American Journal of Mechanical and Industrial Engineering
2020; 5(2): 24-30
http://www.sciencepublishinggroup.com/j/ajmie
doi: 10.11648/j.ajmie.20200502.12
ISSN: 2575-6079 (Print); ISSN: 2575-6060 (Online)

Formation and Management of Industry 5.0 by Systems with Artificial Intelligence and Technological Singularity

Evgeniy Bryndin

Research Center Natural Informatic, Novosibirsk, Russia

Email address:
bryndin15@yandex.ru

To cite this article:
Evgeniy Bryndin. Formation and Management of Industry 5.0 by Systems with Artificial Intelligence and Technological Singularity. *American Journal of Mechanical and Industrial Engineering*. Vol. 5, No. 2, 2020, pp. 24-30. doi: 10.11648/j.ajmie.20200502.12

Received: July 5, 2020; **Accepted**: July 16, 2020; **Published**: July 28, 2020

Abstract: The level of education, training of researchers and technologists and international scientific, technological and technological development allows the world community to gradually move to the formation and management of the industry 5.0 through the cognitive technological mind with the help of ensembles of intelligent agents and digital twins and automated systems with artificial intelligence. The cognitive technological mind on the speech mission of a person forms a design implementation for ensembles of intellectual agents. The ensembles of intelligent agents for the project implementation of a human task activate the work of digital twins with artificial intelligence, corresponding to the industry, for the production implementation of a human task. Cognitive technological intelligence, intelligent agent ensembles, and digital doubles make decisions based on representative data. Their representativeness is reflected by the similarity of the data in terms of the qualitative properties and characteristics of a certain production. Through cognitive technological mind with the help of ensembles of intellectual agents it is also possible to manage financial, ecological and other activities of enterprises of industry 5.0. Cognitive technological mind, ensembles of intellectual agents and digital doubles are a very effective tool of automation of management in all spheres of life of society and the state. The international scientific engineering community can begin the formation and technical implementation of industry control automation systems 5.0 based on cognitive virtual mind with artificial intelligence, additive technologies and 5G network. Sensitive safe robots with cognitive artificial mind will perform high-tech professional work in various fields of industry 5.0. A person will teach robots with a cognitive mind to increase professionalism by recursive self-improvement to technological singularity. Artificial intelligence with technological singularity will be controlled by the results of self-improvement in simulation mode in virtual space. He can become a good assistant to humanity in the safe development of living spaces.

Keywords: Industry 5.0, 5G Network, Cognitive Technological Mind, Ensemble of Intellectual Agents, Digital Doubles, Technological Singularity

1. Introduction

Industry 5.0 begins to be formed by additive technologies based on industry 4.0 and the 5G network. Industry 5.0 will make all manufacturing processes smarter and more flexible, and 5G help achieve this goal. The 5.0 industry will evolve through fast and flexible communication between technology components across the 5G network. The advantages of 5G in speed, real-time performance and reliability of data transmission will transform mobile communication as a whole. The use of the 5G network in industry 5.0 will be ubiquitous. Dividing the physical architecture of the 5G into many virtual layers will allow manufacturers to optimize each layer for a certain set of applications through a common physical network infrastructure. This will allow you to ensure a clearly segmented quality of service and security on an end-to-end basis. It will also help to avoid the simultaneous use of different applications that can interfere with each other. In addition, 5G will tightly integrate computer and storage resources directly into the network. Thus, manufacturers will be able to take full advantage of advanced computing technologies by performing cloud data processing at the border of the network, near the data source, or even directly at the factory.

Industry 5.0 combines virtual and physical reality into cyber-physical complexes, on the basis of which a single

digital ecosystem is created. The cyberphysical system is an organizational and technical system for managing information flows, integrating computing resources into physical production processes. In such a system, sensors, controllers and information systems are combined into a single network throughout the product lifecycle. A cyberphysical network can be, both within one enterprise and within the framework of a dynamic business model in which several enterprises of industry 5.0 are part. Lifecycle operations interact with each other using standard Internet protocols to manage, plan, self-configure, and adapt to changes.

When working on production modernization projects, it is necessary to check for interoperability of automated equipment and software. This should be a strict rule for organizing and managing industry 5.0.

