia. Such focus group was chosen, because these companies represent a huge undiscovered market for IT solutions providers in agriculture.

The survey (Appendix 1) was developed by the author and chosen as a main source of gathering the primary data. Telephone and email interviews were carried out to supplement the survey. A universal interview template was developed by author (Appendix 2). This template was used both for personal interviewing and independent interviewee answering in writing.

### 3.4. Analysis of data

Data provided by telephone interviews, interviewee-filled (sent by email) question lists and surveys was collected and processed. In order to provide findings in an easily understandable form, processed data both from interviews and surveys was combined and formed in graphs, which provided next results:

#### 1) Age of interviewees

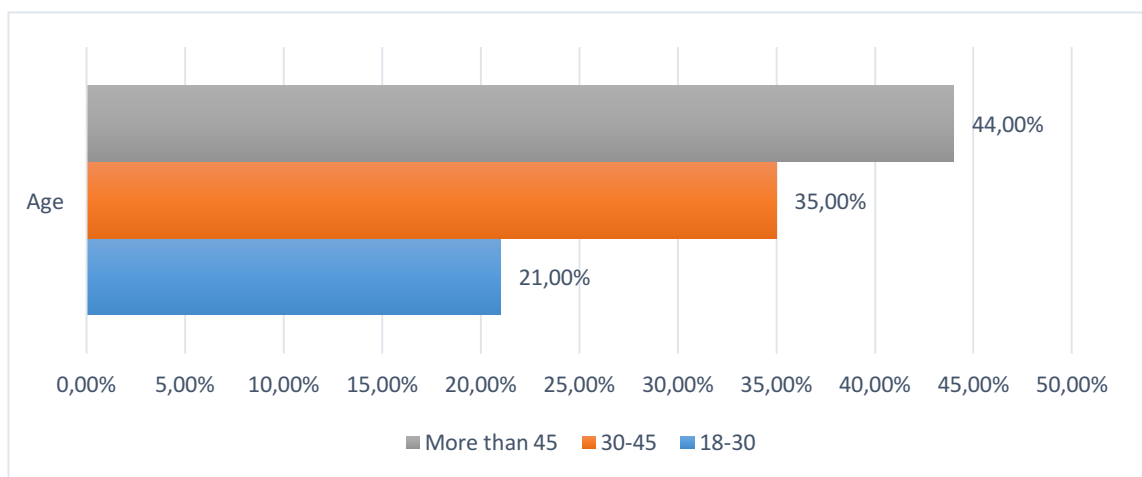


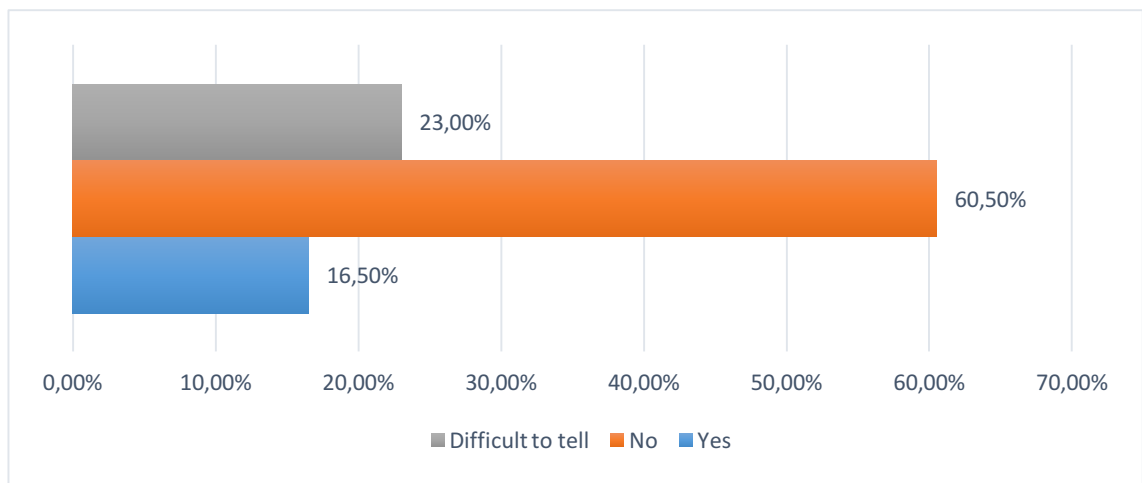
Figure 10 – Age of interviewees

Age of interviewees is important for finding a connection between willingness to use modern technology in agriculture. As it can be seen from the graph, the age of biggest part of the interviewees' is above middle age: more than 45 years old.

