SECTION V

Digital technologies and sustainable, inclusive agri-food sector

CONTENT

TSUE International Online Conference
"Sustainable agricultural development and regional cooperation for inclusive growth in Central Asia"
20 - 22 October 2020

BUzNet App – an internet aid for veterinary medicine hands-on teaching and learning

Augusto M. R. Faustino*, Pablo Payo-Puente, Luís A. de O. Pinho ***, Carla M. P. N. de Mendonça**** and Maria da G. C. A. Lopes*****

* ICBAS-UP, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal; a_faustino@yahoo.com
** ICBAS-UP, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal; pablopayo@gmail.com
*** ICBAS-UP, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal; luisandrepinho@gmail.com
**** ICBAS-UP, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal; cmmendonca@icbas.up.pt
***** ICBAS-UP, Rua de Jorge Viterbo Ferreira, 228, 4050-313 Porto, Portugal; mdglopes@gmail.com

Keywords: Veterinary; practical teaching-learning; "hands-on"; Internet Application; BUzNet

Summary

Teaching-learning practical subjects presents one of the biggest challenges higher education institutions face nowadays. The use of a hands-on contextualize strategy, putting students in real-life situations and allowing them to solve it under a teacher supervision, is the best strategy to achieve this. However, this approach presents several difficulties. The logistics, equipment and teaching personal needed to present each student with enough cases/situations to cover even the most simple and basic aspects are so huge that makes it very difficult as well as expensive. Internet is now almost ubiquitous in the classroom.

However, problems and shortfalls are usually present in using internet in teaching/learning and they also don't take the full advantage of all the potentials that an internet system can provide. Taking this into consideration, we devoloped an application based in the internet and using cellphones in order to create a digital system to be used to increase the efficiency of teaching/learning practical subjects in veterinary medicine. This system, the BuzNet app, was built in a way to take full advantage of all the internet potentialities, maximizing the efficiency of each visit/manipulation/action taken by a student during her/his practical classes as well increase students' motivation in the teaching/learning process.

1. Introduction and research questions

For veterinary students, acquiring practical competences is essential as this will provide the backbone of their future work. As such, teaching and learning practical skills are paramount in a veterinary degree. In fact, international bodies controlling Veterinary Teaching Institutions stress this by providing minimum numbers of hands-on cases/animals that each student should follow in order to approve the quality of the teaching establishment (SOP of EUROPEAN ASSOCIATION ESTABLISHMENTS OF VETERINARY EDUCATION 2019). Nevertheless, teaching-

learning practical subjects presents one of the biggest challenges higher education institutions face nowadays. The use of a hands-on contextualize strategy, putting students in real-life situations and allowing them to solve it under a teacher supervision, is the best strategy to achieve this (PARKINSON 2017). However, this approach presents several difficulties. The logistics, equipment and teaching personal needed to present each student with enough cases/situations in order to cover even the most simple and basic aspects are so huge that makes it very difficult as well as expensive. This is the main reason why medical (human and veterinary), agricultural, etc. degrees are much more expensive to provide compare to the more theoretical (humanities, math, etc.) ones. In addition, there is also the problem of efficiency. In order to make it effective, each contextualize case/situation is in general only used by a very small number of students, sometimes only one, and so, if the strategy is to provide this type of learning experience to all and every student, the expenses are enormous. So it is paramount to increase the efficiency of hands-on contextualize practical learning/teaching (WINDE et al. 2017).

The teaching/learning process of practical competencies can be divided in two parts: "What-to-do and "How-to-do". Both are essential to achieve a good practical training. "What-to-do" is the sequence of needed actions to perform a specific procedure (a surgery, a blood analysis, a control in a meat production line, etc.). All these sequences can be transformed into algorithms and thus transferred into a digital environment. "How-to-do" can be defined as the knowledge of each individual action that compose the "what-to-do" sequence and can be further divided in two aspects: 1 - the theoretical knowledge of how to perform each one of those actions, (how to open a dog's mouth or which kind of scalpel to use in a certain surgery, for instance); 2 - the truly practical part of an action, the correct use of sensorial organs and mechanical movements in order to perform that specific action. So, in terms of practical teaching/learning there is a true practical part, and two other aspects that can be more exactly defined as the theoretical part of the practical teaching/learning process. With this in mind the question now is: is it possible to transfer all the components of practical learning into a digital environment? (WINDER et al. 2018)

The practical part of "How-to-do" implies the acquisition of a series of fine mechanical movements and the training of sensorial systems by the students in order to allow them to execute specific actions in the real world. Only by the repetitive execution of these same actions, preferably in initial times under the supervision of a teacher, can these be mastered. This is why it is impossible to teach/learn how to be a veterinarian without a direct contact with animals and their peculiar situations that requires the presence of a veterinarian (PARKINSON 2017). These same situations are the exact ones that should be used to teach and learn the future veterinarian. So the answer to our question is no. It is not possible to teach/learn practical subjects without a direct contact with real cases and so a teaching/learning system with hands-on in contextualized situations is essential to learn how to be a veterinarian. Or to better put it, it is not possible to teach/learn the practical part of "How-to-do" without a direct contact with real cases. But what about the other parts of the practical learning process? Are those possible to learn/teach without a direct contact with real case situations? The "What-to-do" part should not be a problem as it is can be described as an algorithm (computer way of thinking). Also, the theoretical part of the "How-to-do", as it can be transformed in a series of documents (texts, pictures, videos, etc.) that can be posted digitally. So we need a system based on a hands-on contextualized experience by the students that allows some parts of the process of practical learning to be transfer to a digitalized environment, some kind of blended learning.

Internet is now almost ubiquitous in the classroom and the actual pandemic situation only increased its use. In veterinary schools internet is usually used in two ways to teach/learn practical subjects. The first uses internet as a medium to transmit cases/situations in order to expose the students to a specific type of procedure (clinical visit, surgery, meat inspection, etc.). In this case, internet acts just like a television and the behavior of the student is completely passive. The only action required is to observe. The second is a development from the first and can be achieved with the creation of cases/situations coupled with a series of questions or comments to be fill by the student (KORICH and KEEFE 2017). This second type can be more or less complex, giving the chance to promote discussions between all the students and teachers or even make it possible to evaluate the students (HARDIE 2017). However, some problems and shortfalls are usually present in these systems and they also don't take the full advantage of all the potentials that an internet system can provide. The main problems can be summarized as follow:

- Students are confronted with cases/situations that they already know are not normal. This is a big shortfall as in the real life work of a veterinarian this is one of the major issues to solve – is this that I'm observing normal or abnormal? So, these systems do not allow for the teaching and training of this fundamental skill.
- The cases/situations are usually presented in a poorly structured way. Students will only look to one or few aspects of the procedure, thus missing the complexity and fullness of the whole system.
- The same to the lack or little contextualization of the cases. This leads to a deficient training of the capacity to relate and integrate all the available information into the case resolution.
- Although the role of the student is more active as she/he must interact with the system, it is nevertheless usually not very interesting and/or exciting as all is already present there on the screen. There is no active collaborative (TUDOR et al. 2017) role for the student on the production of the cases.

2. Data and methods

Taking all this into consideration, we set a goal of producing an application based in the internet and using cell phones in order to create a digital system that can be used to increase the efficiency of teaching/learning practical subjects in veterinary medicine. This system is built in a way to overcome the problems mentioned previously and also take full advantage of all the internet potentialities.

3. Main results

Work system. The system is based in pathways made up by all the necessary actions that must be taken during a veterinary procedure (KORICH and KEEFE 2017). So, for example in a

“Neurologic Examination” of a dog, the pathway includes “Anamnesis”; “General Clinical Examination” and “Neurologic Examination”. Each pathway is designed by a team of experts in that area and is build up in the system by a drag and drop of different types of tools.

These tools can be images, videos, multiple choices boxes, dropdown boxes, etc., depending on the objectives on that specific step of the pathway. Each pathway is formed by two different sets of tools. One comprises the tools to upload information from the real case; the other the tools used to comment or answer questions derived from the information provided by the first set of tools. So, a pathway will have one set of tolls to build the case and a second set to solve the case.

A student uploads a case, using the specific pathways already built in the system, during a real veterinarian situation witnessed by him using a smartphone with the application installed. This comprises both the uploaded information to build-up the case and also the information to solve the case. After this is completed the student submits the full case to the system by internet. The teacher responsible for that pathway/student checks the submitted case and approves it if it is OK (case approved). After that the teacher checks the comments and answers provided by the student and also sends back to him the evaluation about that case. The case is now complete with the comments and answers validated by the teacher (if originally correct) or corrected by the teacher (if originally wrong).

The complete case will now be available to other students/users to be viewed and solved. However, the solution can only be obtained after the filing and submission of all the comments and answers to the questions of that specific case by the new student/user. Only after that submission, the student/user will get a response from the system with the correct comments and answers of that particular case, validated by the responsible teacher.

Organization of the System. The platform is organized in several levels. The first level deals with the general type of subject and is subdivided into: “Animals”; “Husbandry” and “Animal Products”. Each of these is further subdivided according to its specific case. So for instance the “Animal” is subdivided in: “Pet”; “Production” and “Wild Animals”. Further subdivision of “Pet”, for instance, includes the animal species (Dog; Cat; Rabbit, etc.). At this point, a

common pathway is present to all the possible subdivisions under “Animals” and it start with “Anamnesis” followed by “General Clinical Examination” as this is the common pathway for all veterinarian activities dealing with animals. From here it is possible to go to the next level of the organization, including: “Specific Clinical Examination” (divided in Respiratory, Digestive, Reproductive, Behavior Systems and so on); “Surgery” (again subdivided by systems); “Complementary Exams” and so on. With this, all the cases of “Animals” will have a minimum common pathway including “Anamnesis” and “General Clinical Examination” but after that they might procced with a specific pathway, depending on what kind of case it is. The same basic system is used for the other major categories on the first level: “Husbandry” and “Animal Products”. With this system all the cases will be placed in a very well define structure based on a logic classification tree that embarks all the possible veterinary practical actions.

4. Discussion

The BUzNet Application. The objective of this system is to provide a digital platform to be use on the teaching/learning process of practical competencies/skills of a veterinary degree. It is formed by a collection of practical, well-structured contextualized cases, up-loaded by the students during their own practical experiences on the real world, thus combining the necessary real hands-on experience with the advantages of the digital world (WINDE et al.2017). After up-loading and validation, the cases will be available to be solve by an infinite number of users from any geographical part of the world improving the low efficiency of practical classes (usually each case can only serve one or a very limited number of students). The results achieved by the students solving the cases will provide a feed-back to the teacher on the success and deficiencies of his own teaching. This will thus provide an opportunity to correct any aspect that may not be clearly learned by the students before their final examination. The collection of cases build up in time will increase the quality of the teaching/learning experience by the inclusion of rare, unusual or uncommon cases from particular locations, making it possible to use cases from far way places dealing with unusual diseases or species not common or present at that given location. Moreover, it is also possible to use these highly contextualize cases in student's evaluations, scientific research or even in improvement of management practices.

5. Conclusions

It is not possible to provide a full training in practical subjects in veterinary medicine without a direct contact with animals and their peculiar situations that require a veterinarian practitioner. This type of training should be based on a structured hands-on contextualized experience, but these came as very expensive and time consuming activities that should be brought to the maximum of efficiency. However, some parts of the practical training can be done in a digital environment. With this in mind, we built a digital platform in order to retrieve and store, in a structured way, the overall experience of a practical class in veterinary medicine. The advantages of this system can be summarized as follows:

- Production of a collection of structured high contextualized cases from veterinary practice available for anyone to use to train himself anywhere in the world;
- Huge increase in the efficiency of each visit/manipulation/action taken by a student during her/his practical classes as it will be shared among all interested in doing it;
- Students highly motivated as they produce their own studying material. Material that will be use by many others too in a kind of peer-assisted learning (MOLGAARD and READ 2017);
- Knowledge by the teachers and students of the level achieved in the teaching/learning process well before the final examination. Thus giving the possibility of correcting, both to teachers and students, any deficiencies in the learning process well before the end of school time;
- Cases can be used in evaluation systems;
- Increased self-knowledge of the highs and lows of the teacher's capacities in transmit the relevant information in order to be apprehended by the students;
- Creation of a database with well structures and highly contextualized veterinary cases that can be used in improving practical teaching/learning, research and animal management.

6. References

HARDIE, E. M. (2017). Learning in the Veterinary Teaching Hospital, in: HODGSON, J. L, and PELZER, J. M. (eds.): Veterinary Medical Education – A Practical Guide, pp. 178-195.

KORICH, J. A. and KEEFE, L. M. (2017). Learning in the Electronic Age, in: HODGSON, J. L, and PELZER, J. M. (eds.): Veterinary Medical Education – A Practical Guide, pp. 163-177.

MOLGAARD, L. K. and READ, E. K. (2017). Peer-Assisted Learning, in: HODGSON, J. L, and PELZER, J.M. (eds.): Veterinary Medical Education – A Practical Guide, pp. 116-130.

PARKINSON, T. J. (2017). Learning in the Real-World Settings, in: HODGSON, J. L, and PELZER, J. M. (eds.): Veterinary Medical Education – A Practical Guide, pp. 196-216.

