Digital transformation of agricultural sector in Uzbekistan: current state, advantages and strategies

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Abstract. Agriculture was and still is the largest sector in economy of Uzbekistan. From the other hand, the digital economy is penetrating to all sectors of the economy, including the agriculture sector. Further development of agricultural sector through the digitalization is of great importance. In Uzbekistan, much attention is being paid to the effective use of information technology in the agricultural field. Creating and implementing an automated farm management system is one of today’s major tasks. This research aimed at analyzing the opportunities and development of agriculture in Uzbekistan using digital technologies in comparison with other well-developed countries. At the end of the paper, the conclusions are made and the recommendations are presented as a result of the research.

1 Introduction

Today, the introduction of the digital economy in Uzbekistan is a really serious driver of effective growth of the country’s economy. Uzbekistan has high intellectual potential, developed telecommunications infrastructure, and the efficiency existing high-tech enterprises form the necessary environment for implementation and further development of the innovative economy.

However, digital transformation is one of the main global trends in the economy. Developed countries have already worked out a number of tools to get rid of trivial methods of doing business and public administration and successfully use them they are in practice. The relevance of the chosen topic is due to the fact that Uzbekistan is just beginning to create the economy of the future and therefore, the term “digital economy” may not be fully understood. The point of digital transformation started in Uzbekistan after the President of the Republic of Uzbekistan Mr. Sh.Mirziyoyev said that “… it is necessary to launch a large-scale system program for the development of the economy of a new technological generation, the so-called digital economy” to the Oliy Majlis [1].

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In addition, one of the key conditions for sustainable development and social welfare growth in any state is the modernization of the economic structure, with high-tech industry, science and education as key growth factors. The task of modernizing the economy, set by the President of the Republic of Uzbekistan, raises the issue of enhancing the level and effectiveness of scientific research and the scientific and technological development of scientific research organizations. With regard to agriculture, the implementation of Uzbekistan’s Development Strategy for 2022-2026 is based on the international experience of farm development based on the development of automated management systems and databases, and on the building of partnerships in the management and maintenance of cotton, wheat and melon [2]. Development of information service technology models in agriculture adapts automated farm management systems to modernization processes based on information services and innovative approaches. In Uzbekistan, much attention is being paid to the effective use of information technology in the agricultural field. Creating and implementing an automated farm management system is one of today’s major tasks. The lack of legal and financial knowledge of most farmers prevents them from making quick decisions about managing their farms, even some farmers do not know the exact amount of their account, and their costs are in the near future, even no idea how much it will cost (taxes, social security contributions, etc.).

As expected, the agricultural technology sector is undergoing changes like other sectors and is gradually becoming a knowledge-intensive enterprise. Through this change, traditional production systems are being transformed into modern, productive and innovative systems [3]. Recently, farmers have faced the fact that management activities are also changing new paradigms beyond production, and this situation requires more interaction with environmental factors [4]. The agriculture means now: water-saving agriculture, smart agriculture, high-quality agriculture, efficient, environmentally friendly. Digital agriculture is the most effective and necessary approach to achieve all these transformations [5].

This research aimed at analyzing the opportunities and development of agriculture in Uzbekistan using digital technologies in comparison with other well-developed countries. To obtain the aim of this study we tried to answer the following research questions:

- What is the current state of research on agriculture and digital transformation?
- What are the advantages of digitalization of the agricultural sector in Uzbekistan?
- What does sustainable agriculture mean in the context of digital transformation?
- What kinds of strategies have been done in Uzbekistan, in order to develop agricultural sector?

2 Concept of Digitalization in Agriculture: A Literature Review

There is still a lot of literature on different forms of digitalization in agriculture (big data, internet of things, augmented reality, robotics, sensors, 3D printing, system integration, communication infrastructure, artificial intelligence, digital twins, and block chain, among others) from a natural or technical sciences perspective, social science researchers have only recently begun to investigate different aspects of digital agriculture in relation to farm production systems. As a result, there is a growing but distributed body of social scientific literature. Mostly as result, there is a lack of understanding of how this field is progressing, as well as established, developing, and new themes and ideas. Beyond introducing this paper dealing with the social, economic, and institutional dynamics of precision farming, digital agriculture, or smart farming, this paper aims to make a contribution in this area.