This indicates, that most of the people, owning a managerial position in agricultural organization, are mature specialists with a long experience in the industry.

## 2) Implementation of IoT application in the business processes

Understanding of the overall level of implementation of IoT principles in the industry is the key for understanding of the innovation situation in the small- and medium- business sectors of the agriculture in Russia.



*Figure 11 - Implementation of IoT application in the business processes*

From this chart it can be seen, that the biggest part of interviewees' companies is not using applications of the IoT. However, this does not necessarily mean, that they do not use related technology at all. This can be connected to the lack of knowledge and experience regarding the IoT applications and principles, because some of them, for example, are already implementing monitoring systems for storing of goods. Usually, such developments are used by young startups, which are built on the principles of Western practices. From another hand, there is a small amount of such examples.

### a. Types of used IoT applications

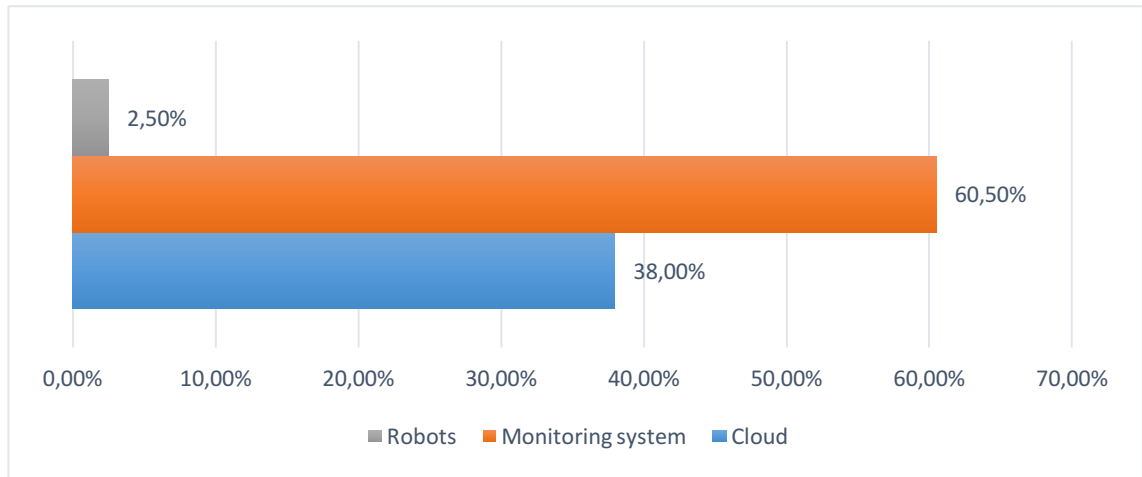


Figure 12 - Types of used IoT applications

Generally, there are only three main applications of IoT principles are used. 60,5% of respondents, who are using IoT applications have implemented different monitoring systems, for example, some of the systems are controlling temperature at storages, there are also several examples of automatic climate control systems, some systems are used for tracking of delivery trucks. Moreover, some of the interviewees are using cloud-based applications, commonly using them as a statistical data storage and control panel. There are only few examples of robot applications. Such robots are used for packing and they are programmed for autonomous work and controlled remotely. However, robot technology is very expensive and usually unprofitable in case of small agriculture business.