SOP OF EUROPEAN ASSOCIATION ESTABLISHMENTS OF VETERINARY EDUCATION"ESEVT_SOP_2019_adopted_by_the_32nd_GA_in_Zagreb_on_30_May_2019" accessed from internet on 28th August 2020 (https://www.eaeve.org/esevt/sop.html)

TUDOR, E., DOOLEY, L., BOLLER, E. (2017). Collaborative Learning, in: HODGSON, J. L, and PELZER, J.M. (eds.): Veterinary Medical Education – A Practical Guide, pp. 79-100.

WINDE, C. B., LEBLANC, S. J., HALEY, D. B., LISSEMORE, K. D., ANN GODKIN, M., T. F. DUFFIELD (2017).

Comparison of an online learning module to hand-on training in teaching a cautery disbudding technique for dairy calves including cornual nerve block application, Canadian Veterinary Journal 58: 735-740.

TSUE International Online Conference
“Sustainable agricultural development and regional cooperation for inclusive growth in Central Asia”
20 - 22 October 2020

The significance and ways of development of digitalization of the economy in agriculture

E.Dj.Yusupov - TSAU, prof. of econom.
D.D.Djalalova - TSAU, student of PhD

Abstract: Resource efficiency in the agri-food sector is a global urgent issue considering the urbanisation phenomena, the increased nutritional needs, and the emergence of diversified dietary norms. Despite the ongoing progress in digital technologies that could enable resource-efficient operations in the sector, their effectiveness even in developed countries remains debateable mainly due to the limited understanding that further impedes their adoption by farmers. Among others, ease of access, training, and engagement with digital technologies appears to be challenging for most stakeholders, especially during the production (farming) stage. Specifically, in developing countries, that often encounter major natural resources challenges, the diverse socio-cultural background of the farmers hinders the adoption of digital technologies to perform highly automated and efficient agricultural operations for ensuring sustainability output. In this regard, we explore publicly available data sources (i.e., institutional reports, databases) to identify key challenges in adopting digital technologies for efficient resource use from a systems-level perspective. There after, we map the determinant factors using the System Dynamics methodology in order to identify areas of interventions to limit natural resources' appropriation and support agri- food sustainability.
Keywords: digitalisation; resource efficiency; system dynamics; food supply chains

1.1. Introduction

The way agriculture influences food security and humanity poses a very complicated issue. However, it is unquestionable that its impact is significant. An agri-food system depends on different operations such as arable farming, soil cultivation, production of diverse products such as crops, fibres, and timber, breeding and raising livestock, and manufacturing and marketing of foods. Thus, today's societies request the global agri-food system to use fewer resources and be more environmentally-friendly.

Digital technologies significantly influence all segments of the economy including the agri-food sector. The latest report from the World Bank outlines the key gains from the application of advancements in Information and Communications Technologies (ICT) in the agri-food system. In particular, ICT support higher involvement in the wider economy, boost effectiveness by supplementing other production elements, and foster innovation by intensely decreasing transaction costs. Smartphones and the Internet assist in overcoming information obstacles that limit market entrance for small producers and expand current knowledge supplying extension services that advance food supply chain management. Despite the numerous encouraging examples of concrete results, these have not been materialised to the anticipated level. The key cause is that technology can only address some, but not all, of the barriers encountered by food supply chain stakeholders in developing countries.

The challenges facing the agri-food sector differ significantly, depending on the economic status and development level of every region. Developed countries deal with overweight malnutrition while, in the other extreme developing countries, like the Middle East and North Africa (MENA) region, struggle with undernourishment. In this regard, a prevailing concern, given the resource efficiency issues in such regions is the expanding dependence on the global market for essential food products. Current policies in the MENA area focus on sustaining cereal production and consumption and, as a result, 65% of cropland is planted with water-demanding grains. The outlook of the Organisation for Economic Co-operation and Development (OECD) and the Food and Agriculture Organization of the United Nations (FAO) for the MENA region foresees on-going dietary changes toward meat consumption, extended freshwater appropriation at non-sustainable rates, and progressive dependence upon global markets. Initiatives to reduce poverty and produce added-value agricultural products could contribute to more diversified and nutritious diets. However, such changes require capacity building in the agri-food system by leveraging digital technologies. A holistic view in the agri-food system should also consider the implementation of management accounting and control system principles since these facilitate the evaluation of the benefits stemming from the adoption of sustainability-driven innovations in organisations. Indicatively, the external focus of management accounting and control systems is documented to enhance export propensity for the establishment of food value chains.

This research attempts to map the agri-food sector's resource efficiency related challenges in the developing world from a "how to leverage digital technologies" perspective. In the extant literature, management accounting and control systems have been used to align individual operations with organisational goals. In this regard, in order to effectively capture the underlying complexities and the non-linear behaviour of the agri-food system over time, we adopt the System Dynamics (SD) methodology to further understand the long-term effects of digital technologies in sustainable agri-food systems. SD is a simulation-based approach, which has been proven quite successful in policy- making at a strategic level regarding a wide range of sectors and challenges. Our research findings, reflected upon the proposed causal loop diagram, echo the major resources' efficiency challenges being encountered by developing countries since these are identified in the reviewed policy documents. Therefore, we do not focus on a particular country as an exemplar case.

This research contributes to the extant body of literature by systematically mapping the complex interrelations governing the resource-constraint agri-food sector in developing countries and by indicating targeted digital technology interventions to tackle major sustainability challenges from an end-to-end supply chain perspective. In addition, existing systems-level analysis methods for agri-food sustainability are mainly positioned on a high-level conceptual space whereas the provided mapping approach has been thoroughly structured to be able to inform further quantitative analysis and provides the backbone for a simulation-based decision support tool.

The paper is structured as follows. The next section sets the objectives and describes the research approach employed. Afterwards, we discuss the key challenges under the different agri-food system levels, which is followed by a synthesis of results at a Systems Dynamics causal-loop projection. In the last section, we outline the main conclusions and provide the implications of the current work through future research suggestions.

2.1. Research Objective and Approach

The object of scrutiny in the current work is two-faceted, including synthesis of the extant literature (i.e., institutional reports and research articles) and mapping of sustainability related challenges in developing nations with reference to the agri-food system. The multi-faceted character of our approach aims to inform a coherent construct about the complex topic of this research.

Research Objective

The main objective of this research is to support academics and practitioners alike toward ensuring sustainability and viability of the agri-food sector in developing countries by specifically providing an SD-based mapping framework that could inform the effective assessment and implementation of digital interventions. In this regard, we first map the key challenges that affect the triple-helix of sustainability with regard to the agri-food sector in developing countries. At a greater extent, we identify targeted digital technology-driven interventions and recognise their causal effect in an end-to-end agri-food supply chain system, which could promote sustainable performance.

Methodology

At the first stage, the methodological step refers to a literature review in order to recognise the key challenges that govern agri-food supply networks in developing countries. In this regard, to ensure a high integrity, our review focuses on reports by FAO as the appreciated public actor that provides widely accredited standards with regard to food agriculture sustainability. We also retrieved major publications by OECD since the organisation that gauges the impact of national agricultural policies towards global food security and sustainability. At a second stage, we use SD mapping to capture the causal effects of the identified challenges across end-to-end supply systems. SD defines problems dynamically through two stages, i.e., mapping and modelling, in order to ensure modelling robustness and inform targeted and efficient policy interventions. The structural elements of the SD include feedback mechanisms, causal loop diagrams, and stock and flow maps.

- Feedback structures assist in capturing the actual patterns of a system's behavior over the course of time.
- Causal loop diagrams help capture the mental models that describe a system. Annotated arrows depict the causal influences among a system's variables. A positive (denoted as "+") polarity denotes a reinforcing loop, which means that the cause and the resulting effect change toward the same direction. On the contrary, a negative (denoted as "−") polarity denotes a balancing feedback where the cause and the effect change towards the opposite direction.
- Stocks provide memory to a system, which enables a dynamic disequilibrium.

Contrary to traditional optimisation and simulation techniques that are appropriate for analysing static and linear systems, SD can help capture the dynamic behaviour of a system, introduce system interventions, and assess a system's response and evolution phenomena in time. Recent sustainability-focused studies incorporate SD to evaluate the impact of alternative interventions at either a policy or a technological level on the resulting sustainability performance of agri-food supply chains.

3.1. Challenges in the Agri-Food System

The impact of digital technology interventions on agricultural outcomes and overall supply chain's performance sustainability and efficiency is unquestionable especially in developing countries. First, digitalisation significantly improves market transparency and traceability. Mobile phone coverage in Niger resulted in greater arbitrage openings, reduction in price dispersion, lesser waste, and welfare growth for consumers and producers. In India, Internet kiosks contributed to rises in farm prices due to bargaining advances with middlemen as well as better market involvement in isolated areas via effective management and marketing. Second, digital technologies are associated with an increase in farm productivity. In Peru, mobile phone coverage improved income and food security (mainly at a rural household level) over better management practices. In India, hotline voice services facilitated the acceptance of enhanced inputs by allowing cost- effective extension guidance and weather forecasts while supporting agricultural investment decisions. Third, a considerable improvement in logistics efficiency occurred. In Zambia, an SMS-based service optimised supply chain management by enabling better coordination of transportation and delivery of products. Lastly, in Kenya, mobile money simplified secure payments, which allowed quick and secure money transfer for agri-inputs and subsidies etc..

Nonetheless, fundamental problems remain unresolved and key challenges need to be addressed. Our review attempts to identify such challenges. For a more meaningful presentation of the review's output, we adopted an end-to-end supply chain perspective. Thus, in the following five sub-sections, we provide a taxonomy of key challenges with respect to the main pillars of sustainability (i.e., economy, environment, society) regarding production (farming), processing-manufacturing, distribution (transportation-logistics), wholesaling-retailing (trade) and consumption levels, respectively.

- *Production (Farming)*

Global food availability is the common denominator among the several challenges at the production (farming) level. Increasing demand, due to income and population growth, overtakes expected supply gains stemming from productivity advancements and increased mobilisation of land, water, and other resources. Tighter global markets indicate higher food prices and, therefore, the availability issue affects nations with low food affordability. In particular, the identified key challenges mainly refer to the food "safety-security-affordability" nexus and the associated resources' efficiency issues. As a result, one of the main challenges relates to the effective way farmers gain access to new knowledge in agriculture and resource management in an era of patent rights and regulations imposed by the World Trade Organization. Investments in the agri-food system could result in bridging the gap between production and the growing demand for food commodities, adjusting to the evolving dietary patterns in a more sustainable way. Such a sustainable increase in productivity could offer greater scope compared to mobilising more resources.

- *Processing-Manufacturing*

The agri-food manufacturing sector is a vital sector in many agri-based developing countries. For instance, in sub-Saharan Africa's most countries, agriculture signifies between 30% and 50% of total production value added while, in some countries, this respective value accounts for more than 80%. Nonetheless, the lack of essential infrastructure—from rural roads and electrical power grids to storage and refrigerated transportation—refrains any attempt from further growth. Financing essential infrastructure and new technology interventions could result in significant improvements with respect to efficient energy use, reduction in waste, and water scarcity.

- *Distribution (Transportation-Logistics)*

Increasing need for greater volumes of high-value food commodities raises challenges at both the upstream supply chain, from the suppliers of production inputs and manufacturers/processors, and downstream to the packaging, distribution, and storage levels of operations. At a greater extent, a lack of appropriate infrastructure typically impacts the quality of the distributed food supplies. Distribution is a critical echelon of operations in an agri-food system. Supporting the sector with infrastructure and technology investments to improve links among all supply chain actors could assist in overcoming the prevailing challenges.

- *Wholesaling–Retailing (Trade)*

In addition to the previously mentioned established challenges governing agri-food systems in developing nations, there are rising doubts about trade risks globally. Agri- food trade plays a vital role towards food security and emphasising the need for supporting trade-related digital technology interventions. Global trade can influence positively rural development by supplying inputs and equipment and by fulfilling food demand. Nevertheless, trade liberalisation results in growing imports, which benefits consumers and restrains local production at the same time.

- *Consumption*

Food demand depends on population/income growth, emerging dietary patterns, and diversified consumer preferences. Current trends suggest developments in consumer demand patterns due to the observed increase in average incomes such as the declining role of cereals and the growing demand for protein-rich diets.

Synthesis of Results

Below, we present the complexity and non-linear behaviour of the challenges governing agri-food supply chains in developing countries through the respective causal loop diagram. In particular, we synthesise the literature results and we map the key challenges and their interrelations to structural elements of an agri-food supply chain.

System Description

We consider an agri-food supply chain that consists of the following stages: (I) agricultural production, (II) processing, (III) distribution, (IV) wholesaling-retailing, and (V) consumption. Each stage accounts for sustainability in a variant degree. We identify a total of 78 feedback loops (described in detail in Appendix A), which denote a sequence of causes and effects that circulate across each loop and impact a food sustainability related challenge. Compared to the common traditional methodological approaches that have a static and free- of-feedback view of agri-food systems, SD allows us to capture the dynamic nature of the sustainability issue in the agri-food sector. Overall, our mapping approach includes 29 reinforcing (denoted as R—Table A1 in Appendix A) and 49 balancing (denoted as B—Table A2 in Appendix A) loops.

