


Digitalization of Lifecycle Management of Domestic Russian Tour Products Based on Problem-Oriented Digital Twins-Avatars, Supply Chain, 3D-Hybrid, Federated, and Coordinated Blockchain

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ABSTRACT

The article fits into a moment of operational uncertainty and theoretical redevelopment of the nature of tourism in a society marked by geopolitical turmoil and declining international security, as well as rapid changes at the global level, including the pandemic, which is currently posing new challenges for the sector. Today, it is more relevant and appropriate than ever to reflect on them, with the new, digital energy of blockchain technology, using a fundamental approach to digitalizing the decentralized lifecycle management of the domestic Russian tour product with problem-oriented digital twin avatars, supply chain, volumetric hybrid, and federated-consistent blockchain. The goal of the article is a theoretical study and practical implementation, in the form of basic models and software modules, of artificial intelligence algorithms in managing the life cycle of an internal Russian tour product, and the use of laboratory for digitalization and management, using multi-agent models of intelligent digital twins-avatars, is being created. The purpose of these studies is to solve a scientific problem.

KEYWORDS

3D-Hybrid and Federated-Consistent Blockchain, Based Problem-Oriented, Condition Monitoring, Digital Twins-Avatars, Digitalization, Domestic Tourist Product in Russia, Lifecycle Management, Supply Chain

INTRODUCTION

The article fits into a moment of operational uncertainty and theoretical redevelopment of the nature of tourism in a society marked by geopolitical turmoil and declining international security, as well as rapid changes at the global level, including the pandemic (COVID-19), which is currently posing new challenges for the sector. Today, it is more relevant and appropriate than ever to reflect on them, with the new, digital energy of blockchain technology, using a fundamental approach to digitalizing the decentralized lifecycle management of the domestic Russian tour product with problem-oriented digital twin avatars, supply chain, volumetric hybrid, and federated-consistent blockchain.

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The article's goal is the theoretical study and practical implementation, in the form of basic models and software modules, artificial intelligence algorithms in managing the life cycle of an internal Russian tour product. Why at the State Sochi University, using the scientific potential of the head and responsible executors of the project, the Laboratory for digitalization and management of tour products, using multi-agent models of intelligent digital twins-avatars, is being created, the purpose of these studies is to solve a scientific problem in terms of creating an integrated scientific and methodological approach to modeling and design of monitoring systems, diagnostics and management of distributed cyber-physical objects and processes in the network segments of the Industrial Internet of Things based on the convergence of engineering technologies, data mining and in-depth analysis of processes, predictive modeling and machine learning.

The research objectives are related to the development of new models, methods, and a set of tools for the digital transformation of monitoring, diagnostics, and management of distributed cyber-physical objects during the transition to the digital economy within the framework of the fourth industrial revolution (Industry 4.0). Design research results are needed to synthesize the architecture of a new generation of intelligent cyber-physical systems, which represent a multi-agent computing ecosystem. It is designed to provide decision support processes based on monitoring events and processes at distributed cyber-physical objects of the Russian tourism industry. In such systems, many cyber-physical objects receive a huge amount of sensory data that humans cannot process in real-time. There are currently no ready-made integrated solutions for modeling and designing distributed monitoring and control systems for cyber-physical objects. Despite advances in engineering and knowledge management, the use of this approach for the synthesis of cyber-physical monitoring and control systems is still poorly developed. Such systems work with various distributed cyber-physical objects, which are, in most cases, measuring devices with sensors that collect and accumulate sensor data for transmission to a processing center via a telecommunications network. Data analysis results are used for predictive modeling of the dynamics of the development of processes at cyber-physical objects and for making management decisions. Cyber-physical monitoring and control systems are needed to automate the decision-making process based on data mining.

The project's relevance is associated with the need to develop and develop new universal mechanisms for modeling and designing cyber-physical systems using new control technologies and in-depth analysis of processes at controlled objects of the Russian tour product. For in-depth analysis of processes, it is necessary to develop automated technologies for collecting, storing, and intelligent analysis of data obtained from controlled cyber-physical objects of the Russian tour product. The scientific novelty of design research consists in the creation of a new scientific and methodological approach to the modeling and design of cyber-physical systems for monitoring and controlling distributed objects and processes in the network segments of the Industrial Internet of Things, as well as the methodology for distributed monitoring, diagnostics and recovery of these systems during their operation.