#### b. IoT application satisfaction level

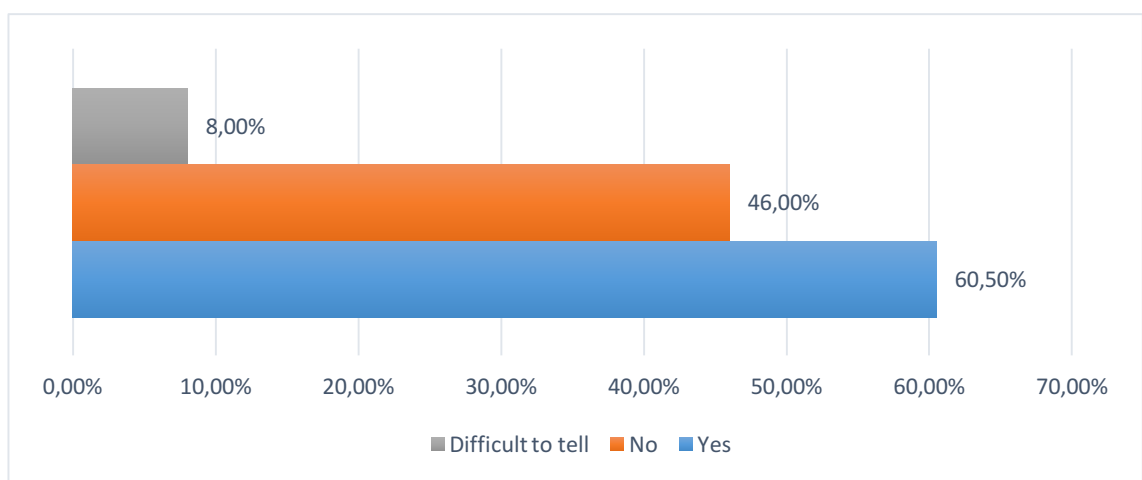
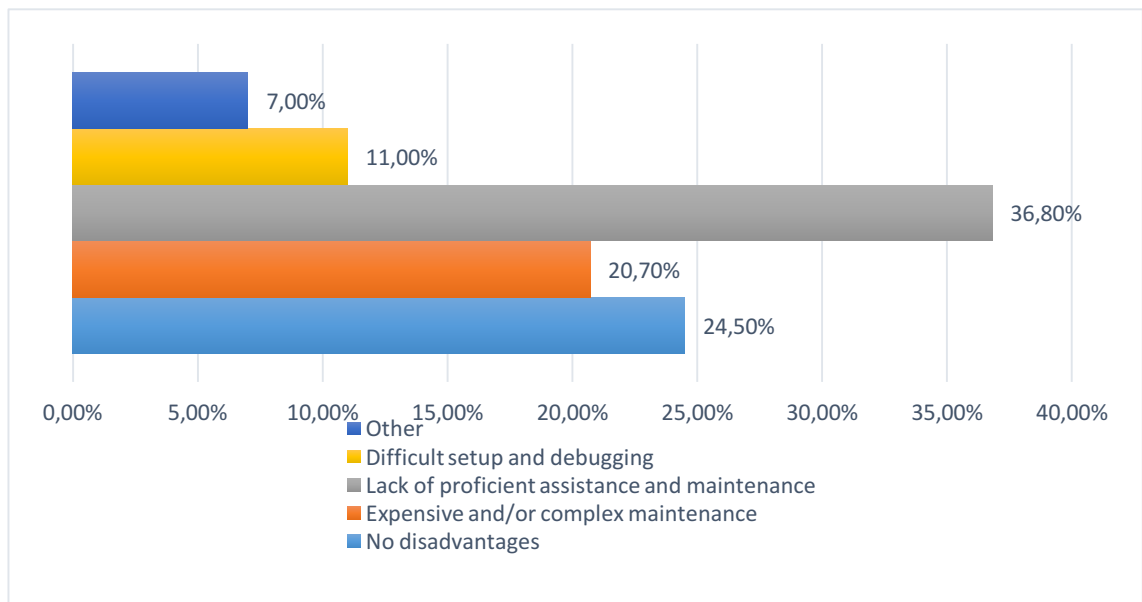


Figure 13 - IoT application satisfaction level

From the graph above, it can be seen, that almost a one third of respondents are not satisfied with performance of their current system or applications. This is indicating on the low level of preface planning and understanding of the needs. Moreover, it can be a result of insufficient service and bad maintenance and system development. The reason behind this, might be the fact that some ignorant managers believe, that IT applications do not require much maintenance and development, considering it a one-time investment. As a result of such approach, performance of such IT solutions is insufficient, which makes it unprofitable and useless in the opinion of these managers.