Five theme clusters of existing social science literature on digitalization in agriculture have been discovered, according to an exploratory literature review: 1) farmer identity, farmer skills, and agricultural work; 2) the impact of digitalization on the farmer's identity,
skills and work on the farm; 3) power, ownership, confidentiality and ethics in the digitization of agricultural production systems and value chains; 4) digitization and Agricultural Knowledge and Innovation Systems (AKIS); and 5) economics and management of digitalized agricultural production systems and value chains.

The main contributions of the special issue articles are mapped against these thematic clusters, presenting new perspectives on the relationship between digital agriculture and farm diversity, as well as new economic, business, and institutional arrangements on-farm, in the value chain and food system, and in the innovation system, as well as developing ways to ethically govern digital agriculture. Within these theme clusters, emerging lines of social scientific inquiry are recognized, and additional lines are proposed to form a future research agenda on digital agriculture and smart farming.

2.1 Digital agriculture: essence and significance

Agriculture in the 21st century will be water-saving, automated and intelligent, and high-quality, high-yield, pollution-free farming. The core of agricultural automation is digital agriculture, which is a required and effective strategy to achieving all of these goals.

Digital agriculture and the research that accompanied it were systematically implemented in industrial countries beginning in the late 1990s. In those countries, digital agriculture research has now advanced to a greater level. In many developed countries, the use of these high-techs has reached a practical level [6]. Users have been able to collect, manage, produce, and send any type of agricultural information using GIS, RS, GPS, DSS, and computer networks, among other things. For example, the United States has developed a crop strain information management system that allows computers to maintain the data of over 600,000 sample plants across the country. The French Ministry of Agriculture's Plant Protection Bureau has created nationwide computer networks to survey and forecast illnesses and insects, which can provide a genuine image of diseases and insects, chemical forecasting, and chemical residue evaluation. The Japanese Ministry of Agriculture, Forestry, and Aquatic Products has developed a data bank system for a variety of crop strains, including rice, soybeans, and wheat. The Research Academy of New Zealand Agriculture and Husbandry, or "farm system," provides a variety of information services [7].

Digital agriculture is an advanced mixture of agricultural science, contemporary computer technology, network connectivity, and geographic information technology that will become the 21st century’s new revolution for agricultural development [8]. The essence of digital agriculture is to use the digitization of each type of process in all aspects of agriculture (including crop production, animal husbandry, aquatic products, and forestry) using information technology. It includes digital informatization of agricultural factors (biological, environmental, technical and social), digital informatization of agricultural processes and digital informatization of agricultural management (agricultural management, agricultural production management, agricultural science and technology management and agricultural technology management).

In other words, each field and agricultural process must be expressed in binary numerals (0, 1) and digital model. So, digital agriculture with the exception of crop production will also include precision gardening, precision cultivation, precision processing, precision operation and management including even forestry, animal husbandry, care, processing, production, supply and sale. It is an agricultural technological system with the whole procedure of the whole agriculture that will be characterized by digital, network and intelligence, using the technology of remote sensing, telemetry, remote control and computer. This will result in efficient business, with information management, reasonable labor for the agricultural product - make every square meter have an optimized use. It will be a
technological system of information agriculture that includes monitoring and estimation of crops, land and soil, current or dynamic analyzes of crop growth and environmental factors, diagnostic forecasting, cultivation stage, management planning and decision support [9].

According to [10], the structure of digital agriculture consists of the following parts: 1) basic agricultural information databases; 2) real-time (or quasi-real-time) information collection system; 3) digital network transmission system; 4) Central Processing System (DSP); and 5) Central Data Processing System (DSP). As shown in Fig. 1 each party shall be connected by a common data interface. The digital agricultural system determines the planting plan of a year according to basic informational databases monitors the vigor of growing crops and provides the structure of the soil, water content, diseases, meteorology and other important information through the information collection system. CPS analyzes all types’ information and then makes reasonable decisions CPS direction, finishing of digitized agricultural machinery a series of works, such as sowing, water or fertilizer control, harvest and return the results to CPS. CPS does the final analysis report at last. Digital agriculture focuses on the integrative development of each side. Only when all parts are closely connected and developed in cooperation, so they can build Digital Agriculture. Anything one or more parts that develop separately cannot be named digital agriculture [10].