The scientific and practical significance lies in creating new technologies and software, and tools for the synthesis of cyber-physical systems for monitoring and controlling distributed objects and processes on the Internet of Things. For in-depth analysis of processes, it is necessary to develop automated technologies for collecting, storing, and intelligent analysis of data obtained from controlled cyber-physical objects of the Russian tour product. The scientific novelty of design research consists in the creation of a new scientific and methodological approach to the modeling and design of cyber-physical systems for monitoring and controlling distributed objects and processes in the network segments of the Industrial Internet of Things, as well as the methodology for distributed monitoring, diagnostics and recovery of these systems during their operation. The scientific and practical significance lies in creating new technologies and software, and tools for the synthesis of cyber-physical systems for monitoring and controlling distributed objects and processes on the Internet of Things. A new generation cyber-physical monitoring and control system is implemented in the form of a hyper-converged component-based architecture of a reconfigurable ecosystem, which

performs multi-agent processing of large amounts of sensor data in a computing grid of sensor node controllers based on a fog (edge) computing model.

MATERIALS AND METHODS

Blockchain technology won many individuals' and corporations' interest due to its technological capabilities and scalability for various use cases. This led to the disruption of traditional internet/intranet business models alongside services such as conducting business transactions and managing information ineffective and secure ways. These use cases clearly communicate a message for systems and experience designers to get equipped with relevant skills and to keep polishing them as the technology grows. Following the evolution of this rapid introduction, blockchain technology nowadays consists of three types: the 'public,' 'private,' and 'federated / consorted.' In a nutshell, these blockchains share similar functionalities. In terms of differences, they rely on the use cases, permission levels, and privacy. Within the business context, the blockchain brings several advantages: time-saving over work processes, minimizing costs, risk reduction, and an increase in trust. By learning these values and benefits, web designers will have the ability to foresee how this technology can reshape our clients' businesses, notwithstanding the knowledge and confidence we need to guide and proposing the right solutions fitting their needs. However, for that to happen, the business must have a network of some kind to ensure a solid foundation of a good blockchain use case. It is often said that 'with great power comes great responsibility.' This statement is heavily applicable when it comes to this technology. The blockchain restores control and ownership of information to its rightful owner, thus eliminating central authorities and third parties' dependencies.

BACKGROUND

An analysis of world experience in transforming the industry into the digital economy and the transition to cyber-physical systems of the industrial Internet of Things shows that work is being carried out by the concept of the fourth industrial revolution Industry 4.0 as part of the transition to the digital economy and the introduction of Smart Manufacturing, Digital Manufacturing, Internet of Manufacturing, Open Manufacturing technologies.

The foundations of the transition to the digital economy have been described for a long time in the writings of Tapscott, D. (1996). The digital economy: Promise and peril in the age of networked intelligence (Vol. 1). Digital economy - various ways to apply technologies (BIM, PLM, CAD, IoT, Smart City, BIG DATA, and others). The International Journal of Open Information Technologies, 4 (1) on the digital economy was devoted to the importance of the integrated application of technology. For example, it noted that the joint use of building information modeling (BIM) technology and geographic information technology (GIS) is the path to building systems that work efficiently in the life cycle of the design, construction, and operation of a building. This is a conclusion made by leading world experts and practitioners.

An essential element for the digital economy is cyber-physical systems (Kupriyanovsky, V.P., Namiot, D.E., & Sinyagov, S.A. (2016). Cyber-physical systems as the basis of the digital economy. The essence of cyber-physical systems is that they connect the physical processes of production or other processes (for example, transmission and distribution control of electric power), which require the practical implementation of continuous control in real-time, with software and electronic systems. This is a rather little-studied topic in Russian literature. At the same time, its importance is obvious.

Cyberphysical systems are characterized by multidimensionality, structural, and functional complexity. Research in this area lies at the intersection of many disciplines and is still in the initial development stage. All this determines the need to develop adequate methods for their design. The most promising approach is the model-based approach. A review of the design methods, modeling and integration of CFS, and signs of their use, are presented. The diversity of descriptions of such

systems, consisting of physical, cybernetic, and communication parts, requires a unified approach to the description, allowing simple integration of parts into a single whole, reuse of parts, and support portability and interoperability. These requirements can be satisfied to some extent using the languages UML, SysML, XML. However, the disadvantage of these languages is either focusing on the presentation of syntactic information or limited semantics. Semantic Web technologies offer much greater opportunities. For example, descriptions based on ontologies make it possible to present semantic information in addition to syntactic information. Besides, there is the possibility of ontological reasoning, which is useful in the analysis, verification, and validation of the ontological model.