Indicatively, in the reinforcing loop R10 (see Figure 1), an increased "*Retail Inventory Discrepancy*" results in higher "*Retail Prices*". However, increased prices of food commodities reduce "*Food Supplies Affordability*", which, in turn, reduces "*Food Security*". Nevertheless, increased "*Food Security*" assists in sustaining the population of "*Farmers*", which further supports an increased "*Farming Rate*" and high "*Farming Commodities Inventory*" levels. The availability of commodities can then sustain an enhanced "*Processing Rate*", which increased the "*Use of Freshwater Resources*". However, the appropriation of freshwater resources negatively impacts the "*Environmental Sustainability Performance*" of the respective supply system, which accordingly impacts "*CSR*" and "*Sales*". In turn, enhanced "*Sales*" reduce "*Retail Inventory*", which decreases the "*Retail Inventory Discrepancy*".

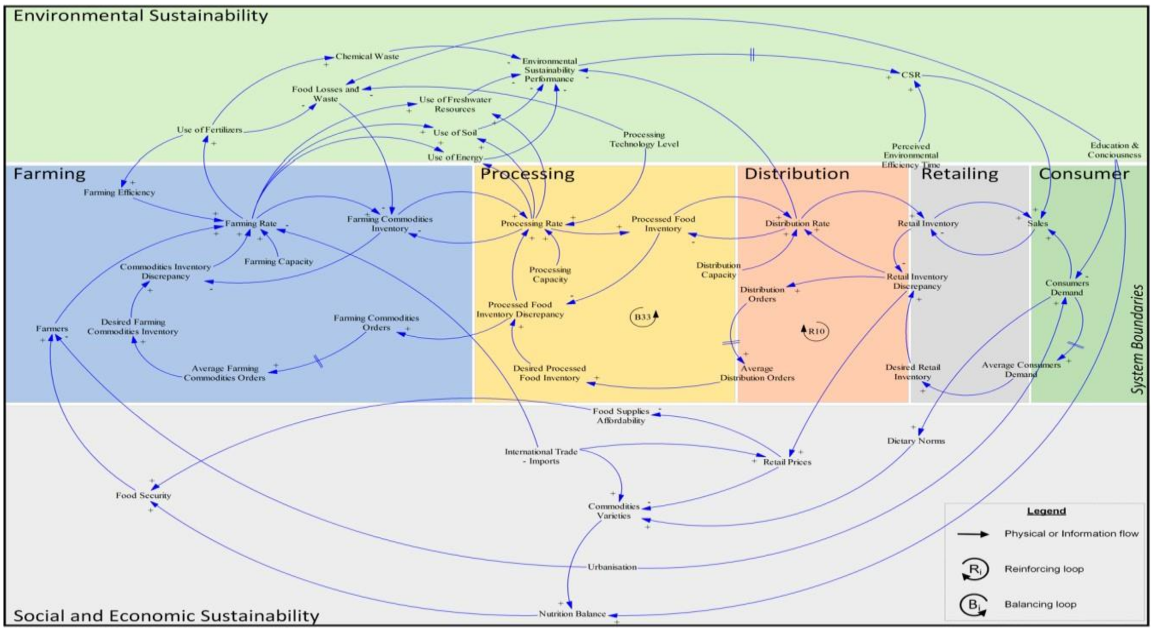


Figure 1. System Dynamics—causal loop diagram.

Furthermore, in the balancing loop B33 (see Figure 1), as the "*Retail Inventory Discrepancy*" increases due to the difference between the market demand and the retailer's inventory, enhanced "*Distribution Orders*" are placed to balance supply and demand. Thereafter, the "*Average Distribution Orders*", which are the smoothed "*Distribution Orders*" over time due to the physical response limitations of the ordering system, are increased and, in turn, increase the "*Desired Processed Food Inventory*". Augmented "*Desired Processed Food Inventory*" increases the "*Processed Food Inventory Discrepancy*", which associates to greater "*Farming Commodities Orders*". However, increased "*Average Farming Commodities Orders*" result in an elevated "*Desired Farming Commodities Inventory*", which widens the agricultural "*Commodities Inventory Discrepancy*". The greater this discrepancy, the more intense is the "*Farming Rate*". Thus, an enhanced "*Farming Rate*" results in augmented "*Farming Commodities Inventory*". The more the availability of commodities, the greater the "*Processing Rate*", which results in greater "*Use of Freshwater Resources*". The intensive appropriation of freshwater resources decreases the "*Environmental Sustainability Performance*" that negatively impacts "*CSR*(Corporate Social Responsibility)" and market "*Sales*" due to the environmental consciousness of consumers. Lower "*Sales*" have a minimal impact on the "*Retail Inventory*", which results in a lower "*Retail Inventory Discrepancy*".[1]

The developed SD-based causal loop diagram imparts a better understanding of the enhanced complexity in sustainable agri-food supply chain management by capturing the dynamic relationships among natural resources' appropriation, consumers' social sensitivity in terms of food security, markets' responsiveness towards commodities' prices, and corporate social responsibility. At a greater extent, the provided causal loop diagram, in conjunction with any external sustainability goals and drivers at both corporate and institutional levels, assist the ex-ante assessment of the sustainability performance resulting from the potential implementation of digital technologies. In particular, Figure 1 could support business stakeholders in selecting appropriate digital technologies to tackle challenges across end-to- end agri-food supply chains. The selected technology-driven interventions should result in a balanced, yet optimum, nexus among environmental impact, economic effects, and social phenomena. Indicatively, the FAO and the International Telecommunication Union recognise the role of unmanned aerial systems to address the challenges of hunger, malnutrition, and counter the effects of climate change with further implications to prices and natural resources' use.

Conclusions

There are many challenges in the agri-food sector toward resource efficiency, both in developed and developing countries. Several of these challenges refer to the same issues at a global level, e.g., energy-related concerns, yet others differ dramatically depending on the country's status of (economic) development, e.g., water scarcity. Without any doubt, a key approach to tackle these challenges is by leveraging digital technologies not only from a practical and applied perspective but also from a policy-making angle.

The most essential challenges identified refer to: tackling hunger and malnutrition, sustainably improving productivity, reducing waste, and ensuring a sustainable natural resource base. However, the main contribution of this research is the comprehensive illustration of the complex interactions among the factors influencing these challenges within the agri-food system. The SD approach clearly demonstrates that every challenge requires a set of actions to be properly addressed due to numerous interdependencies among different processes and stakeholders. Investigating this topic by employing an end-to-end supply chain approach reveals that individual interventions in a single supply chain echelon or operation are highly unlikely to resolve any challenge.

Implications of our findings and, at the same time, suggestions for future research imply the quantification of the proposed SD causal loop, which employs data for high priority developing regions. Particular focus should be attributed to the modelling of the social sustainability parameters captured in the modelling approach and assess the behaviour and performance of the agri-food system toward potential interventions. This shall initially validate the theoretical approach and then strengthen the impact of any interference derived from such an analysis. In a greater scale, this concept could be applied at a country (or even system of countries) level, leveraging digital technologies in feeding

References

1. Traitler, H.; Zilberman, D.; Heikes, K.; Petiard, V.; Dubois, M. *Megatrends in Food and Agriculture: Technology, Water Use and Nutrition*, 1st ed.; John Wiley & Sons Ltd.: Hoboken, NJ, USA, 2018.
2. World Bank. *World Development Report 2016: Digital Dividends*; World Bank: Washington, DC, USA, 2016.
3. Deichmann, U.; Goyal, A.; Mishra, D. *Will Digital Technologies Transform Agriculture in Developing Countries?* World Bank Group: Washington, DC, USA, 2016.
4. OECD; FAO. *OECD-FAO Agricultural Outlook 2018-2027*; OECD Publishing: Paris, France; Rome, Italy, 2018.
5. FAO. *e-Agriculture Summary Discussion e-Forum on ICTs and Open Data in Agriculture and Nutrition*; FAO: Rome, Italy, 2018.

6. Gomez-Conde, J.; Lopez-Valeiras, E. The dual role of management accounting and control systems in exports: Drivers and payoffs. *Span. J. Financ. Account.* **2018**, *47*, 307–328.

7. Jack, L.; Florez-Lopez, R.; Ramon-Jeronimo, J.M. Accounting, performance measurement and fairness in UK fresh produce supply networks. *Account. Organ. Soc.* **2018**, *64*, 17–30.

8. Forrester, J.W. *Industrial Dynamics*; MIT Press: Cambridge, MA, USA, 1961.

9. Roberts, E.B. *Managerial Applications of System Dynamics*; MIT Press: Cambridge, MA, USA, 1978.

10. Agovino, M.; Cerciello, M.; Gatto, A. Policy efficiency in the field of food sustainability. The adjusted food agriculture and nutrition index. *J. Environ. Manag.* **2018**, *218*, 220–233.

11. Sterman, J. *Business Dynamics: Systems Thinking and Modelling for a Complex World*; McGraw-Hill Higher Education: Boston, MA, USA, 2000.

12. Aivazidou, E.; Tsolakis, N.; Vlachos, D.; Iakovou, E. A water footprint management framework for supply chains under green market behaviour. *J. Clean. Prod.* **2018**, *197*, 592–606.

TSUE International Online Conference
“Sustainable agricultural development and regional cooperation for inclusive growth in Central Asia”
20 - 22 October 2020

The need to use software technologies in implementing greening and implementation of urban territories in the conditions of digitalization of the economy

Eshniyazova Gozzal Baxtiyarovna - Assistant to the Nukus branch of the Tashkent University of Information Technologies named after Muhammad al-Khorezmiy

Annotation: in the design and production of landscaping and landscaping of urban areas, various software systems are used, however, the majority of them are aimed at visualizing the design decisions that have already been made, and the decisions themselves are made according to the subjective assumptions of the design organization, resulting in significant labor and financial losses. Therefore, the actual implementation of software for calculating the economic parameters of such work.

Key words: digital economy, landscaping, improvement

Nowadays, digital data is a key factor in most activities. Manufactures are developing rapidly and for their work now large amounts of data are required, which become difficult to process and analyze without using specialized software systems. Therefore, such a direction of development as digitalization in various fields of activity is gaining momentum. The Challenges of the Digital Economy: Results and New Trends 83 direction as a digital economy gained great importance due to the fact that the economic effect plays a significant role in socially important sectors [2]. In particular, let us take as an example the branch of urban economy, namely, the provision of the urban environment with landscaping objects. It is known that according to the functional purpose and use of landscaping and landscaping objects, they are divided into three main categories: public landscaping objects (various parks, forest parks, gardens, squares, boulevards, green areas of public buildings with street plantings); landscaping objects of limited use (green areas of residential buildings, children's and educational institutions, hospitals, industrial enterprises, vertical and roof gardening); special purpose landscaping objects (sanitary, wind and snow protection, anti-erosion and water protection plantations, decorative and forest nurseries, botanical and landscaping and landscaping are carried out by enterprises and organizations of various forms of ownership and production and technological orientation of work. The number of employees in these institutions corresponds to small enterprises, which is less than 100 people [5]. In real production, the organization of work in the creation of landscaping and landscaping objects is based on such documents as: - architectural design project; - dendrological plan for planting green spaces; - costings. This testifies to the irrationality of the chosen solutions and, accordingly, the redundancy of financial costs and time spent for creating landscaping and improvement facilities, which is associated with the lack of project documentation. At present, the design and organization of more than 84 construction of landscaping and landscaping facilities is actually left to the discretion of the work contractor, and no one calculates the economic losses. This situation is aggravated by the fact that organizations that carry out landscaping and beautification in the urban economy have no incentive to develop and optimize the cost structure, since they work on budget financing and the profit of the organization itself does not depend on the economic effect. The problem is aggravated by the fact that, as shown by studies on these works, a low level of mechanical-to-weight ratio (does not exceed 12%). It is to eliminate these shortcomings at the enterprises of the industry that it becomes necessary to include in the practice of production activities the methodology for the development of landscaping and landscaping projects in accordance with environmental aspects, including not only programs for the design of architectural and building structures and decisions on the choice of elements of landscape design ArchiCAD, but also optimization programs. calculation of POS and PPR for landscaping and improvement objects. [4] In such enterprises, in the planning and design of landscaping and landscaping facilities, software systems are used aimed at visualizing the design decisions already made, and not at calculating the indicators, depending on which these decisions are made, which significantly complicates the calculation of the economic indicators of the project, since it has to be produced not automated. The software systems used in the design of landscaping and landscaping objects are divided into: drawing programs (AutoCAD, ArchiCAD, etc.); programs for 3D visualization of landscape design (Realtime-Landscaping Architect, Our Garden Crystal, etc.); Challenges of the digital economy: results and new trends 85 programs for 3D modeling and graphics (Photoshop, Google, SketchUp, CorelDrow, 3D MAX) [3]. In addition to software systems aimed at visualization, software systems are also used to optimize the activities of enterprises for the general calculation of optimization through mathematical algorithms (for example, the simplex method), but such calculations require the development of an economic and mathematical model that includes a rather extensive system of restrictions. Because of the difficulties that arise, the overwhelming majority of enterprises abandon the optimization calculation, which casts doubt on the rationality of the chosen design solution and entails significant economic costs. That is why there is a need to develop specialized software systems for the optimization calculation of such economically important parameters as the cost and labor intensity of work, this will provide enterprises with a tool for the prompt selection of a design solution and help advance the digital economy in the urban sector.