![Framework of digital agriculture](image)

Fig.1. Framework of digital agriculture [10]

2.2 Digital technologies in agriculture

The use of digital technologies in agriculture is a requirement of the 21st century, requiring the introduction of innovative technologies and the emergence of global information processes. This process contributes to further improvement of agricultural activities and improves the performance of the agricultural sector through the use of electronic information resources, thereby improving the work and profits of agricultural sector representatives.

The digital revolution transforms agriculture through the use of modern technology, computer tools and ICT to improve decision-making and performance of the agriculture. Broadcasting of several advanced technologies from GPS to remote sensing big data, artificial intelligence and robotics and the Internet of Things in agriculture leads to growth yields, lower costs and lower environmental impact. Data-driven solutions unlock production potential in a sustainable and resource-efficient way [11].

2.2.1 Automatic systems for intelligent agriculture

Digital agriculture includes various sensor technologies digital platforms and communications, artificial intelligence and machine learning. Recently, wireless sensors and
wireless sensor networks they are used in various scientific fields due to their availability smaller devices. These reductions were possible due to technological advances technology. Intel Corporation in partnership with Intel Berkeley labs research examined deployment network of sensors in the vineyard [12,13]. Research and development team a Accenture Technology Labs has done similar work in a field test in Pickberry Vineyard [14]. [15] provides an overview of modern development of wireless and sensor technologies standards for wireless communications, as applied wirelessly sensors.

Hybrid wireless sensor networks are used [16] for reduces the intensive human involvement required in the current agricultural systems. [17] introduces ZigBee technology architecture and design of ZigBee gathering nodes important environmental parameters such as temperature, humidity and real-time illustration, and then transfer data to the monitoring center. The feature of the Internet of Things, which is to increase the connectivity of physical devices and everyday items to the Internet, has greatly expanded in the agricultural sector. Connected objects interact with each other and are controlled remotely via the Internet. [18] includes an Internet of Things-based monitoring system that monitors environmental parameters and provides the farmer with vital information, thereby maximizing yields.

Using aerial mapping sensors and HD cameras, aerial imagery and Internet-of-things are coupled to make systems smart and scalable [19]. Smart automation and Internet-of-things are utilized in agriculture to execute tasks such as weeding, spraying, moisture detection, and other tasks based on real-time data. To carry out the aforementioned tasks, intelligent drones or robots can be constructed [20]. The integration of Internet of Things with a wireless sensor network simplifies greenhouse monitoring, assuring the smooth functioning of the greenhouse and making it convenient to remotely monitor large scale greenhouses [21].

2.2.2 Irrigation system management and use of distributed wireless sensor network

Several other researchers have explored the potential use of feedback from wireless field detection systems to control variable speed irrigation systems, but few have fully integrated these systems. Miranda et al. [22] used a closed-loop irrigation system and determined the amount of irrigation based on distributed soil moisture measurements. Shock et al. [23] used radio transmission of soil moisture data from data loggers to a central computer recording station. Wall and King [24] explored projects for intelligent soil moisture sensors and sprinkler valve controllers for plug-and-play implementation and proposed distributed sensor network architectures to automate site-specific irrigation. Perry et al. [25] compared the uniformity of sprinkler irrigation with and without the sprinkler on and off and indicated that the sprinkler irrigation cycle for variable rate irrigation does not affect uniformity. The development of automatic irrigation management software was studied by Abreu and Pereira [26], who designed and modeled sprinkler irrigation systems using computer-aided design software, which allowed the design of a simplified aspect of the irrigation system. Coordination of control data and instrumentation is most efficiently achieved using cheap data networks and microcontrollers [24].

Bluetooth wireless technology is an example that has been adapted and used to detect and control agricultural systems [27, 28]. Zhang [29] evaluated Bluetooth radio for various agricultural conditions, power consumption and data rates. Zhang identified 1.4 m as the optimal radio height for a maximum range of 44 m and reported significant limits on signal loss after 8 hours of continuous battery operation and 2-3 s transmission delay at a time with an increase in the communication interval. Oksanen et al. [27] used a Bluetooth-enabled personal digital assistant to connect a Global Positioning System (GPS) receiver to their open, versatile, customizable farm automation platform. Lee et al. [28] investigated the application of Bluetooth wireless data transmission of moisture concentration in the harvested silo and
reported a 10 m range limitation. However, the limitations identified in the revised publications on Bluetooth applications in agricultural systems can be eliminated or minimized by optimizing the system design. For example, power outages can be eliminated with solar panels that recharge the battery, and range can also be increased by improving the power class and antennas.