The models and methods proposed in the project correspond to the world level of scientific research, which is confirmed by the increase in the number of scientific publications in recent years in the field of creation and development of intelligent cyber-physical systems such as “Smart Energy Grid,” “Smart Road,” “Smart city” (Smart City). These systems are developed based on technologies for distributed processing of big data, intellectual analysis, and machine learning methods, M2M interaction of cyber-physical devices in the network of the industrial Internet of things, etc. In recent years, many foreign publications have appeared in a similar field.

An example of the smart environment for a Smart City is the Smart Road. Therefore, research and development in this area occupy a large place. For such environments, the main component is an intelligent transport infrastructure monitoring system; Smart City Road Monitor by Iagem and Antea Group wins Geospatial World Excellence Award (<https://geoinformatics.com/smart-city-road-monitor-wins-award/>). An example of research on the analysis of streaming information and forecasting the development of situations in this area is developing a road traffic modeling system for forecasting traffic incidents with coordinate reference to digital map layers. To process sensory data in cyber-physical systems, it is proposed to use sensory network nodes (a layer of “foggy” computing). Wireless sensor networks are now widely used in various human activity fields, which determines the huge interest in them from scientists and researchers to create new innovative developments. Leading developers of software and hardware, such as NXP, offers innovative developments in integrating several network technologies and protocol stacks (technological and network convergence), for example, the connected ZigBee and Bluetooth modules in the sensor node. Examples of publications in the field of wireless sensor network application research. The fog computing platform is a variation of the cloud computing model. The computing nodes for distributed data processing are not servers but sensor nodes with limited computing and energy resources. Ontologies and ontological models began to be used in modeling cyber-physical systems relatively recently proposes a semantic framework based on models for system design, tracking requirements, simulation, and assessment of cyber-physical systems. In this paper, domain ontologies are used for computing and decision making.

Work is associated with the development of knowledge structures to support the correct (“correct-by-design”) design of cyber-physical systems (CFS). This article presents a new ontological knowledge base and logical conclusion to support decision-making for cyber-physical systems. This allows the development of deterministic, provable, and feasible models of cyber-physical systems supported by reliable semantics, strengthening the approach to the design of cyber-physical systems based on model management.

An approach is proposed to develop a digital representation of all information available about an object and from an object, which can be a hardware system or software platform. Digital presentation is based on semantic knowledge presentation formalisms such as RDF, RDF Schema, and OWL. In this paper, we also introduce the Semantic I4.0 component concept, which solves the problems of communication and understanding in the scenarios of Industry 4.0 using semantic technologies.

The brief overview given above testifies to the facts of using ontological models for modeling structures of cyber-physical systems, contexts of cyber-physical systems, verification of projects of cyber-physical systems, decision-making in the design process, and presentation of information about an object. At the same time, it can be stated that at the moment, there are no works that use dynamic ontological models in which changes would be incorporated into their semantics.

Currently, the ontological approach is used in combination with model-oriented design, and in the future, it can completely replace it. In general, ontology-based software development refers to new methods by which ontologies can improve models, techniques, and software development processes. Benefits include optimal verification of program code, reusability of artifacts, and increased interaction and integration of software system components.

The direction of developing management methods and forecasting the behavior of cyber-physical systems and processes are technologies for extracting knowledge and the intellectual analysis of big data. Big data has several properties. The high speed of generation and processing of data in real-time allows you to make the most appropriate decisions regarding the control process's specific impacts. C) Diversity - a wide range of information generated from various sources in various formats, with different structures and sizes, sorted into different categories related to all aspects of the management process, allowing preparing classifications, groupings, and correlations. D) The complexity of processing and data management - the heterogeneity of data taken from various sources requires a comprehensive and heterogeneous data processing methodology.

The method of deep analysis of processes (Process mining) can be considered to develop the method of deep analysis of data (Data mining). Still, as a result of process mining, an output is obtained that describes the dynamics of the system. The ancestor of the Process mining method is Wil van der Aalst. This method is actively developing in its group. The basic principles of the Process mining method are described. The process mining method begins to be actively used in monitoring systems.

A new approach to the automatic generation of trust properties obtained from studying and analyzing the system using the Process mining method and comparing it with the formal specification of the tested system is proposed.

The use of the Process mining method in an online and traditional audit system is proposed. Moreover, a continuous information monitoring system is proposed to identify and prevent risks in the big data environment in advance by monitoring risk factors in organizations and enterprises. This work aims to develop a preliminary risk factor verification system using practical examples of sales audits.