LITERATURE

1. Angelidou M, Artemis P, Nicos K, Christina K, Tsarchopoulos P, Anastasia P. Enhancing sustainable urban development through smart city applications. J Sci Technol Policy Manag. 2017;9:1–25.

2. Belanche D, Casaló L, Orús C. City attachment and use of urban services: benefits for smart cities. Cities. 2016;50:75–81.

3. Сергеева Н.Д., Цыганков В.В. Методология организационно технологической подготовки на объектах примагистрального шумозащитного озеленения: Монография – Брянск, БГИТУ, 2018 – 146 с.

4. Голотина И.А., Сергеева Н.Д. К вопросу развития методологии проектирования объектов благоустройства в городском хозяйстве // «Инновации в строительстве – 2018»: материалы международной научнопрактической конференции (Брянск, 22-24 нояб. 2018 г.)/ Брян. гос. инженер.- технол. ун-т; Брянск - 2018. С.170-173.

5. Голотина И.А., Сергеева Н.Д. К вопросу совершенствования производственной деятельности предприятий городского хозяйства города Брянска // Международный студенческий строительный форум -2018 Белгород – 2018 г.

6. Ландшафтная архитектура и зеленое строительство. [Электронный ресурс] // Режим доступа: URL: http://landscape.totalarch.com/node/12 (дата обращения на 12.03.2019).

7. Кривопуск Т.А., Скок А.В. Современные способы формирования зон экологического комфорта в условиях уплотненной застройки // Актуальные вопросы техники, науки, технологий: сборник научных трудов национальной конференции / Под общ. ред. Е.Г. Цубловой. – 2019. – С. 55-57.

TSUE International Online Conference
“Sustainable agricultural development and regional cooperation for inclusive growth in Central Asia”
20 - 22 October 2020

Application of digital system in food safety chain management in Uzbekistan: a preliminary evaluation

M. Sartoni*, S.Hasanov **, L.Cianti*, A. Guidi *******

***Department of Veterinary Science, University of Pisa, Italy martina.sartoni@vet.unipi.it**
*****UslToscanacentro, Calenzano, Italy luca.cianti@uslcentro.toscana.it**
*******Department of Veterinary Science, University of Pisa, Italy alessandra.guidi@unipi.it (corresponding author)**

Summary

It is estimated that augmented food demand and international trade will result in the increase of food borne diseases with a rebound of important challenges for the global food safety, especially in Regions where the agrifood system is expected to significantly grow. In Central Asia agricultural and food production expanded rapidly over the last decades and in Uzbekistan the expected enrichment of population will result in a higher food quality food demand. Innovation could face the biggest challenges of the food sector and digital technologies could help in finding solution to overcome problems related to food safety. In this work the application of innovative food safety management system in Uzbekistan is analysed. Results show how innovation and digital technologies could be helpful in addressing and solving problems related to food safety and sustainability as well as competitiveness in international market.

1. Introduction and research questions

It is estimated that that global population reaches nearly 9 billion by the year 2050 requiring up to 70% more food and sustainable production chains. This means that the need for making food chains efficient and effective has never been greater. It is also estimated that the augmented demand for food and the augmented international trade will result in the increase of food borne diseases. In this context, the global food safety has to face other significant challenges too, including climate changes, emerging and reemerging pathogens and toxic contaminants together with the speed in the spread of illness due to the globalization on one side, and the rise of aging, risks related to specific groups of population (children, pregnant women, older, people with a weakened immune system) on the other. According to the WHO data, globally, billions of people are at risk of foodborne diseases (FBDs) and millions fall ill every year, with two millions deaths, especially children. And even if FBDs are more critical in developing countries, food safety has become a shared concern among both developed and developing countries. Beyond the health level, food safety and food borne diseases negatively impact on the economic development of a country, mainly challenging agriculture and food industries but also tourism where, nowadays, food has became one of the major drivers. [1]

In Central Asia (CA) agriculture plays a crucial role for the Countries economy, still accounting for a large share of employment and a high percentage of the population lives in rural areas (49% Uzbekistan, 73% Tajikistan, 64 % Tajikistan, World Bank data). In Uzbekistan, population expecting enrich 35 million at 2022, and to meet a demand for high-quality protein among consumers the economic policy of the country is ensuring focusing on food security and safety. According with the Regional Overview of Food Security and Nutrition in Europe and Central Asia (ECA) 2018, agricultural and food production expanded rapidly over the last decades, with the highest increase observed right in CA. As a result of the regional economic growth, poverty levels are declined; however, in rural and remote areas, disadvantaged groups and populations are still facing food insecurity, and policies and institutional systems should be carefully designed to assure social security, healthcare and education. In the framework of the European Union and the Eurasian Economic Union, strategic documents and policy action plans related to food security and nutrition have developed, covering various socioeconomic aspects such as rural development, agricultural production, social protection, market regulation, and sustainable natural resource management. Countries are also taking steps on the national level to implement international and regional agendas on improving policy areas related to food security and nutrition via adopting various policy frameworks, strategies and resolutions. Kyrgyzstan and Tajikistan adopted measures to improve food availability by supporting agricultural production. Kazakhstan promoted healthy diets among the population, Turkmenistan and Uzbekistan implemented measures to improve food security through improved coordination of agrifood value chains. [2]

In this context, food safety pays a central role in the food security objectives, as interrelated concepts with a profound impact on public health but also on the economic development of CA Countries.

Producers' access to the global market depend on their capacity to meet the national legislative requirements or international standards for export, while food safety incidents have a big impact on trade and on consumers' confidence at national and international level, as a local problem can become an international emergency due to the globalized trade.

Moreover the global food sector operates in an environment where policies, standards, regulations, guidelines, education and news relating to food, especially those related to the safety and unsafety of food, are continuously being either developed or updated. This situation adds confusion and complexity if there is a lack of specific knowledge, education and training on this subject, if the production is not harmonized and the consumers are not informed and aware about food safety issues.

At the same time, the food industry is currently and globally affected by what is called the fourth industrial revolution, which through a techno-combination of automation, information, connection and programming is changing the paradigm through a digital transformation destined to upset the manufacturing sector. [3]

Innovation could face the biggest challenges of the food sector, from the growing food demand to the environmental and commercial sustainability, from regulatory constraints to the recent Covid19 pandemic. In this scenario, the use of digital technologies, known as "Food Tech", could help in finding solution to overcome problems related to food safety and to apply food safety management achieving in a shorter time the goals set for the agrifood sector in this raising economies countries.

The aim of this work is to analyze digital and innovative solutions designed to set up and manage food safety system and their applicability in fast developing countries with high potential for food production like Uzbekistan. In order to be productive, sustainable but at the same time, to gain competitiveness on the market, it is desirable for the sector and for the Country, to put in place strategies aiming to addressing and overcoming these challenges.

2. Data and methods

In the studio were included systems related to food safety management, based on digital technologies. One of this is applied for the implementation of a computerized development and management of food safety, based this on the HACCP methodology as well as the systems of Quality or Certification, improving data sharing within the company, and projected into dematerialization. Meanwhile other considerations and deepening on new wearable technology such as smart glasses were carried in order to estimate benefits of the use of these devices.

The first digital system, Safeaty Content Management (SCM), has been developed by a Spinoff of the University of Pisa[4], in its activity of technology transfer and open innovation where IT and food safety specialists worked in a multidisciplinary perspective; SCM has been thought and developed to be capable of realizing and managing Food Safety plans remotely and interactively, drastically reducing the use of paper and easing the dialogue with Official Control, all in the light of Industry 4.0. SCM slows to set up, implement and manage the Food Safety Plan and the documentation related to self-control, aligned with current legislation, in accordance with the provisions of the EU legislation on the simplification of the application of the HACCP system. The solution is based on the prerequisite system [5] and on the ISO 22000 managing all the information deriving from the self-control plan, and subject to official control. In addition, the software can be integrated with existing remote temperature or other parameter detection systems as well as with the Internet of Things for the detection of the same. SCM is currently experimentally implemented in some food industries in different countries in the EU, including food business operators (FBOs) different in size, type and logistic distribution, and has provoked huge interest. This system overcomes the problem on the traditional implementation of HACCP methodology with his nature of being a customizable and user friendly solution, able to provide a continuous and real-time monitoring and feedback, from production to distribution on various contents: maintenance of the cold chain, on the compliance status of a company with respect to planned tasks, continuous and centralized view of the outcomes of those performed an many more, helping in this way to maintain or to strength all the process food related . [6] On the other side. a deepening on new wearable devices was carried, as new smart glasses will probably quite soon provide an answer for the global manufacturers controls and auditing system, allowing to share through audio-video feed from an office in another part of the world the surrounding scenery, all through augmented reality. The remote operator is able to see exactly what the person on site sees, and then quickly provide feedback during the audio/video streaming and receiving the photos and videos that can been taken during the audit. The collected material can be saved in a cloud, thus allowing it to be shared and viewed both in real time as well as later on. Once again, this technology allows shorter reaction times in solving non-conformity issues and eliminates most of the additional, non-value paper administration.

3. Main results

Although there is currently an increasing investment into research and development in Uzbekistan’s food processing sector, there is a great deal of potential. The Country has a pool of qualified graduates and resources that could be potentially involved in food supply chain and and food security field [7]. New resources should be trained to spread knowledge and taking advantage of multidisciplinary skills and innovative methods, also with the help and support of external sources as experts who could provide additional value and increase the exchange of competences for those occupied in the food sector, regardingfood regulation, food processing, food certification and trade

In effect, nowadays in addition to official regulation, quality standards and certification are more and more used and required in and between food trade to ensure and guarantee that organization or the products comply specific conditions While agro firms are supposed to ensure that the exported produce meets the phytosanitary requirements of Russia and, for some products, the EU, much more work is needed. Food processors highly dependent on the quality of the produce, will have to work directly with agro firms and farmers in order to ensure adequate supplies of high quality produce [8]. For this reason, international quality standards, such as ISO, are slowly spreading throughout the country, even if so far, though, only a few companies have obtained certification. The use of systems and tech solution that have the possibility to be integrated end extended, and set up individually due to scalable, flexible and customized settings, becomes in this context very interesting. Safeaty Content Management has in his setting tools, the possibility to implement and manage a Food Safety Plan integrated with all the common certification contents as BRC, IFS, ISO 22000. This will also help to overcome the extensive complexity of today’s globalization of food production chains and limitations arising from manual insertion and data processing of products information making at the same time easier for authorities, stakeholders and consumers the possibility of being informed in real- time. These obstacles could be overcome, and the current level of technology and low implementation costs allow full automation of this process.

Regarding auditing, the process of conducting evaluations remotely is a relative novelty, since some organizations are already adopting this technique. Some organization involved in the food field all around the world and others, occupied also others field, have already adopted remote management. By the way, some of them have been doing it for quite some time, but for others, it’s pretty new.

Remote auditing and remote food safety management, are some example of food-related activities that could be carried in this new manner; This innovative method consists of evaluations carried by electronic methods such as a video conference, a phone call or a smart device talk to obtain evidence just like during an on-site audit. The use of remote auditing technique provides a springboard for tools such as file and screen sharing, real time record keeping, and live data analysis. This offers the advantage of having a qualified person available and helpful in the support during the audit itself and also for the training of auditing technique; it would also be facilitated by exploiting the innate “digital natives“ generational skills. In Country where this technique is not commonly known or performed, the possibility of a continuative “assistant director help“ that gives training, support, and advise could be very significant, in reaching a good level of performance and use of the technique in a short- mid term.

4. Discussion

The field of food safety, food consultancy, food regulation is evolving, just like the field of technology. Uzbekistan is evolving too, as in the past almost 30 years, the country has managed to gradually move away from cotton monoculture towards a more diversified palette of agricultural and food production [9]. Expanding the cultivated area and increasing yields made Uzbekistan almost completely self-sufficient in all locally sourced basic food products, and an exporter of certain grains. FAO global sustainability goals also will be incorporated in the planned comprehensive Agricultural Development Strategy, supported by FAO [10]. The strategy should shape the structural, institutional and technological transformation of the sector for the coming 10–15 years. FAO promotes further improvement of the agriculture and food sector and will assist Uzbekistan in introducing an international system that ensures the quality and safety of primary and processed agrifood products for both the domestic and foreign markets. Pilot projects for value chain development in selected areas, training in sustainable agricultural production methods, and the gradual introduction of modern technologies should strengthen rural livelihood. Within this background, the implementation and use of types of solution tech related fits in the goal and the strategy program defined also by FAO [11].

Since independence, the Country has made many efforts to develop agriculture and to improve the safety and quality of production. For this reason, as a result of the measures taken over the past 10 years, in 2015 Uzbekistan became one of the 14 countries that received awards of the Food and agriculture organization of the United Nations for achieving the Millennium development Goals in the field of food security. [12].