### c. Disadvantages of IoT applications



*Figure 14 - Disadvantages of IoT applications*

As it can be seen from the graph, the main problems, which managers are facing are related to the service providers. The biggest amount of problems is related to the setup and debugging of the systems. The reason behind that is the immaturity of the whole market of IoT application is the agriculture. Service providers do not have enough experience and clients do not have clear understanding of their needs and opportunities. Furthermore, ineffective and sometimes unprofessional setup and maintenance results in high maintenance costs for the client. This is a big problem, which might even scare away possible clients.



#### d. Willingness to invest in innovations

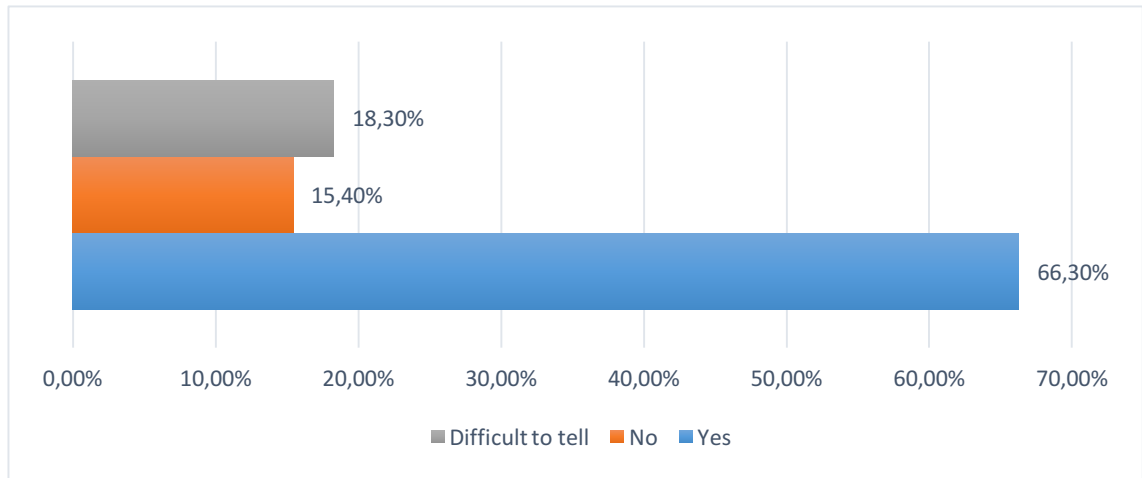


Figure 15 - Willingness to invest in innovations

This graph shows, that managers of most companies', where there are already some implementations of IoT or IT, are willing to continue development existing systems or implement other technology, aimed at optimization and simplifying of companies' processes. Consequently, it can be told, that there are already rudiments of IT, specifically IoT, market aimed at the agricultural application.