A promising direction is the expansion of the Process mining method of the semantic component. An attempt in that direction was made. This study examines the learning process - how data from various process areas can be extracted, semantically prepared, and converted into executable mining formats to support real-time detection, monitoring, and improvement of processes. Simultaneously, the proposed method allows predicting individual patterns/behavior through further semantic analysis of the generated models. The article proposes the formalization of the so-called "Semantic Learning Process Mining (SLPM)," technically implemented as a "fuzzy semantic miner" (Semantic-Fuzzy Miner).

An analysis of the literature on using the Process mining method in monitoring systems showed a promising but not yet explored. The segment is the extension of the Process mining method of the semantic component based on ontologies.

In conclusion, we note that a review of the scientific literature and existing design studies in this field of knowledge showed that there are several problems, which include the lack of adequate mathematical models for the analysis of large sensory data and the in-depth analysis of processes in cyber-physical systems, the imperfection of technologies for accounting for hidden patterns in time series and event logs, taking into account the influence of external factors and random fluctuations on the behavior of the cyber-physical system, the complexity of automation to accept I make decisions in the process of monitoring and process control in cyber-physical systems. This confirms the proposed project's relevance, aimed at developing new models and methods for modeling and designing cyber-physical systems.

The main scientific competitors

The most widespread research in the field of knowledge related to the development of cyber-physical systems and technologies of the Internet of things is conducted in the USA, EU, China,

Japan, and Korea by research institutes and universities of public authorities. Let's consider some projects in this area.

1. Intel is developing models, methods, and technologies of cloud and GRID computing to increase the efficiency of distributed computing, reduce the complexity of the practical use of cloud solutions and increase the security and stability of distributed computing systems. The main focus is the development of solutions and tools for cloud data centers.
2. Toshiba is working on combining cloud computing, big data, and smart technologies to support the work of the energy sector, healthcare, and services to implement the "Smart Human Community" concept.
3. Cisco is developing IoT technologies using the network infrastructure of multiple sensors and distributed data processing systems based on a fog and cloud computing model. Toshiba and Cisco are conducting joint research on the Internet of Thing, creating the ubiquitous wireless Internet, machine communications, fog, and cloud computing in a wide range of devices for managing multimodal transport and smart cities. The main goal is to increase the efficiency of technological processes, productivity, and functional capabilities of production, transport, and the urban environment. The basis is the development of the ubiquitous Internet (Internet of Everything) by combining the Cisco Fog Computing network infrastructure with Toshiba Group technologies in the area of network point management. This will allow you to track and maintain geographically remote devices to develop distributed computing technologies.

Scientific research in terms of the creation and development of an industrial Internet of things network for cyber-physical systems, smart energy grids (Smart Energy Grid), and the use of fog computing is carried out by:

MAIN FOCUS OF THE ARTICLE

Issues, Controversies, Problems, Solutions and Recommendations

The main scientific problem solved in the research process is associated with the synthesis of a new approach to modeling and designing cyber-physical systems for monitoring, diagnostics, and control of distributed objects and processes in the Industrial Internet network segments of Things. Optimization of management is one of the central tasks facing the Russian economy. Currently, there is a gradual transition in control systems from simple automation to technologies of "smart" or "smart," and the concept of "digital twin" is central to the development of the corresponding systems. The existing experimental systems have several obvious bottlenecks - cyber vulnerability, fragmentation, binding to a specific tour product, etc. The use of intelligent avatar technology to develop twins can eliminate bottlenecks, which is detailed in three fundamental monographs of the project manager. As a result of the implementation of the proposed scientific research, new scientific, scientific, technical, and technological digital solutions will be created that will provide an innovative and digital transformation of product tour management, as well as the development of a typical multi-agent system of intelligent avatars for effective management.

The expected results correspond to the world level of scientific research in this area, as they relate to the development of new approaches to monitoring and controlling complex geographically distributed cyber-physical systems, which are the basis for the implementation of intelligent cyber-physical systems of a new generation. The project results are components for the creation and implementation of new technologies and systems within the framework of the fourth industrial revolution, the transition to a digital economy, the digital transformation of management processes, and decision support. The project's public and social significance is determined by the fact that the

results of the project are intended for the implementation and development of new intelligent cyber-physical systems for managing the tour product of the Russian Federation.

The main scientific problem solved in the research process is the synthesis of a new approach to modeling and designing cyber-physical systems for monitoring, diagnostics, and management of distributed objects and processes of creating and implementing an internal tour product the network segments of the industrial Internet of Things.