But a new round of development of legislation in the field of food security, with a greater attention toward food safety, began with the arrival of the new leadership of the country in 2016, which has established within "the 5-year development strategy for the period 2017-2021" the need for the development of socio-economic scenarios and plans for the long-term development of the agricultural sector and the health care system, investment in scientific and technological progress in this field and the strengthening of links between industry, agriculture and health [13]. The Agricultural Development strategy for 2020-2030 was adopted in October 2019, which contains further transformative reforms in the sector. According the state procurement program was removed from cotton production, while it will eliminate the use of forced labor from the cotton industry in country. The strategies are not only aimed to increase the agricultural crop productivity but also to create new jobs in rural areas, to improve food and nutrition security and to develop internal and external market accessibility in the country [15]. This renewed policy toward further improvement and modernization of the food systems aligns perfectly with application of new technologies with the aim oft he creation of a more inclusive, smart and efficient agrifood systems.

The potential and advantages associated with the application of the systems subject of this study in a country like Uzbekistan are manifold. These include the possibility of covering extensive territories and reaching distant or difficult to reach places, saving economic resources, but ensuring in this way the coverage of large areas and the immediate achievement of great distances which in a territory such as Uzbekistan can represent limiting factors. Another advantage is that the implementation would also make it possible to obviate the current lack of internal resources trained in this specific field. Moreover, in regard to the types of companies that could be involved in the use of the systems, the EU experience that is actually on field, already includes and with significant results, the application in diversified sized organizations inside Member States. Since that, the ductility of the systems allows their application across the board in different types of companies in the food sector as multinationals corporations, small and medium-sized enterprises (SMEs), but also micro-enterprises and traditional realities. Related to that, it would be interesting to test in Uzbekistan and CA territory this model, as inside these areas there is an heterogeneous pattern of production realities.

The horizontal implementation of smart systems and food tech, would also allow, thanks to the rapid flow of information , to conduct a mapping on the current status of organizations, carried out with objective and standardized criteria; this would also give a chance to Institution and authorities to get a picture of the active realities in the Country, and to simplify, strengthen and speed up the dialogue between parts [14].

In addition, that this is just a close future, it is shown also by the point of view of Official Control; we can speak of legislation 4.0 with the new EU Regulation 625/2017, aimed at harmonizing the official controls of the agrifood chain, in force since 14th of December 2019 [16]. The Regulation makes precise reference to the use of IT systems for collection, management and processing of data deriving from the control, hoping for the creation of new ones and integration with existing ones, both at national and community level, for the purpose of a more targeted programming and a reduction of the environmental impact linked to the progressive abandonment of the paper.

In the era, the future of auditing and management lies in specialization and the use of technology to make the operator' role less intrusive and more cost-effective and in finding better utilizations for the enormous amount of data collected. This is why it is reasonable that we will assist soon at the reorganization of the auditing and management tools with the common aim to consolidate the existing control practices, making them stronger and more tailored to the context, while also optimizing the costs and resources [17].

5. Conclusions

Uzbekistan possesses high potential for production increase of environmentally safe horticultural and livestock products, to strengthen the food safety requirement and their promotion to the world market [7]. By the strategy of actions in five priority directions of the Republic of Uzbekistan development in 2017-2021 the measures on intensive development and modernization of agriculture and processing industry of the country, their innovative development were defined and are directed at the agrarian sector development, food security of the country strengthening, export potential increase and population standards of living rising, keeping at the same time the traditional customs and traditions and the knowledge proper of the Country [18]. Those who think that innovation cannot coexist with the "traditionality" of the productions are wrong, on the contrary, innovation could be a valid support. As for the future, Covid19 pandemic has forced us to become more technological and to change our work models, speeding up processes that in normal times would have been much longer [19]. Surely the food sector will also be able to make the most of this leap forward, managing to find the right balance between tradition and innovation. This requires persistent work on all measures fulfillment provided by the strategy. Informatization, digitalization, mechanization are required, as these could help and provide massive benefits in the implementation and management of activities related to the food supply chain. We believe that progress cannot be stopped; man has always tried to find better and more effective solutions to do his job. Just think of accounting, before there were accounting books, pen and paper were used, today everyone relies on information technology and no one would call avant-garde one of the many management systems on the market. Systems described in the studio were born from the desire to overcome some problems, and designed to make a food safety management plan simpler and at the same time more effective and economical; perhaps, at the moment, we can speak of avant-garde, but in the future these probably will become normal.

6. References

1. http://www.fao.org/publications/card/en/c/CA7153EN/
2. https://www.adb.org/sites/default/files/publication549916/agriculture- development-carec-countries.pdf
3. http://uis.unesco.org/sites/default/files/documents/higher-education-in-asia-expanding-out-expanding-up-2014-en.pdf
4. L. Pizzi, L. Cianti, L. Tinacci, M. Garniga, A. Guidi (2019) Gestione della sicurezza

alimentare 4.0 italian Journal of Food Safety, 7, 1S, 19.

5. Commission Notice 2016/C 278/01 on the implementation of food safety management systems covering prerequisite programs (PRPs) and procedures based on the HACCP principles, including the facilitation/flexibility of the implementation in certain food businesse

6. European Commission. DG(SANTE) 2015-7752 – MR. Food Veterinary Office, 2015, final overview report - report on the state of implementation of haccp in the eu and areas for improvement

7. UNDP Investment Guide to The Food Processing Sector in Uzbekistan (2009), Investment Guide to Uzbekistan 2009, Tashkent

8. V. I. Nabokov, and K. V. Nekrasov, “Innovation activity management of AIC organizations under modern conditions,” Agri-food policy of Russia, №1, pp. 30– 32, 2017.

9. Yuldashev, Nuritdin & Nabokov, Vladimir & Nekrasov, Konstantin & Tursunov, Bobir. (2019). Innovative development of Uzbekistan agroindustrial complex. 10.2991/ispc-19.2019.75.

10. http://www.fao.org/europe/news/detail-news/en/c/1177059/

11. http://www.fao.org/3/I9301EN/i9301en.pdf

12. Decree of the President of the Republic of Uzbekistan on January 23, 2017 "On the Strategy of Actions for the Further Development of the Republic of Uzbekistan." http://www.lex.uz

13. The strategy of actions in five priority directions of development of the Republic of Uzbekistan in 2017-2021. http://strategy.regulation.gov.uz/uz/document/1

14. Changes in the character and competitiveness of Uzbekistan's agrarian foreign trade. By: Ortikov, Akhmadjon. Conference: 26th International Scientific Conference on Agrarian Perspectives - Competitiveness of European Agriculture and Food Sectors Location: Czech Univ Life Sci, Fac Econ & Management, Prague, Czech Republic Date: Sep 13-15, 2017. Agrarian Perspectives Xxvi: Competitiveness Of European Agriculture And Food SectorS Book Series: Agrarian Perspectives Series Pages: 264-271 Published: 2017

15. S. F. Ryan, N. L. Adamson, and A. Aktipis, “The role of citizen science in addressing grand challenges in food and agriculture research,” Proceedings of the royal society b-biological sciences vol. 285 issue 1891 Article Number 20181977 Published: NOV 21, 2018.

16. Regulation (EU) 2017/625 of the European Parliament and of the Council of 15 March 2017 on official controls and other official activities performed to ensure the application of food and feed law, rules on animal health and welfare, plant health and plant protection products,

17. https://fpsc-anz.com/wp-content/uploads/2020/08/FPSC-2025-Innovation- Agenda-Review-of-the-Audit-Process-Report-for-Public-Release.pdf

18. Djanibekov, Utkur; Finger, Robert Agricultural risks and farm land consolidation process in transition countries: The case of cotton production in Uzbekistan.(2018): AGRICULTURAL SYSTEMS vol. 164, pp. 223-235

19. Sartoni M and Guidi A. Food Industry 4.0 and The Challenges of Food Safety in Italy in Covid-19 Pandemic Era.2020, Austin Food Sci; 5(2): 1040

TSUE International Online Conference
“Sustainable agricultural development and regional cooperation for inclusive growth in Central Asia”
20 - 22 October 2020

Priority areas for digital development of agricultural organizations

Olga A. Rodionova*, Tamara G. Evsyukova**

* 15 Orenburgskaya str., 111621 Moscow, Russia, olanrod@mail.ru
**15 Orenburgskaya str., 111621 Moscow, Russia, 8309219@gmail.com

Summary

The pandemic crisis is a catalyst for structural changes in the chain of promotion of goods, works and services, and digital tools act as promotion mechanisms. Depending on the industry specifics, the use of one or another tool is expressed to varying degrees. One of the methodological approaches that can be applied to assess the development of digital components (tools) is the method of paired comparisons. The research was based on the results of a survey of Russian agricultural organizations. Priority areas are identified and presented as an inverted pyramid, reflecting broad coverage and bottlenecks. The prospects for the development of digital tools in the agriculture of the Russian economy echoes global trends.

1 Research questions

Digital transformation - as the process and state of the economy is developing in a crisis, and at a rapid pace, the acceleration of which is external in nature, associated with the coronavirus pandemic. The pandemic crisis is a catalyst for structural changes in the chain of promoting goods, works and services; and e-commerce, marketplaces, logistics, and 3D printing act as promotion mechanisms. The determinants of digitalization are the data necessary to form the rules of conduct for business entities. Russian state project "Digital Agriculture" specifies such indicators as the share of resources in BigData; share of Smart contracts with subsidy recipients; share of investments in digital technologies (Digital Technologies). The above indicators are absent in the official statistical and financial statements. Information on their quantitative characteristics can be obtained only on the basis of questionnaire results or online surveys, as well as from publications that highlight the experience of introducing digital technologies or their individual tools.

Leading consulting agencies have proposed methods for assessing the digital maturity of organizations. Some investigate both the degree of use of digital tools in production or operational activities, and in business processes, management decisions. In this case, the basic information for the assessment is a survey of enterprises (PWC 2018).

There are various approaches to the typification of digital economy instruments (J’son&Partners Consulting 2019; PWC 2018). The most significant of them that are characteristic of digital transformation are the following:

- artificial intelligence (advanced computing systems and artificial mind);
- blockchain ("Smart" technologies of network interaction);
- machine learning;
- Industrial Internet of Things (voice interface, face recognition);
- robots (cloud computing, promising sensors);
- unmanned vehicles (remote controlled operations, smart cars);
- computer vision (industrial visualization).

The previous study by the authors of this paper focused on the digital economy development in agricultural organizations of one of the central regions of Russia. It provided the basis for further research, namely, determining the priority areas for the development of digital tools.

2 Data and methods

One of the methodological approaches that can be applied to assess the development of digital components (tools) is the method of paired comparisons. It is based on the construction of a matrix in the form of a table, consisting of compared digital components, the numerical values of which are determined at the intersection of lines horizontally and vertically. The algorithm for settlement operations includes several stages.

At the first stage, a numerical value is selected, which is determined based on the following rule. Each cell of the matrix is filled with one of the values, namely: "0", "1", "2". The choice is made on the basis of comparison by quantitative or expert criteria. First, if an element is compared with itself, then "1" is assigned. The value "2" is given to the component (element) that has the highest quantitative or qualitative value in relation to the one with which it is compared. Therefore, the compared component is assigned the value "0".

At the second stage, the total values of the rows are summed horizontally, i.e. the weight of each element and the total sum of the weight values are determined.

The third and final step involves calculating the weights of each component in order to convert it to points. To do this, the individual value of each component is correlated with the total value and multiplied by 100 percent.

To assess the use of digital tools, the digital development of the surveyed agricultural organizations is diagnosed. The study recruited 45 agricultural organizations. Data on the use of digital tools in the enterprise were presented via a questionnaire. After determining the number of respondents-enterprises for which one or another element is used in economic activity, each component was compared with each other with the assignment of the corresponding value according to the method of paired comparisons. The value "2" is given to the component (element) of digital technology, which is more often used by agricultural organizations, in relation to the one with which it is compared. The result is a matrix (Table 1)

Table 1 - Matrix for digital tools implementation

	IoT	AI	EoSM	GPS	BT	BD
IoT	1	2	2	0	2	2
AI	0	1	2	0	2	2
EoSM	0	0	1	0	2	2
GPS	2	2	2	1	2	2
BT	0	0	0	0	1	2
BD	0	0	0	0	0	1

Source: authors' calculations

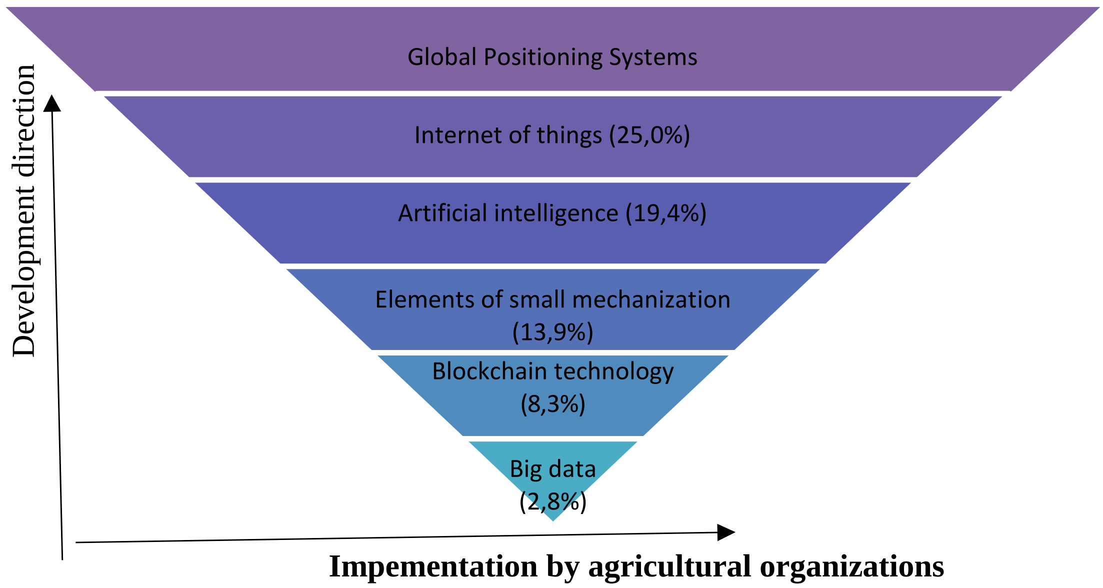
By summing the row values horizontally, the weight of each element and the total sum of the weight values were determined.