2.2.3 Remote sensing

A variety of remote sensing technologies, from proximal sensors (at a distance of 1 m from subject to monitoring), drones, satellites used by the agricultural sector, providing a perspective to address uncertainties arising from changes in weather and management conditions strategies. These sensors use vegetation reflective properties and provides the ability to assess biomass, yield, area, vegetation strength, drought stress, and phonological development to enable early and effective decision making when fertilizing, watering and pest control.

Much recent progress has been made in using satellite-based remote sensing to produce higher resolution (spatial and temporal) and more accurate data products for agriculture. According to [30], “remote sensing data can greatly contribute to the task of monitoring agriculture, providing timely, synoptic, economic and repeatable information about the state of the Earth’s surface”. It can provide comprehensive information on crop area, biomass and yield, monitoring of stressors as well as accurate information on farm management actions such as crop rotations and structures such as farm buildings, fences, and conservation buffer. Digital agriculture enables the use of technology to turn concrete data into actionable knowledge to support and encourage complex decision making on the farm and throughout the value chain. The perspective is that while past sources of knowledge are often based on shared knowledge gained from research, smart technologies can provide farmers with local data [31]. In this way, digital agriculture reflects a shift from total farm resource management to highly optimized, individualized, real-time, hyper-connected, and data management [32].

3 Methodology

3.1 Summary of the method

This paper consists of both quantitative and qualitative research methods. Because seven large farmers were interviewed in their farming about the advantages and disadvantages of digital transformation, following the research questions and its impact on work efficiency. At the same time, an analysis was made of the economic and financial consequences of digital transformation in agriculture using state accessibility. Semi-structured interviews took place in Kashkadarya region, Uzbekistan. Every interview took about five minutes to discuss the research questions.

Despite significant methodological progress, many program evaluation and monitoring data were limited utility due to excessive dependence only on quantitative methods. While surveys provided generalizable findings with regard to what results or impact have or have not taken place, qualitative methods are better able to identify the explanations behind these results and impact and therefore allow for more effective answers. Qualitative methods also inform the design of the survey, identify social and institutional factors and the impacts that are difficult to quantify, to discover unforeseen problems and to follow the paths of impact. When used together, quantitatively and qualitative approaches offer more coherent, reliable and useful conclusions than each does on its own. This note identifies the key elements of
good mixed-method design and provides examples of these applied principles in several countries [33]. Quantity methods are less effective in an explanation of these results, especially when the explanations involve issues that are difficult to quantify, but are often fundamental to understanding program outcomes such as beliefs and representations, social relations, administrative difficulties, or institutional dynamics. Qualitative methods is better to fix these problems, because of using more flexible questions, ask open-ended responses, carefully study the topic and promote mutual understanding between researcher and research theme. As mentioned above the methods helped to carry out research efficiently about digital agriculture of Uzbekistan.

Although farmers reported that it is now the season for harvesting and growing cotton and other crops, so they are busy but they were so welcome and showed every necessary data in their farming, farmers and experts were interviewed to find the answer and saw all the farming works in real life.

3.2 Focus group discussion

In order to improve the quality of the interviews, the focus group method was considered the best choice for this study. Because focus group discussions are sometimes seen as synonymous with interviews, especially semi-structured one-on-one and group interviews [34]. The process begins with defining the main purpose and defining the key objectives of the study. Depending on the objectives of the study, a list of questions (program or scenario) is prepared as a guide for each focus-group discussion session. The relationship between people’s perceptions and their sociocultural position is critical for making decisions about natural resources, as most people draw their beliefs, mental constructions, and interpretations from their immediate environment and develop them based on empirical knowledge [35].

Given the growth of participatory conservation research in recent decades [36], it is essential to reflect on the scope and mission of focus-group discussions as a methodological tool. Currently, there is relatively little or no critical discussion about the merits and demerits of group discussions compared to other similar quality techniques. Therefore, it is difficult to determine when and in what context the group discussion would be most appropriate. There are no best practice guidelines for applying the technique in the conservation literature. In addition, to our knowledge, there is no comprehensive analysis of the use of focus group discussions in conservation. The focus group discussion consists of four major steps: research design, data collection, analysis and reporting of results.