The expected results correspond to the world level of scientific research in this area, as they relate to the development of new approaches to monitoring and managing complex geographically distributed cyber-physical systems, which are the basis for the intelligent implementation cyber-physical systems of a new generation. During the project's implementation, a new multi-agent approach will be developed—modeling and design of modern cyber-physical systems in the industrial Internet of Things. The project results are components for the creation and implementation of new technologies and systems within the framework of the fourth industrial revolution, the transition to a digital economy, the digital transformation of management processes, and decision support. The results can be used to synthesize new intelligent monitoring systems, which proves the practical significance of design research, as well as the versatility of the developed models, methods, and technologies, which in turn will allow the use of tools for creating various geographically distributed cyber-physical systems for creating and implementing an internal tour product.

Our studies found out that “signs” of information on the Internet act as symptoms or show problems. The researchers took the hidden information and knowledge available in blogs, and so on. They began to determine the nature of the “signs” in these media to make the signs and knowledge about them more explicit. Accordingly, these data sources record indicators and potential indicators of activity. This study can be interpreted as the result of the generation of signs from what is sometimes regarded as a data source in “Big Data.”

As a result of the search, the context was defined (Dictionary.com) as a set of circumstances or facts surrounding a particular event, situation, etc. First, consider the concepts of circumstances or facts. In the case of “big data” or “Internet of things,” there would be significant data that could be used to describe circumstances or facts. Such data will precede, occur, or occur with a specific event or situation. This would provide essential data as a basis for characterizing the context. Secondly, in the definition, the context is defined around an event or situation. As a result, one approach would be to define a model of the world surrounding specific events or situations that would help define the context. For example, Schilit and Theimer (1994) defined the context as consisting of a location, the identity of nearby objects and people, and changes in these objects. As another example, Schilit et al. (1994) show that an important part of the context/events includes the resources (resources) with whom you (the adjacent agents) and where you are (location). In his work, Day (2001) suggests that these definitions are too specific and that it is difficult to list the entire set of interesting variables a priori. Accordingly, he suggests such a definition “Context” is any information that can be used to describe a situation in essence. An entity is a person, place, or object relevant to the user's interaction and application, including the user and the application. As a result, the definition of Day (2001) is that it is consistent with the use of the essential data available in the “Big Data” and “Internet of Things” to collect and analyze data about a particular event or situation.

Our research has shown that at one level, the context is determined by a set of “preceding,” “accompanying,” and “subsequent” data. But as events occur, the data is generated from different sources. Capturing more different data leads to the fact that more “context” limits. If the context is captured using all available data, then “Big Data” should also provide “Big Context.” In this parameter, the “Big Context” will refer to access to significant amounts of data in different formats from different sources, situations, or events, but integrated and available for use.

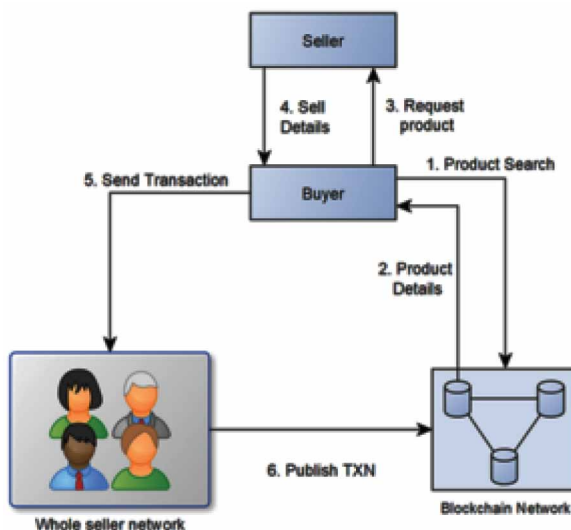
Accordingly, “Big Data” provides an opportunity to provide “more” context than traditional settings. As a result, the recent development in the “Big Data” was to integrate the data into context. As an example, as Hernandez notes (Hernandez, 2012), in the case of business transactions, a new

perspective is to store “each transaction in the context of business activity, for example, pay, search or purchase, how well it was performed, who initiated it, where the user was, and much more. “

In business settings, there may be theoretical structures or schemes that can facilitate the identification of the relevant variables and the expected relationships between them (for example, O’Leary, 1999). Thus, contextual identification variables are likely to require some consideration of events, situations, or settings of interest.