For example, the value of artificial intelligence is 7, the total amount is 36, therefore, its score will be 7/36 * 100 = 19.4. Thus, the score for each digital component is determined.

3 Main results

In the end, the priority areas of digital development of agricultural organizations were identified. The level of qualitative characteristics of digital tools is presented in the form of an inverted pyramid, where the least implemented digitalization tool is below (figure 2).

Thus, GPS and the Internet of Things are identified as a priority area for the development of digital tools for agricultural organizations, the average degree of development is estimated for artificial intelligence and elements of small mechanization. Today, digital tools such as big data and blockchain technologies are least used. The lack of demand for the latter is explained by the high cost of implementation and maintenance, the need for additional equipment and staff training, and the lack of access to data. The blockchain system has a number of obstacles, and the most serious of them are identification and intellectual property rights.



Source: authors' calculations

Figure 2 - Priority areas for digital development of agricultural organizations

The prospects for the development of digital tools in the agriculture of the Russian economy echoes global trends. So, Chinese economists highlight the need for an Information collection system of the whole agricultural industry chain, agricultural intelligent equipment research and application, Big data service and cloud platform (CAO, LI. 2020). Further development of machine learning and artificial intelligence and its application is possible in economic forecasting (Munisamy, Batarseh 2020).

The slow development of the Internet of Things in the Russian economy is explained by a wary attitude due to national and cultural traditions. New technologies require quick management decisions, flexibility and trust in process automation.

4 References

20. J’son & Partners Consulting (2019). Russian market of machine-to-machine communications and the Internet of Things, *Report*,

21. <https://json.tv/ict_telecom_analytics_view/rossiyskiy-rynok-mejmashinnyh-kommunikatsiy-i-interneta-veschey-po-itogam-2019-goda-prognoz-do-2025-goda-20200717045903>

22. CAO, F. and LI, X. (2020). How can digitalization contribute to improving sustainability of Chinese food system?, paper presented at the IAMO FORUM 2020 held in Halle 24-26.06.2020

23. Munisamy, G., Batarseh. F. (2020) Applications of Machine Learning and Artificial Intelligence to Economic Forecasting, paper presented at the IAMO FORUM 2020 held in Halle 24-26.06.2020

24. PWC (2018). Digital champions. https://www.pwc.ru/ru/iot/digital-champions.pdf

TSUE International Online Conference
“Sustainable agricultural development and regional cooperation for inclusive growth in Central Asia”
20 - 22 October 2020

Digital technologies: concept and prospects of effective usage in agriculture

Kholikova Rukhsora Sanjarovna

PhD researcher, Tashkent State University of Economics. rxoliqova@bk.ru

Abstract*:* This article reveals the concept and essence of implementation and development of digital technologies in agricultural sphere, considers its impact on the agriculture: to feed a growing population, to meet the demand for quality of food products and services, on improving the efficiency and profitability of agriculture.

Keywords*:* digitalization, information technology, agriculture, digital economy.

1. Introduction

Currently, the introduction of the digital economy in the Republic of Uzbekistan is a serious driver of effective growth for the economy. Our country's high intellectual potential, well-developed telecommunications infrastructure, efficiently operating high-tech enterprises form the necessary environment for the introduction and further development of an innovative economy.

In this regard, digital transformation is one of the main trends in the innovative economy. Advanced countries have already developed a number of tools to get away from the trivial methods of doing business and public administration, and are successfully using them in practice. The relevance of the chosen topic is due to the fact that the Republic of Uzbekistan is only embarking on the path of creating the economy of the future, and therefore the term “digital economy” may not be fully understood. The starting point for the development of the digital economy in our republic can be considered the Speech of the President of the Republic of Uzbekistan Sh.M. Mirziyoyev in his message to the Oliy Majlis “... 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” [1].

The easiest way for digital transformation is in the high-tech industries associated with the development and distribution of software. In addition, the financial sector and the service sector are rapidly modernizing. Among industrial enterprises, noticeable progress is seen in the chemical industry, mechanical engineering. Almost all industries are inevitably involved in the global digitalization process [2].

The modern economy is post-industrial, and it is often called the new, innovative, economy of knowledge, competencies, network interaction. It should be noted that this series of definitions, on the one hand, has different meanings, and on the other hand, characterizes the same period of economic activity. The combination of two industries - the agro-industrial complex (AIC) and software development (software) - opens up great opportunities for Uzbekistan.

As it is considered, agriculture is not attractive because of the long production cycle, which was exposed to natural risks and large crop losses during cultivation, harvesting and storage, the inability to automate biological processes and the lack of progress in increasing productivity. and innovation. The use of information technology in agriculture was limited to the use of computers and software, mainly for financial management and business tracking. Not so long ago, farmers began to use digital technology to monitor crops, livestock and various elements of the agricultural process.

Technologies developed, and a sharp leap in attention to the segment occurred when technology companies turned their attention to agriculture, which, together with partners, learned to control the full cycle of crop production or livestock production using smart devices that transmit and process the current parameters of each of them, the object and its environment (equipment and sensors that measure the parameters of soil, plants, microclimate, animal characteristics, etc.), as well as unhindered communication channels between them and external partners. By combining objects into a single network, exchanging and managing data based on the Internet of things, increasing computer performance, developing software and cloud platforms, it became possible to automate the maximum number of agricultural processes by creating a virtual (digital) model of the entire production cycle and creating interconnected chain links, as well as with mathematical precision, plan a work schedule, take emergency measures to prevent losses in case of fixed the risks, calculate the possible yield, production costs and profits.

2. Main section

“Goldman Sachs predicts that next-generation technology can increase global agricultural productivity by 70% by 2050.”[3]

Agriculture is on the verge of the Second Green Revolution. Experts estimate that thanks to precision farming technologies based on the Internet of things, a surge in yields of a scale that mankind has not seen even at the time of the advent of tractors, the invention of herbicides and genetically modified seeds.

The world's population is growing. In 30 years, humanity will need 1.7 times more food than it produces now. For this purpose it is necessary to modernize agriculture seriously.

According to UN forecasts, the world population by 2050 will reach 9.8 billion people, to feed it, it is necessary to increase food production by 70% [4].

This means that farmers must change the production processes, make them as efficient as possible. The technologies have evolved, became cheaper and have advanced to such a level that for the first time in the history of the industry it has become possible to obtain data on each agricultural object and its environment, mathematically accurately calculate the algorithm of actions and predict the result.

The industry, which was the farthest from IT, began to receive data. And with them inquiries for vacancies of specialists in the field of Big Data, Data Science, mathematics, analytics, robotics.

Digitalization and automation of the maximum number of agricultural processes is included as a conscious need for a development strategy for the largest agro-industrial and engineering companies in the world.

By 2010, there were no more than 20 high-tech agricultural companies in the world, and for the period 2013-2016. Investors have already invested more than 1,300 new technology startups totaling more than $ 11 billion in 4 years. A new investment segment, AgroTech (Agrotech), was formed, which in 2014 overtook FinTech (Fintech). Moreover, Canada, India, China, and Israel are also notably active [5].

A long value chain of agricultural products and a large number of unresolved problems in the industry that can be solved using IT and automation is one of the main reasons for the investment attractiveness of the industry.

Nowadays elements and modern IT instruments in agriculture are [6]:

- SMT: GPS / Glonass trackers, fuel sensors
- Animal Activity Sensors / Boluses
- Personal Identifiers (RFID Cards, IButton)
- Parallel driving systems
- Precision farming systems
- UAV / Drones
- Smart weather stations
- Weight measuring instruments
- IP cameras
- Smartphones / Tablets
- Animal milking systems
- ERP systems

The concept and essence of the digital technologies in agriculture.

The standard processing schedule (continuous irrigation, fertilizer, chemicalization) do not take into account local characteristics and natural variability and lead to an ineffective result - over- use of resources or undetected problems. Drought or excess moisture, lack or excess of fertilizer, weeds and insects require immediate intervention. An outbreak of the disease may occur unexpectedly and it is not always easy to determine its cause; with late detection and mistreatment, the disease can destroy part of the crop.

During the season, the farmer has to make more than 40 different decisions: what seeds to plant, when to plant, how to treat them, how to treat a diseased plant, etc., how to cope with situations threatening the well-being of the field. The lack of information for decision making leads to the fact that in the process of planting, growing, caring for crops up to 40% of the crop is lost. During harvesting, storage and transportation another 40% is lost. Moreover, as scientists have revealed, besides the weather, 2/3 of the loss factors can be controlled today using automated control systems (Hi-Tech Management) [5].

The task of IT is to maximize automation of all stages of the production cycle to reduce losses, increase business productivity, and optimize resource management. But even in this case, the result applies only to plants ready for harvesting or animals, but does not guarantee profit, because the crop still needs to be collected, stored, carried out primary processing and transported to the buyer / consumer. Further automation represents a higher level of digital integration, which affects the most complex organizational changes in the business, but their implementation can dramatically affect the profit and competitiveness of products and the company as a whole. Integration of the received data with various intelligent IT applications that process them in real time realizes a revolutionary shift in decision-making for the farmer, providing the results of the analysis of multiple factors and the rationale for subsequent actions. Moreover, the more sensors, sensors and field controllers are connected to a single network and exchange data, the more intelligent the information system becomes and the more useful information it can provide to the user.

According to experts in the Uzbekistan, the general level of automation and informatization of agricultural enterprises is not satisfactorily developed.

Even the elementary supply of farms with the simplest information technologies - a computer with access to the global information network "Internet" today is an overwhelming problem for Uzbek farms. Meanwhile, based on statistics, we can observe the following picture of the use of information technology in agriculture around the world (see table. 1).

Table 1.

Number of farmers using the information technologies (Data for 2018)

Country	**Number of farms**	**Number of farmers using computers**		**Number of farmers using internet**	
		number	**%**	**number**	**%**
Norway	70 000	52 000	74.3	40 000	57.1
Denmark	60 000	48 000	80	30 000	50
Finland	80 000	50 000	62.5	40 000	50
Netherland	100 000	60 000	60	50 000	50
Switzerland	30 000	24 000	80	14 000	46.7
Great Britain	80 000	60 000	75	30 000	37.5
Germany	170 000	75 000	44.1	55 000	32.4
Japan	426 000	144 000	33.8	52 000	12.2
Spain	100 000	45 000	45	10 000	10
France	330 000	110 000	33.3	25 000	7.5
Italy	260 000	80 000	30.8	10 000	3.8
Poland	200 000	100 000	50	5 000	2.5
Czech	175 000	30 000	17.1	4 000	2.3
Russia	275 000	9 000	3.3	3 000	1.1

Source: Чибисова И.С. Применение информационных технологий в сельском хозяйстве России.// Эпоха науки № 13 – Март 2018 г. Технические науки

The Table 1. shows that the most intensive use of information technology occurs in the European Union. At the same time, the use of computers for communication with the global

Internet rarely exceeds 50%. Many of the farmers work to provide food for themselves and their loved ones, and do not consider it necessary to increase the informatization and automation of their farms. But recently in the sphere of agro-industrial complex huge efforts on introduction of information technologies are made. First of all it concerns programs of optimization of placement of agricultural crops in zonal systems of crop rotation and rations of feeding of animals. Applied computer programs on calculation of doses of fertilizers, regulation of a mode of food of plants in greenhouses, and also on management of technological processes in processing and storage of meat and meat products are developed. There are programs for the complex of land management.

Currently, the Republic of Uzbekistan occupies the 76th place in the world in the development of the digital economy based on the BCG rating. The calculation of the BCG digitalization index is based on the growth dynamics of online spending and user activity. However, like most indices, the BCG digitalization index is a statistical indicator that has a share of conventionality [8].

3. Conclusion

The agro-industrial complex (AIC) is the most important intersectoral complex. It was created to provide the population with food and is one of the main priorities of the economy. AIC is a complex bioeconomic production system. Its central link is agricultural production, the main resources of which, along with tools and labor resources, are land, climate, weather, which together constitute a bioclimatic potential.