As a result, four participants have already launched their own agro-industrial production. And the other participants were chosen because of the fit between the agricultural industry and their profession. All participants had different backgrounds and were a mix of men and women.

3.3 Data collection and data analysis

The data was collected by using a semi-structured approach by interviewing farmers and experts in the sphere of agriculture. In addition, information was collected by using quantitative research method and all data has been analyzed properly. There was a short questionnaire around young generation between 18 years old and 45 years old. Using a mixture research method was useful to understand the agricultural system and digitalization deeply by collecting data.

Thus, data analysis is the process of cleaning and transforming data to provide useful information for business decision making. The data was given has been analyzed properly
after collecting all materials, information and transcripts of interviews and questionnaire. In the annex have images of the coding tree and a survey that was conducted among 15 people to get to know their options better. The topic interested most of the participants, and even those who had no idea about the topic invited to get to know digitalization better. Because the survey was organized in social networks (Facebook, Instagram and Telegram channels) and, therefore, the audience consisted of different fields of activity. Moreover, 15 people expressed their opinion about digital agriculture and, after conducting a survey and interviews, most of the participants mentioned about the fact that the digital agriculture system of Uzbekistan is developing step by step. Also, the coding tree was helpful during the interview to make an interesting conversation with the focus group participants.

4 Results and Discussion

4.1 Advantages of digitalization of the agricultural sector in Uzbekistan

The majority of farmers interviewed in the city of Karshi, Uzbekistan, said that digital agriculture will also be the most important progress in Uzbekistan’s agriculture. For example, they found the drip irrigation system in the city of Karshi useful, as there is a big problem with water during the seasons of harvesting and growing the crops. This is why farmers who have a greenhouse use drip irrigation to grow tomatoes, cucumbers, and strawberries.

Currently, the digital economy is penetrating all sectors of society, as well as the economy. Agriculture is no exception. Moreover, the further development of this sector through the digitalization of agriculture is of great importance. For modern society, the digital economy is a relatively new process. Uzbekistan is also working on a practical solution. Due to the development of this sector, it is based on the processing of a large amount, which will increase the efficiency of agricultural production, improve technological solutions and equipment, and develop a system for storing, selling and delivering finished products to the end consumer. In the future, the digitalization of agriculture will lead to further development of this sector. As a result, the opportunities that open up in the process of digitalization will undoubtedly solve all the problems that have arisen [37].

Speech of Minister Jamshid Khodjaev – “One of the major projects is the launch of the Ministry of Agriculture's own geographic information platform. At the moment, contract negotiations are being completed and by November of this year it is planned to launch the system in test mode. The system based on satellite images and other materials obtained with the help of drones using artificial intelligence technologies, will allow determining the favorable time for planting or harvesting, calculate the fertilization scheme, monitor, predict the harvest of agricultural crops, timely identify their diseases and much more.” [38].

4.2 Sustainable agriculture in the context of digital transformation

The concepts of sustainable agriculture are better maintenance of environmental health, economic profitability, and social and economic equity. Doing this ideally it can be difficult because so many elements affect function and integrity agro ecosystems. The issue of time is central to all sustainable systems. Success it is measured in generations or even centuries [38].

Understanding the ecosystem and the function of alternative farming systems is essential to make a line the transition to sustainable agriculture. While sustainable agriculture is an ideal goal that many people aspire to, achieving it can be extremely difficult practice as
sustainable agriculture involves many different elements and dimensions, some of which may conflict with each other.

4.3 Strategies in Uzbekistan for developing the agricultural sector

On strategies, Minister of Agriculture in Uzbekistan, Jamshid Khodjaev answered question about the potential of the country's agricultural sector in the interview [38]:

Speech of Minister Jamshid Khodjaev – “We are working within the framework of the 10-year Agricultural Development Strategy developed by the Ministry of Agriculture of the Republic of Uzbekistan with the support of the EU, the World Bank, FAO, as well as other interstate national organizations and experts. In accordance with the "Strategy for the Development of Agriculture in Uzbekistan for 2020-2030"

- Ensuring food security of the population. In a short period of time, the "malnutrition index" in Uzbekistan dropped unprecedentedly from 15% to 2.4%, becoming one of the best results in the region.
- Improving the agribusiness environment and creating value chains.
- Reducing state participation in the industry and increasing investment attractiveness.
- Ensuring the rational use of natural resources and environmental protection.
- Development of modern systems of public administration.
- Diversification of public spending to support the sector.
- Development of the agrarian science, education, information and consulting services.
- Development of rural areas.
- Development of a transparent system of industry statistics.