#### 3) Willingness to apply principles of IoT in the company (which do not have such applications)

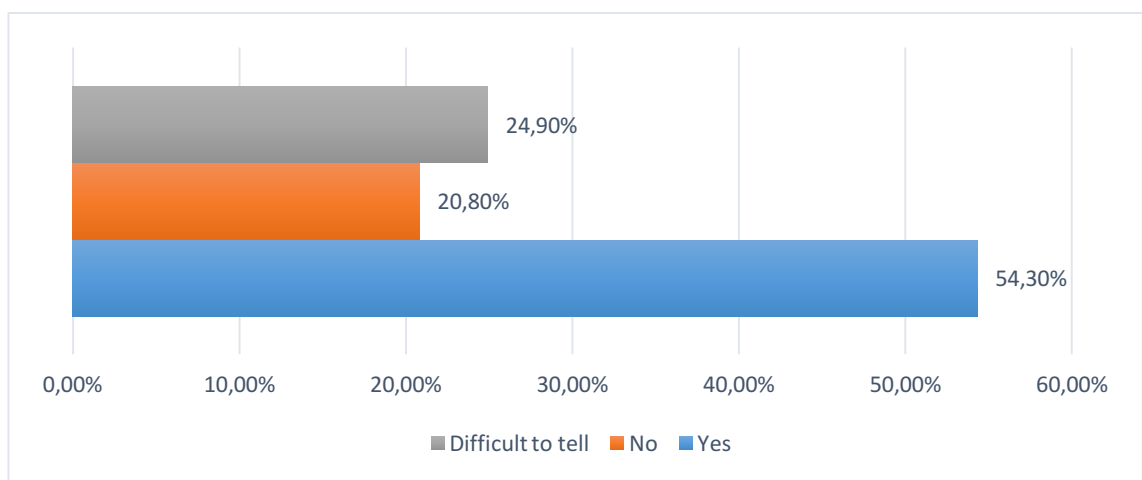
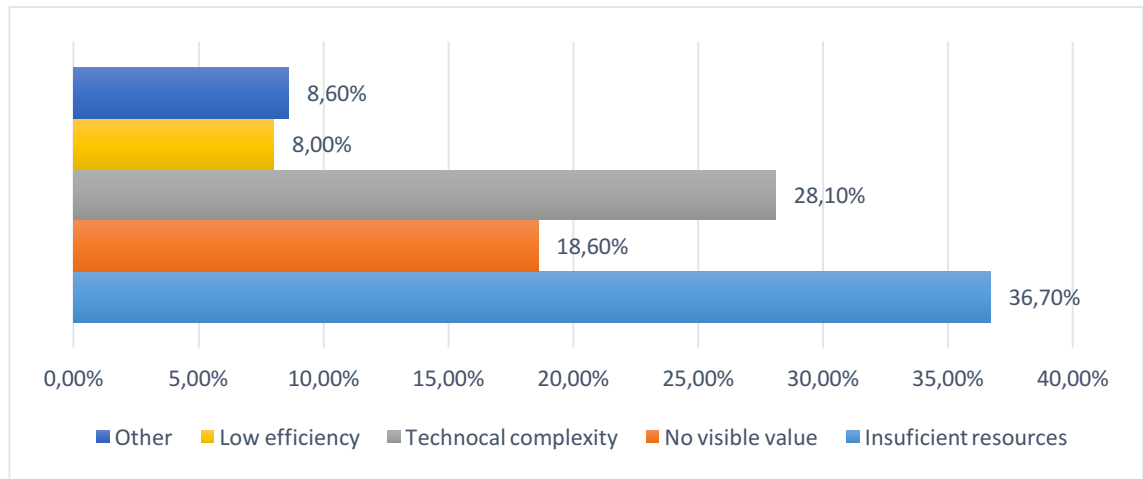


Figure 16 - Willingness to apply principles of IoT in the company

This graph shows, that more than a half of respondents, who come from companies where there are no IoT applications, are willing to start implementation of such technology. This is a good sign of readiness of market

emerging. However, almost a quarter of all respondents can hardly tell if they are ready to implement innovative technology in their business. This is a sign of managers' ignorance regarding the IoT and other IT solutions. This is an unpleasant sign and this can be solved only through marketing or government support.