In the world of digital technology, innovative technologies for effective management should be introduced in all spheres of life. New challenges in agriculture: to feed the growing world population, to satisfy the demand for high-quality food products and services are no less acute problems of increasing labor efficiency, profitability of the agricultural enterprise. To conclude:

1. The digital economy has enormous potential for promoting economic development in all areas, as well as in agriculture.
2. The Internet significantly activates the existing markets for goods, services and labor, as well as the principles of the functioning of the agricultural sector.
3. Directions for further research are seen in the development of proposals to address the problems of digital transformation of the agro sector, in the development of a system for ensuring digital economic security.
4. For these purposes, the republic should work on the creation of technology parks, research and production clusters and other innovative projects, the widespread and accessible training of farmers of digital literacy, the introduction of digital technologies, ensuring the coverage of the country`s rural area with the Internet with a network of 5G or higher, and the introduction of electronic management in the activities of farms.

All these measures will require huge financial investments from the state, trained specialists to educate employees of farms and the population in the basics of the digital economy. Thus, the Digital Uzbekistan-2030 program is not just another major state project of the country, it is an important aspect of the innovation activity of the Republic of Uzbekistan, the main purpose of which is not only to achieve a high level of development, but also to integrate and interact with developed countries of the world.

References:

1. Speech of the President of the Republic of Uzbekistan Sh.M. Mirziyoyev to Oliy Majlis, dated December 28, 2018 // People’s Word, dated December 29, 2018.
2. Odintsov S.A., Vashchenko A.V. The development of theories of the information society and the concept of "Cyber-space" // Political Mathematical Network Electronic Scientific Journal of the Kuban State Agrarian University. 2016. No. 121. S. 1-14.
3. http://www.goldmansachs.com›worldwide
4. http://www.un.org/en/sections/observances/united-nations-observances

5. http://www.tadviser.ru/index.php
6. http://agrarnyisector.ru
7. Чибисова И.С. Применение информационных технологий в сельском хозяйстве России.// Эпоха науки № 13 – Март 2018 г. Технические науки
8. North D. Institutions // Journal of Economic Perspectives. 2018.No.1.

TSUE International Online Conference
“Sustainable agricultural development and regional cooperation for inclusive growth in Central Asia”
20 - 22 October 2020

Issues of using digital technologies to improve agricultural performance

Z.K. Kusharov (Tashkent State Agrarian University, Uzbekistan)
O.Z. Koraboshev (Tashkent State Agrarian University, Uzbekistan)

Summary

This article examines the use of various software tools in agricultural modernization. It allows digitization of all sectors of the agricultural sector on the basis of software tools. In general, these software tools help to develop the agricultural sector.

Key words: modern information technologies, special software, constant monitoring of the use of special software, automated workstation for agronom.

Since our country gained independence, large-scale reforms have been carried out in the field of agricultural education, as in all spheres. In particular, this requires studying the role of management theory and practice in the education system in the training of management personnel. The result of radical reforms aimed at building a democratic, free society based on a socially oriented market economy largely depends on how activities in this area are organized. This, in turn, shows that in order to achieve goals, interests and aspirations that are manifested in different ways in this direction, it is necessary to rely on the principles of democratization, renewal, modernization and reform of the country, strengthening its economic and political independence.

On February 7, 2017, by the Decree of the President of Uzbekistan, the "Strategy of actions for the further development of the Republic of Uzbekistan for 2017-2021" was approved, the fourth section of which is aimed at increasing the efficiency of education and science: the quality of higher educational institutions based on the implementation of international standards. and improving efficiency was identified as an important challenge. Also, the Decree of the President of the Republic of Uzbekistan dated April 20, 2017 №. 2909 "On measures for the further development of the higher education system" identified the most important tasks for the further improvement and comprehensive development of the higher education system. The first of these tasks is the further improvement of the educational process, curricula and programs of higher education based on the widespread introduction of new pedagogical technologies and teaching methods, a qualitative update of the research and educational process of the magistracy and the introduction of modern organizational forms. If the existing reproductive education in the field of knowledge, skills and competencies formation in the agricultural sector is sufficient, the development of independent learning and creativity skills, the use of various modern software products in solving the problem of managing one's activities will be very effective.

At the same time, the term "Digital economy" is used by politicians, economists, journalists, businessmen and almost all industries around the world. In 2016, the World Bank presented a report on the state of the global digital economy to the world community with a report entitled “Digital Dividends”. In fact, Al-Khorazmi, the great scientist who introduced the number "0" in mathematics, the founder of the concept of "Algorithm", is considered to be the ancestor of modern computers, mobile devices, information and communication technologies and high technologies. Althoughthere are more than 10 interpretations of the term "Digital economy" in the scientific literature to date, it has not yet been identified as a holistic term in science. The basis of these interpretations are: according to them, "Digital economy" is a virtual environment that complements the real being; economic production based on digital technologies; economy based on Internet technologies; new economy; web economics; economics based on the generation of new methods of information processing, storage and transmission, as well as digital computer technology; it is not any other economy that needs to be created from scratch, it means the transition of the existing economy to a new system by creating new technologies, platforms and business models and introducing them into everyday life.

If we look at the state of the digital economy in the country today, today consumers are actively using digital technologies to order food. Various online stores and electronic payment systems are also actively developing. Our entrepreneurs are implementing electronic transactions using digital technologies. But to date, users are making small deals that don’t require large expenditures, and are less prepared to increase purchases and sales. The next task is to develop medium and large economic transactions and financial transactions through digital technologies.

In terms of monetary policy, the digital economy has such terms as its own currency (cryptocurrency, bitcoin), money-saving wallet (blockchain), calculation methods (mining), and detailed work on them and their widespread application is one of the important stages of our time.

Today, the introduction of these digital technologies in developed agricultural countries is growing rapidly in every segment of agribusiness. The reason for this is clear: it is making huge profits by reducing costs based on digital technologies. This is especially noticeable in the case of specific farms. At the same time, digital data-based technologies used to manage and optimize crop production clearly define control, evaluation and management.

In recent years, agricultural producers have been using these technologies more actively. These include: efficiency of use of chemicals, fertilizers, water, fuel and other resources; improving product quantity and quality; high profitability; reduction of negative environmental impact; such as reducing various risks.

In addition, the application of "Smart" agricultural machinery in all sectors of the agricultural sector is as follows: Accounting for "Smart" agricultural machinery; Getting acquainted with the instructions for the operation of "Smart" agricultural machinery; data entry and performance monitoring in the information system; Control over the interaction of "smart" agricultural machinery; connecting sensors and chips to the system; Control over the correct operation of "Smart" agricultural machinery; Control over the correct input of information about "smart" agricultural machinery through sensors into the information system; Drones (unmanned aerial vehicles); work in various information systems, preventive maintenance: use of GIS technologies: use of computer technologies for the collection of information obtained through "smart" agricultural machinery; It is possible to provide services such as "smart" agricultural machinery.

Another developed sector of "Smart" agriculture is "Smart farm", ie in the field of animal husbandry, as noted above, the application of these technologies leads to the rapid development of this industry. In addition, the "Smart Field" and "Smart Greenhouse" systems can be considered as important links in agriculture.

The software completely overhauls all aspects of farming. Data storage processes are now simpler and more portable, and the execution of records and calculations has been greatly simplified. Below are 10 companies that are alreadychanging data management in agriculture and will continue to do so in the future. Software currently used in agriculture: Farm Logs, Granular, The Climate Corporation, FarmFlo, Cropio, Conservis, Agrivi, Farm Lead, ARMA a others.

In connection with the above, the constant introduction of modern information technologies in agriculture opens up many opportunities for improving the quality of agricultural products, reducing costs, increasing the profitability of farms, reducing risks, timely and correct application of mineral and chemical fertilizers, and so on. Therefore, the introduction of special software tools currently used in developed countries in the agriculture of our country will lead to a positive solution to many issues. “ARMA” (Agro office, Automated workstation for agranom, AWA) is one such software tool. The “ARMA” program stores and maintains information on mineral fertilizers, plant protection products, agronomic practices and crops. “ARMA” has the following capabilities: registration of information about planted and harvested crops; registration of the use of plant protection products; registration of fertilization; formation and publication of reports on the use of varieties of agricultural crops, chemicals, mineral fertilizers; calculate the amount of fertilizer required to achieve the desired yield; generate maps of cartographic fields; description of the economic card; registration of information on the shortage of securities, etc. Requirements for the computer configuration for using the ARMA software: minimum system configuration: 64-bit (x64) processor with a clock frequency of 32-bit (x86) or 1 GHz or higher; RAM 2 gigabytes or more; hard disk capacity 20 gigabytes; Graphics device DirectX 9 Driver version WDDM 1.0 or higher, Operating system: Windows 7 x86 / x64; Windows Vista x86 / x64; Windows XP SP3 x86 / x64.

If the user meets the above requirements, then the ARMA program is ready to start and works without notifying the user about any errors, and the main window shown in the picture will appear on the screen.

The results of the analysis of the program show that the important information about the farm stored in this program also determines the future direction and prospects of the farm. Because today the reception, processing, transmission and analysis of information and the constant use of this information leads to high-quality, accurate work in farms. There are many types of such software products. The use of each of them in various sectors of agriculture is one of the urgent tasks of today, and the widespread promotion of the use of such modern software tools also poses enormous tasks for agricultural educational institutions. It should be noted that the enormous creative work carried out in the republic, reforms, the growth of the economic power of our country have led to radical reforms in the education system, which is the central link in the social sphere of society. New decisions, orders, documents are adopted, advanced pedagogical methods and teaching methods are created to improve the education of young people, enrich the content of knowledge with modern and foreign skills and ensure continuity. This, in turn, implies the following tasks: the use of modern software used in agriculture in teaching students in the field of agriculture and the constant updating of innovations in this area; effective use of modern information and communication technologies in agriculture and analysis using world experience; constant monitoring of the use of special software based on various sectors of agriculture; Continuous improvement of knowledge and skills in agriculture based on the achievements of world experience, as well as continuous training of representatives of this field abroad. In addition, when using the software "ARMA" in the effective organization of the activities of farms, the following recommendations can be given: the use of the same and similar modern software in training students-agrarians and their application in industry; explain the benefits and conveniences of this program to staff currently working on the farm; receive in the future new information based on world experience in agriculture, and organize a workflow based on this information; development of similar programs in cooperation with experts.

Taking into account the above recommendations, we can say that the introduction of digital technologies in agriculture will automate the work process of diversified farms, provide them with the necessary information, analyze them on the basis of various statistics and draw different conclusions. capable of removing. and action development. will be. And this, in turn, will lead to the further development of the agricultural sector of our native Uzbekistan.

Literature:

1. "Strategy of actions in five priority directions of development of the Republic of Uzbekistan for 2017-2021". Decree of the President of the Republic of Uzbekistan dated February 7, 2017 №. PF-4947.

2. Misty E. Vermaat, Susan L. Sebok, Stephen M. Freund. Discovering Computers (C) 2016 (2016 edition). USA, 2016.

TSUE International Online Conference
“Sustainable agricultural development and regional cooperation for inclusive growth in Central Asia”
20 - 22 October 2020

Strategies to increase the effectiveness of Internet marketing in Uzbekistan

Madiyeva Zukhra Iskandarbekovna*

* Basic doctoral student, Tashkent State University of Economics, Tashkent, E- mail: zuxraxon1119@mail.ru

Extended abstract title

The development of digital technologies has brought the economy to a new stage of development. The rapid development of sectors and industries of the economy is being achieved through the Internet. Therefore, this article shows the development of the economy through modern digital technologies and its prospects.

1 Research questions

At present, the Internet focuses on the management of innovative activities on the basis of information technology. In this regard, the role of information and communication technologies in increasing the effectiveness of management, as well as the rapid development of computer technology today and their intensive implementation in the educational process, is very positive in the education system. These changes are based on the fact that they affect the strategic direction of all higher education institutions, as well as the active implementation of innovative activities.

Accelerate the development of Internet marketing in Uzbekistan, the theoretical and methodological aspects of improving the development of Internet marketing in Uzbekistan and the study of foreign experience, solving problems in the development of Internet marketing, evaluating and analyzing the effectiveness of future strategic directions focus.

Ensuring the implementation of the State Program on the implementation of the Action Strategy on the five priority areas of development of the Republic of Uzbekistan in 2017-2021 in the "Year of Active Investment and Social Development", as well as educational and a number of Cabinet decisions have been made to support the creation of useful web resources.[1]

The adoption of this decision, the creation of conditions for the promotion and popularization of the Internet in the global information network, the development of state information web resources, including official websites, the creation of a bank of text, photo, audiovisual materials on the activities of government agencies to organize and maintain, expand the participation of state media in mass social networks and mobile messengers, further improve e-learning resources for preschool, secondary and higher education systems, as well as provide access to local and global educational resources; and the formation of modern web resources that promote the development of creative potential, as well as support the promotion of the history, science, culture and art of Uzbekistan in the information space, the expansion of information and communication technologies in the activities of information and library institutions. introduction, remote access of users to information and library resources, archives and museums of the country, effective organization of work and their service on the Internet, regular study of trends in the development of the global and national segment of the Internet, The formation of proposals for improving the mechanisms of content development, the introduction of public-private partnerships and improving the regulatory framework, as well as a comprehensive program for further development of national content in the global information network Internet, showed the urgency of such issues.