Speech of Minister Jamshid Khodjaev – “Another important project is the creation of a unified state information system for the allocation of subsidies in the agricultural sector. It will be possible for farmers to receive 18 types of subsidies, as well as to monitor their intended use. Subsidies are allocated by the state to support farmers for the purchase of agricultural equipment, the use of water-saving technologies, the cultivation of vineyards and intensive orchards, the development of the livestock industry to improve pedigree breeding, and much more”.

5 Conclusion and Recommendations

The fundamental research questions of this study included the role of agriculture in Uzbekistan and analyzed the development opportunities for farmers to improve work efficiency through digitalization. The development of a “digital agricultural” system will raise modern agriculture’s efficiency. It’s worth noting that modern digital technologies have a lot of potential for lowering expenses and enhancing the quality of planning and budgeting in agriculture. Moreover, the use of digital technologies in modern agriculture will involve the development of environmentally friendly products, reduce agricultural pollution, reduce the anthropogenic impact of production on the environment, help minimize resource costs in the agricultural production process, increase agricultural production efficiency, and increase competitiveness and sustainable development.

Furthermore, the creation of a common information space, improved quality and efficiency of management decision-making through the use of modern analytical methods of research, promotion of state support for domestic agricultural producers, optimal satisfaction of the requirements of consumers of information resources, increased the reliability of indicators of agricultural production development, and reduced response time will be the outcomes of agriculture digitization.
In order to develop digital agriculture in Uzbekistan, government support is of strategic importance. In this context, the development of an action plan for digital agriculture and the support of this strategy with related policies and implementations, as in the EU and US countries, will allow the vision of agricultural production in Uzbekistan to be expanded. It is important to support the establishment and research infrastructures of enterprises that aim to develop and encourage internal practices in digital farming.

Increasing the number of micro- or large-scale hybrid initiatives that combine data-driven IT expertise with agronomic expertise will pave the way for innovative agricultural implementations. Techno-polices and university incubation centers will be able to turn the acquired scientific knowledge into business and create a digital ecosystem focused on agriculture. In addition, the enrichment of the higher education curriculum and other educational opportunities to improve the skills of young farmers in digital farming applications, which will begin to grow in this sector in the next few years, can accelerate the transition to digital technologies. During the interview, the city of art of Karshi and “the internet of things” technologies in agricultural scenarios were analyzed. Karshi city presents challenges for farmers. Cultural attitudes, a lack of local technical experience, infrastructure limits, knowledge and technology gaps, and expensive start-up expenses are only a few of them. Farmers should be active in the development of these technologies and their deployment in their businesses. Methods to ease integration should be available to implement this solution. Using low-cost sensor technology and unique communication paradigms, this paper presents a new technique for involving farmers in the development of new solutions. Digital agriculture is based on modern agricultural ideas and utilizes digital technology. It will increase growth and keep agriculture expanding by implementing agricultural procedural intelligence. Digital agriculture research is not just a support technology, but also a strategic aim that modern agriculture will unavoidably choose. The implementation of digital agriculture in many sectors of Uzbekistan is still in its early stages. Farmers gain from automated agriculture systems for farming. These devices allow farmers to remotely monitor their crop fields, saving them time, money, and energy. There are numerous systems available now that employ various automation and communication mechanisms. However, these systems are not complete and lack many aspects. This study provides an overview of the various features, advantages, and disadvantages of existing systems. There is room for improvement in existing systems and this document would be useful to create an improved automated farming system that overcomes most of the shortcomings of existing systems and develop the agriculture system of Uzbekistan as well.

References

2. S.B. Narzullaev, Automated farm management system in Uzbekistan. Tashkent pharmaceutical Institute (2021)


16. Z.Y. Xiaojing, Zigbee implementation in intelligent agriculture based on internet of things. 2nd International Conference on Electronic & Mechanical Engineering and Information Technology (EMEIT) (2012)