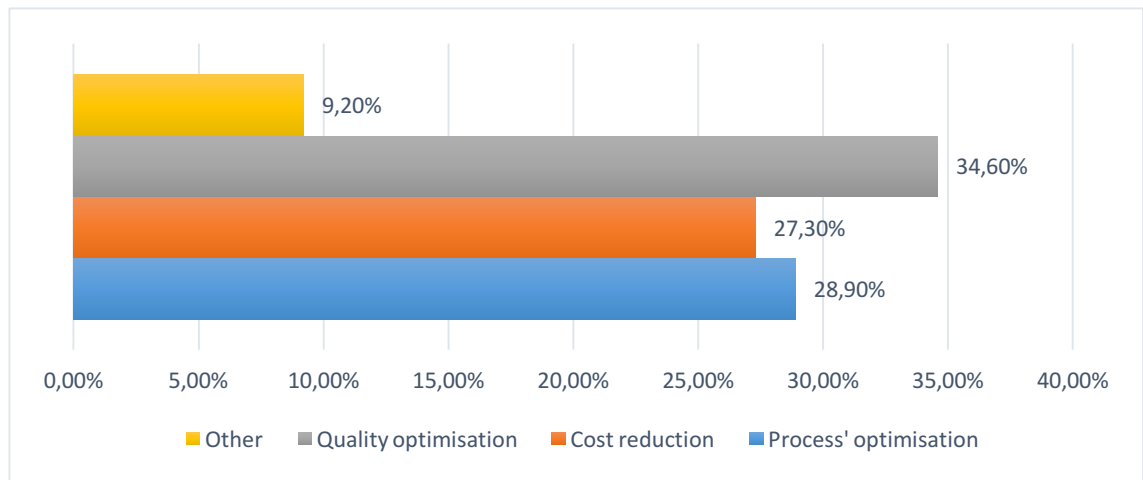
a. Reasons to avoid IoT applications



*Figure 17 - Reasons to avoid IoT applications*

Research results show, that the biggest fear of agriculture managers regarding the IoT applications is the need of big investments. Many of respondents assume IoT to be extremely resource-demanding. Furthermore, many of them are afraid that investment in IoT will acquit. In opinion of many respondents, complex and resource-demanding setup is required due to the current low level of technical development. Managers are afraid of starting investing in innovations, in their opinion, because of the underdevelopment and discrepancy of their organisations to the modern standards. From another hand, some of the managers consider IoT as a low-efficient tool and continue to do business in their way, while some of them do not see any value in such applications at all. These opinions are related to the fact, that they have never seen the benefits, which IoT could provide to their business, since there are a very small amount of already successfully operating systems in the market.

## b. Possible opportunities for business development



*Figure 18 - Possible opportunities for business development*

The main possibilities, that IoT application might provide is considered to be the quality optimisation. Managers see IoT in agriculture as a tool for quality control. Respondents believe, that more precise control on the production and storing of goods would result in higher product quality, resulting in higher value for the customer. Moreover, almost a one third part of respondents consider IoT as process optimisation tool, which would decrease the level of bureaucracy in the company and result in better company's performance.

## 4. RESEARCH QUESTIONS ANSWERED

In order to estimate the results of the work and be able to give suggestions for future development, answers for research questions are essential. To provide answers for the questions, a wide theory analysis was fulfilled along with collection of empirical data through interviews and surveys. Data from the news, analytics' market researches and literature was compared and linked with empirical data.

### ***How can principles of the Internet of Things be applied in agriculture?***

M2M communication technology are only beginning to be implemented in the agriculture, but the ideas of "smart" farm are gradually coming to the reality. Processes of such farm are interrelated between machines and users and are

connected to the sources of statistical information about environment, climate, economy, machines' settings, etc.

IoT has infinite number of applications and agriculture is one of the most the most rapidly developing industries in the Europe, Americas and Asia. Agriculture is a very large industry and IoT applications have a very significant role in the process of optimization of agriculture processes, reducing labour and costs, decreasing the weather impact and increasing of soil fertility. IoT applications are the connecting links between all of the parts of the industry. IoT allows intercommunication between all of the systems' parts and providing an absolute process control tool for the managers.

There are huge developments in the vegetable growth processes. Smart farming is gaining popularity and it is considered to be the future of the whole industry. Old technology in farming are being replaced with IT solutions, resulting in record harvests and higher value for the end customer. Technology becomes available for wide audiences of farmers, this is not a preference of huge agriculture corporations anymore. With a popularization of IoT solutions in industry, the costs of setup and maintenance is decreasing gradually. The market is developing rapidly, there are many offers in the market already and now is the best time to access a share of this market.

Examples of IoT solutions for agriculture are infinite, because every system can be suited specifically for a customer, meaning fulfilment of specific needs and applications. Speaking more generally, there are some common types of IoT applications in agriculture: cloud data processing and storing, precision seeding, climate control, pest control, automatic control of machines for routine operations, soil monitoring, storing conditions control. Usually, a number of such applications are interconnected in one system, aimed at meeting a particular farm's needs.

The following two years are expected to be a period of experimental smart farming and from 2017 to 2020 it will come to the intensification phase, during which the pace of change will accelerate.

***What are the trends of agriculture industry in Russia?***

Agriculture in Russia is currently a developing industry. For the last two decades there have been a lot of developments, comparing to the degradation period of 90's, but the industry is still underdeveloped comparing to the western level of progress. However, current situation of fluctuating economy and complications in relationships between Russian Federation and Europe is resulting in unobvious impulse for the industry's development. Government and entrepreneurs have realized, that importing of vegetables, meat and dairy products is a deadlock for the country. Dependence on the import is decided to be minimized on the governmental level. Local and national authorities are developing measures aimed at the evolution of the agriculture in Russia and popularization of the industry for the investments.