2 Data and methods

At present, the President of the Republic of Uzbekistan Nursultan Nazarbayev signed a decree on the regulation of the process in the system with the assistance of socio-economic development of the population, strengthening the market economy, improving state and society building, strengthening the material and technical base, modern equipment and training of civil servants. - Modern knowledge, growth in the number of national web resources and the Internet world news, ensuring the implementation of the Decree "On the State Program for the Year of Active Investment and Social Development" in 2021 on the five priority areas of development of the Republic of Uzbekistan. The rapid and effective solution of problems arising in the creation of conditions for promotion and popularization in the industry remains a requirement of the times.

Effectiveness of Internet marketing development in Uzbekistan, ie opening the way for development in all spheres of the country, development of digital economy, demonstration of innovative achievements, efficiency of networks, study of problems in Internet marketing, investment development in Internet revenue generation and Internet marketing risks development of a mechanism for identification, evaluation and comparison.

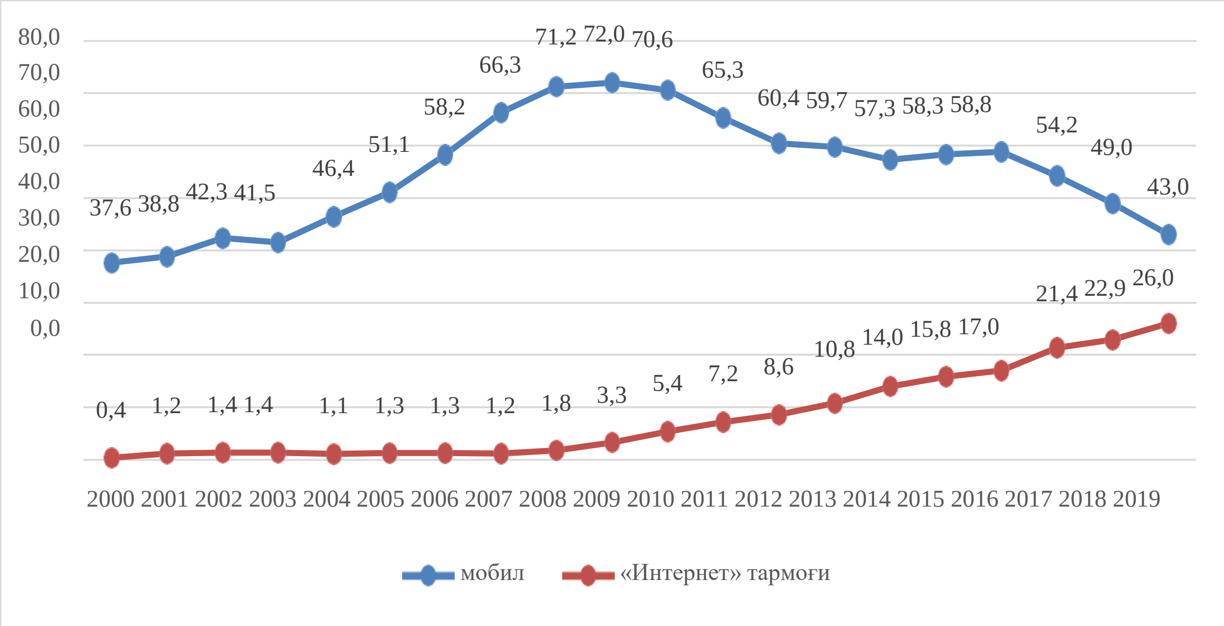


Figure 1. The structure of revenues of communication enterprises from communication services.

In recent years, communication services have been developing and growing. In particular, if we look at the development of the mobile communication system, its development from 2000 to 2019 can be divided into 2 parts. If it had an upward trend from 2000 to 2009, a decline can be seen after 2010.

On the Internet, however, there is no significant change from 2000 to 2008, and a significant growth trend can be observed in the post-2009 period.

The changes in these 2 indicators can be explained by the development of social networks first watsapp, then telegram and weber.

The development of information technology, including the Internet, the emergence and rapid growth of e-commerce has laid the foundation for the emergence of a new direction in the modern marketing concept - Internet marketing. From a marketing point of view, the Internet is a digital (informational, communicative, etc.) environment to which its marketing rules apply.

Although Internet marketing began to take shape in the 1990s, to date, the content, scientific and theoretical concepts of Internet marketing have not been fully explored. Research on the theoretical and methodological aspects of Internet marketing began after the 2000s. Currently, extensive research is being conducted in this area. As a result of research, the essence of Internet marketing is becoming more widely understood.

Internet marketing is the process of planning, pricing, distribution and advertising of ideas, goods and services in order to exchange products in accordance with the requirements of individuals or organizations, based on the use of Internet technology.

Internet marketing is a modern concept of traditional marketing. Internet marketing complements traditional marketing, ensuring the online implementation of traditional marketing functions. Therefore, it is wrong to assume that Internet marketing "marketing itself" is another parallel and independent. The four elements of a traditional "marketing mix" are brand, price, distribution, and promotion, each of which makes it possible to work online in Internet marketing.

Internet marketing is the theory and methodology of organizing marketing in the Internet hypermedia environment. In other words, internet marketing is a set of management decisions and functions that ensure the steady growth of customers and sales, which is part of a company on the

Internet.

One of the main features of the Internet environment is its hypermedia nature, which is characterized by high efficiency in the presentation and assimilation of information and significantly increases marketing opportunities in strengthening communication between businesses and consumers.

The main tool of Internet marketing is the site. The Corporate Website is a virtual office of the company, as well as a representative on the Internet with several functions:

- providing information about the company and its products;
- promotion of products and brands on the Internet;
- conducting current marketing research;
- engage with consumers;
- customer service and data provision;
- use the site as an e-shop;
- Involvement of intermediaries and strengthening of relations with intermediaries.

One of the most important characteristics introduced by the Internet to the modern commercial world is the transition of the key role from producer to consumer. The Internet has allowed companies to capture the attention of a new customer sitting in front of a computer screen in a matter of seconds. But at the same time, it also allows the same user to overtake competitors by pressing the mouse button a few times. In such a situation, the attention of the buyers will be of the greatest value, and the established relations with the customers will become the fixed capital of the company.

In the current process of globalization of the world economy, the main goal of Internet marketing is to develop and choose the right market conditions and opportunities, the ratio of supply and demand, brand characteristics, market strategies of enterprises using modern information technology.

It should be noted that there is a significant difference in price between the sales forces, which are traditional communication media, web networks, which are television and electronic media, and e-mail. The cost-effectiveness and interactivity of digital channels enhances interactivity and personalization through low cost, while enabling marketers to stay in touch with their customers through direct dialogue between consumers and businesses.

Traditional marketing is the process of marketing research and advertising conducted to sell products and services that attract the attention of consumers. Internet marketing uses digital tools to create integrated, targeted, and effective communication in order to build a strong connection with consumers as well as expand the ranks of consumers. It delivers information to consumers using printers, televisions, mobile phones and radios from all the media available in digital media. While traditional marketing uses radio, television, newspapers and posters, internet marketing uses mobile marketing, e-mail marketing, SMS, instant search engine and display advertising technologies.

In the current process of globalization of the world economy, the main goal of Internet marketing is to develop and choose the right market conditions and opportunities, the ratio of supply and demand, brand characteristics, market strategies of enterprises using modern information technology.

It should be noted that there is a significant difference in price between the sales forces, which are traditional communication media, web networks, which are television and electronic media, and e-mail. The cost-effectiveness and interactivity of digital channels enhances interactivity and personalization through low cost, while enabling marketers to stay in touch with their customers through direct dialogue between consumers and businesses.

Internet marketing provides a wide range of transport and logistics services, delivery and storage of goods and cargo, ordering, collection and processing of operational information on stocks, trade enterprises sell goods online to buyers, and in the tourism business tour operators, travel agents online tour packages. sales, booking hotel rooms, and banks transfer money with customers, providing various types of commercial services.

Internet marketing is widely used mainly by small businesses operating in various fields. Because the scale of activities of small businesses, work with the market and the short range of consumers allows you to effectively use this system. Small businesses are proving in practice that they can improve their sales and business activities by using Internet marketing opportunities.

The effectiveness of Internet marketing development directly depends on the number of users, the weight of businesses and settlements connected to high-speed Internet. It is also important to create a modern computerized infrastructure. An IT park with modern infrastructure is being built in Uzbekistan. Such parks will be established first in Tashkent and Urgench, and later in Nukus, Bukhara, Namangan, Samarkand and Gulistan. As a result of this organizational work, the development of Internet marketing will accelerate.

The number of Internet users in Uzbekistan has been growing over the past decade. This figure is much higher when compared to Internet users in some Asian countries (Table 1).

Internet users and residents of some Asian countries

Asian countries	Population (2018)	Internet users (2000)	Internet users (2018 йил)	Introduction (% of population)
Afghanistan	36373,1	1,0	6003,1	16,5 %
China	1415045,9	22500,0	802000,0	56,7 %
Kazakhstan	18403,8	70,0	14063,5	76,4 %
Kyrgyzstan	6132,9	51,6	2493,4	40,7 %
Tajikistan	9107,2	2,0	3013,2	33,1 %
Turkmenistan	5851,4	2,0	1049,9	17,9 %
Uzbekistan	32364,9	7,5	15453,2	47,7 %
Total across Asia	**4207588,1**	**114304,0**	**2062197,3**	**49,0 %**

There are a number of problems in the use of Internet marketing in our country. One of the main problems is the lack of commercial experience in both sellers and buyers. This can be seen in the activities of some start-ups (torg.uz). Consumers have to get a lot of tips when making purchases.

But at the same time, all the opportunities to use the digital market in our country are developing at the level of world demand. According to the Uzreport news agency alone, more than 15 million people in Uzbekistan now use the Internet. In other words, 47.7% of the country's population are Internet users. This has led to an increase in the share of Internet marketing in the country, which can be done through the online commercial networks korzinka.uz and torg.uz. The reason is that these online commerce networks not only allow consumers to purchase products directly online, but also provide any services online.

The methodological basis for improving the effectiveness of the development of Internet marketing is related to:

To increase the effectiveness of the development of Internet marketing in enterprises, it is necessary to ensure its integration with traditional marketing. Because, despite the huge role that new information technologies play, internet marketing does not replace traditional marketing, it only complements it. Identify areas of use of Internet marketing technologies for each element of marketing activities in enterprises.

To develop Internet marketing in all areas of marketing activities, not only in sales and advertising, but also in all areas of marketing activities: organization of online surveys in marketing research, the process of creating new products, product orders, product delivery, storage, loading and unloading, sales channel management , negotiations with commercial intermediaries, etc.

3 Main results

Enterprises operating in the sectors of the economy of Uzbekistan carry out their activities in the following areas of Internet marketing: communication between consumers and sellers using corporate web pages or social marketing, which are digital marketing channels; quick and accurate response to consumer inquiries using mobile, email and internet marketing; encourage consumers to buy their products by providing consumers with detailed information about the products; can develop services to consumers through regional organization.

4 References

1. Address of the President of the Republic of Uzbekistan to the Oliy Majlis January 24, 2019. https://president.uz/uz/lists/view/2228
2. Resolution of the President of the Republic of Uzbekistan "On measures to further modernize the digital infrastructure for the development of the digital economy" // "Khalq so'zi" newspaper, November 22, 2018
3. Gulyamov S.S., Ayupov R.H., Abdullaev O.M., Baltabaeva G.R. Blockchain technologies in the digital economy. Study guide. T .: TMI, “Economy and Finance”, 2019, 404 p.
4. Abduxalilova L.T. Internet marketing. Study guide. - T .: TDIU, 2011. -285 p.
5. Gavrilov L.P. Electronic commerce: a textbook and practicum for universities. - M .: Izdatelstvo Yurayt, 2019. - 477 p.
6. Danko T.P., Kitova O.V. Questions of development of digital marketing. Problems of modern economics. 2013. №3 (47)
7. Martovoy A.V. Dryness and basic characteristics of electronic business, electronic commerce, electronic and Internet marketing. URL: http://www.nbuv.gov.ua/Articles/ Kultnar / knp56_ / knp56_146-152 pdf 17.
8. Meshkov A.A., Musatova J.B., Tverdoxlebova M.D., Goroxov M.A. Internet marketing. Ucheb. Posobie. M .: REU im.G.V.Plexanova, 2012.
9. Tverdoxlebova M.D. Internet marketing: Textbook. M .: KNORUS, 2020-192 p.
10. Fablinova O.N. Behavior in the Internet as an object of study - social science //Sotsiologicheskiy almanax. 2015.№6. S. 543-549
11. Gulomov S.S., Ayupov R.H. Fundamentals of digital economy and e-commerce. Study guide. T .: TMI, “Economics and Finance”, 2020. 510 p.
12. www.yourclients.ru/.../internet-marketing.html