Our research has shown that any discussion of the context in semiotics gives an idea of the context. In his work, Eco (1981) emphasizes the importance of contexts, noting that the sign becomes only. Completely meaningful when it is inserted into a broader context” As another example, also noted by Eco (1981), “... I need to look for possible contexts that can make an expression ... understandable and reasonable. The very nature of signs postulates an active role on the part of their translator.” Our research has shown that semiotics offers terms that make information part of the context: meaningful, understandable and reasonable. “Value” implies that there is a model of how the functions of the world allow us to understand data in both the local and global contexts. “Intelligent” means that the relationship between data and the model can be understood. “Reasonable” indicates that the behavior of the data in the model corresponds to the required parameters. The new designs we have obtained, the Internet of Things and the Internet of Signs, can contribute to the definition of both local and larger contexts. For example, a context can be defined as a set of other “things” within some epsilon of a “thing” of concern. Since the Internet of Things forms a network, classical network approaches can be used to facilitate analysis. Alternatively, “things” can be grouped according to some models. Such models can have several relationships, such as a cascading grouping element. Such cascading groupings can be used to determine local and larger contexts. On problem-oriented digital twins-avatars, supply chain, 3D-Hybrid, federated & coordinated blockchain (Blockchain Network) for domestic tour product whole seller network (Mkrtrtchian, et al, 2017,2019,2020,2021) show in fig.1.

Figure 1. On problem-oriented digital twins-avatars, supply chain, 3D-Hybrid, federated and coordinated blockchain and domestic tour product whole seller



FUTURE RESEARCH DIRECTIONS

This study can be expanded in the future in several ways. This article did not explore the role of business intelligence or the more classic data warehouse. This collection and analysis of data are usually more associated with traditional transaction data. However, data from the “Internet of things” and “large data,” including social media and other forms of unstructured data, can be integrated into business intelligence and data warehouse, including Internet Signs in touristic products.

CONCLUSION

As a result of the research, key technologies of the “Industry 4.0” era were identified, their characteristics and role in use were given. Conclusions are made that introducing these technologies will favorably affect productivity, revenue growth, employment, and investment; in conclusion, the detailed description of various areas of using the Internet of things in the agricultural organizations’ activities results. The study allows us to conclude that the agricultural sector’s digitalization will entail the release of better products. Also, Industry 4.0 will lead to the creation of more flexible systems. The participants will exchange information via the Internet, which will significantly increase labor efficiency and reduce production process costs.

Digitalization is an absolutely logical process that takes place in all areas of the economy: in marketing, retail, and service. Modern information systems and neural networks will be able to analyze more factors and significantly increase any business process’s efficiency. Of course, this also applies to tourist industry.

Any touristic producer in the competitive market has two main tasks: to minimize production cost and increase the resulting net revenue while maintaining product quality at a consistently high level. To solve them, all stages of the production process must be fully manageable and transparent. For example, you need to clearly, gradually monitor the value chain for each unit of production. For this, a single information space is being created at the agricultural enterprise, where high-tech equipment, analytical, and managing IT systems non-stop exchange data.

The study showed that using the Internet of things technology can radically change farm management. The introduction of various kinds of sensors and sensors, the introduction of big data technology, and the use of uncrewed aerial vehicles and self-propelled tractors and machines today can transform traditional farms into new generation farms, Smart farms.

Blockchain solutions are applicable for different touristic product operations where workers can **directly interact with regulatory authorities**. This will help them to gain information on prices, weather, and market trends. They can also use the services to **develop co-op touristic products** where the secure and transparent platform will benefit them. The technology will be helpful for nearly all touristic products, either small or large-scale. Subsequently, the technology will be used to track food through supply chain based contracts.

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APPENDIX

Key Terms and Definitions

- Big Data** – is extremely large data sets that may be analyzed computationally to reveal patterns, trends, and associations, especially relating to human behavior and interactions.
- Internet of Things** – is the interconnection via the Internet of computing devices embedded in everyday objects, enabling them to send and receive data.
- Internet of Signs** –is categories of signs, including written language, natural language, cultural codes, aesthetic codes, codes of tastes and a number of others.
- Context**-is the circumstances that form the setting for an event, statement, or idea, and in terms of which it can be fully understood.
- Internet of People and Things** -is a system of interrelated computing devices, mechanical and digital machines, objects, animals or people that are provided with unique identifiers (UIDs) and the ability to transfer data over a network without requiring human-to-human or human-to-computer interaction
- Internet of Everything** -is a broad term that refers to devices and consumer products connected to the *Internet* and outfitted with expanded digital features
- Semiotics** – is the study of signs and symbols and their use or interpretation.
- Big Context**–is defined as a better understanding of how entities.

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