From another hand, there are risks, related to the unclear future of the country's economic wellbeing on the background of unstable economy, complicated relationships with western countries and low level of development of the industry. Investment opportunities in agriculture are defined by the industry's ability to consume innovations and create innovations. However, in conditions of chronic underfunding of the industry it is extremely difficult, and the involvement of investments is hampered by low profitability of agricultural production and the high dependence of performance on climatic conditions. However, a crisis like this is a great opportunity to renovate and rebuild the industry, which would allow to solve the problem of dependence on import of the food products. Such situation is a good opportunity to forget about cul-de-sac ways of development and outdated technology and try to achieve a qualitatively new level of industry's development.

***How ready is the agriculture industry in Russia to the application of IoT-based systems?***

There is no sufficient technology background in agriculture in the country, which is meant to be solved by adopting western experience and technology along with developing of domestic research facilities and supporting of local startups. Foreign technology providing companies are welcome to the Russian agriculture market more than ever.

There are several governmental programs, both regional and national, aimed at investment to innovations in agriculture. Through sharing a risk with government, farmers are more willing to invest in implementation of innovative technology in their businesses. However, the research has indicated some issues, like ignorance regarding innovations in agriculture and insufficient knowledge of other experiences in this field. There are several governmental programs aimed at increasing of the level of farmers' knowledge regarding new technical advancements in the field of agriculture and experience sharing between research, service providing and production organizations.

The complex of these factors is showing a good trend of development of the industry, meaning, that there are already opportunities for promotion and selling of IoT solutions to the agriculture market. Forward-thinking managers are looking for innovations for their businesses, which could provide them with the western experience and knowledge. There are only few examples of such service providers, meaning the availability of the market for new players.

## **5. SUGGESTION FOR DEVELOPMENT**

Speaking about the opportunities specifically for the company A-Lab Oy, author is suggesting to continue development of new services in IoT for the Russian agriculture market. There are signs of improvement of the stagnation situation towards the standardisation and optimisation of the industry's processes through the implementation of modern technology. Modern technology in this case relates to the whole spectre of agricultural developments: breeding, chemicals, machinery, IT applications, etc.

Russian agriculture market is currently emerging and there is a sure potential for a bigger market share for A-Lab. Furthermore, existing customer base, experience and understanding of the market are very valuable advantages, which would allow easier product distribution and selling of technical solutions to customers in agriculture.

From the findings and research questions answers, a trend of implementation of IT solutions in agriculture in Russia can be recognised. This means, that the

Russian agriculture market is ready for innovations and managers from different parts of the country and different companies' background are looking for opportunities to improve their business operations. IT applications, specifically IoT play a very important role in the processes of optimisation and innovation. However, due to the low level of innovations in the industry and some special features of Russian people, this significance sometimes can only be demonstrated to a customer by a service provider and a good experience of other organizations. This means, that extension and strengthening of the customer base is essential for successful brand name creation.

However, future precise market research for the particular product may be required. Such research is not possible to be carried out right now, due to the early development stage of company's IoT solutions specialized for the Russian agriculture market. A-Lab already provides some IoT-based applications and solutions like complex of a **a-log.net** database service and **Micro +** controlling device. For the wider market expansion future development of existing and new services is required. Furthermore, partnership with local manufacturers can provide provide cost reduction leading for the strong strategic partnership.

Considering all the data provided by the research, Russian agriculture market can be classified to be perspective. By developing existing and new products and services and building a strong customer base a brand can become recognized and widespread. Through starting with already existing customer base, company can get a bigger market share. Agriculture fairs, exhibitions and, of course, good feedback can create a strong brand name in the sectors of small, medium and even big agriculture businesses in Russia.

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## 7. APPENDICIES

### 7.1. Appendix 1 – Interview template

*The form is translated from the Russian language.*

|   |             |
|---|-------------|
| Egor Kalachev   | Date: _____ |
| <b>Poll: "The use of the principles of the Internet of Things in Russian agriculture"</b>   |             |
| <p><i>Internet of Things unites many devices, sensors, machines, ERP-systems, computers in a network that provides storage and access to the processed data on the actual performance of the system, allowing changing the system settings without leaving your computer. Similar solutions are already widely used in the Western countries and have already proved their solvency.</i></p>  |             |
| Questions:  |             |
| <ul style="list-style-type: none"> <li>• Do you implement any principles of the Internet of Things in your business processes?           <ul style="list-style-type: none"> <li>○ If you do, which technology specifically? (Cloud computing, autonomous monitoring systems, etc.)<br/>               _____<br/>               _____</li> <li>○ Which strengths and advantages do these technologies provide to your business?<br/>               _____<br/>               _____</li> <li>○ Which complications did your company face during the implementation and use of such system?<br/>               _____<br/>               _____</li> <li>○ What opportunities for future improvement this system has?<br/>               _____<br/>               _____</li> <li>○ Do you have any fears regarding future performance of the system?<br/>               _____<br/>               _____</li> </ul> </li> </ul> |             |
| If you have any comments or ideas, feel free to share them:   |             |
| _____<br>_____<br>_____<br>_____<br>_____   |             |

Egor Kalachev

Date: \_\_\_\_\_

- If you do not implement such technical solutions, do you think that they are applicable and have any potential for use in the case of your company?
  - If you do, which advantages would it provide?  
\_\_\_\_\_  
\_\_\_\_\_
  - If you do not, what are the reason for denial?  
\_\_\_\_\_  
\_\_\_\_\_
  - Which disadvantages of such solutions specifically for your business?  
\_\_\_\_\_  
\_\_\_\_\_
  - Which complications, in your opinion, would your company face after implementation of such IT solutions? Do you have any apprehensions regarding implementation of principles of the IoT?  
\_\_\_\_\_  
\_\_\_\_\_
  - What opportunities for business development would this technology reveal for your company?  
\_\_\_\_\_  
\_\_\_\_\_

If you have any comments or ideas, feel free to share them:

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**Thank you for your help!**

## 7.2. Appendix 2 – Survey

*The form is translated from the Russian language.*

|               |             |
|---------------|-------------|
| Egor Kalachev | Date: _____ |
|---------------|-------------|

**Survey: "The use of the principles of the Internet of Things in Russian agriculture"**

*Internet of Things unites many devices, sensors, machines, ERP-systems, computers in a network that provides storage and access to the processed data on the actual performance of the system, allowing changing the system settings without leaving your computer. Similar solutions are already widely used in the Western countries and have already proved their solvency.*

1) How old are you?

- i. 18-30
- ii. 30-45
- iii. More than 45

2) Do you implement any IoT principles or technology in your organization?

- i. Yes
- ii. No (*go to question 3*)
- iii. Difficult to tell

a. What kind of IT or IoT applications are already existing in your company?

- iv. Cloud
- v. Autonomous climate control systems
- vi. Monitoring systems for vegetable storages
- vii. Automatic robots
- viii. Other, specify \_\_\_\_\_

b. Are you satisfied with performance of such applications in your company?

- i. Yes
- ii. No
- iii. Difficult to tell

c. What are the disadvantages of IoT applications for your company?

- i. No disadvantages
- ii. Expensive and/or complex maintenance
- iii. Lack of proficient assistance and maintenance
- iv. Difficult setup and debugging
- v. Other, \_\_\_\_\_

Egor Kalachev

Date: \_\_\_\_\_

- d. Are you willing to continue development of your systems and/or invest in innovative technology?
- i. Yes
  - ii. No
  - iii. Difficult to tell
- 3) If you do not use any IoT applications, do you consider such innovations for your organization?
- i. Yes
  - ii. No
  - iii. Difficult to tell
- b. If you do not consider such innovations, what is the purpose behind this?
- i. Insufficient resources
  - ii. No visible value
  - iii. Technical complexity
  - iv. Low efficiency
  - v. Other, specify \_\_\_\_\_
- c. What is the main opportunity that IoT applications could provide to your company?
- i. Process optimization
  - ii. Cost reduction
  - iii. Higher quality production and more value for the customer
  - iv. Other, specify \_\_\_\_\_

**Thank you for your help!**