If you look at the management of the industry 5.0, then artificial intelligence occupies a special position here. It is being improved in terms of organizational methods for managing the economy of industry 5.0. From the point of view of common sense, it is quite obvious that the main drivers of economic development are the existence of a need for a certain set of benefits, the availability of resources to create this set of benefits (including technologies that ensure the effective use of these resources allocated to meet needs) and the driving force that can organize the transfer of these resources to finished products. This driving force is primarily people who are able to identify needs, and somewhere, if necessary, form such needs, who are able to set specific goals for themselves, form the way/ways to achieve these goals, and most importantly persistently and reasonably, with great energy and taking into account the interests of all interested parties to go towards their achievement. This driving force is certain entrepreneurial qualities, leadership qualities, determination, awareness of high personal responsibility and a number of others. The main purpose of Industry Management 5.0 is to create a capacious, holistic, unified environmental environment of human activity in a broad context, covering the management aspect of management, the technological aspect of management and the human aspect of economic activity.

2. Technology Formation and Industry Management 5.0

Despite the technological progress already made, the industry continues to develop at an incredible speed. And now many engineers notice industry 5.0 on the horizon, which, according to many scientists, will remove the human factor from the production process. While industry 4.0 has brought to the forefront of production automated systems and industrial robots, as well as industrial Internet of Things (IIoT) systems, the 5.0 industry will make cooperation between people and machines more productive. By realizing the potential of these systems, humanity will receive highly accurate automated systems with cognitive skills of critical thinking of the human brain.

The world community can gradually move to the formation and management of industry 5.0 through the cognitive technological mind [1] with the help of ensembles of intelligent agents [2], digital twins and automated systems with artificial intelligence [3-8]. High management efficiency will be achieved mainly by means and methods of artificial intelligence and related processes integrated into a single information virtual space [9-15].

According to Esben H. Östergaard, Chief Technology Officer of Universal Robots, industry 5.0 is dictated by a high individuality of demand. This means that the buyer becomes increasingly demanding on the individual settings of the purchased mechanisms precisely for his specific requirements.

More and more manufacturers are increasing the human factor not only for configuration and support, but also for increasing efficiency on production lines. One example is Paradigm Electronics, which produces high-quality speakers. The company uses the Universal Robots UR10 robotic arm to polish speakers, but this takes a lot of time. However, by adding a person to the production process, he increased his production efficiency by 50%.

This does not mean that robots will eventually be phased out of the production cycle. On the contrary, the 5.0 industry will improve both the role of mechanical components and the human role in the manufacturing industry, leaving monotonous, repetitive tasks to robots and opening the creative side to humans. This will allow staff to take greater responsibility and strengthen oversight of systems to improve the quality of products.

The emergence of industry 5.0 on the horizon may cause alarm among manufacturers who have just begun to apply industry standards 4.0, but fear is in vain. As mentioned earlier in the article, the new standard defines more creative cooperation between man and machine. This is a natural evolution that seeks to make the industry smarter, and robotics manufacturers have already developed special machines for joint cooperation with humans, which are safe to work in tandem with humans and contribute to the prevention of injuries in the workplace.

With increasing demand for quality custom-made products, manufacturers will undoubtedly benefit from what the 5.0 industry has to offer. New skills are needed, but a joint workplace will be useful for everyone in the long run. All we have to do is not be closed to getting new knowledge and skills.

For example, when implementing Beyond Budget, the organization:

1. Constantly keeps focus on the product portfolio, improves products
2. Sees a real need for resources
3. Matches itself with competitors
4. Continuously manages performance
5. Can always assess the investment attractiveness of his business (business)
6. Works effectively with the staff. Constantly engaged in

professional development and loyalty

7. Works in the management cycle: Plans, Initiates and executes, Accounts and controls, Adjusts deviation activities

Companies using this approach are one of the leaders in their areas of activity. The approach creates an environment for the company to constantly improve its work, find new markets, increase the variety of products, provide services, and the level of service provided. This approach gives these companies a very tangible competitive advantage. Information systems support automation of project management, budgeting tasks, relations with customers and suppliers, management and accounting of the production cycle, routine accounting, monitoring and performance assessment. For example, Business Performance Management, BPM; Enterprise Performance Management, EPM; Corporate Performance Management, CPM; Strategic Enterprise Management (SEM) provides strategic enterprise management.

An automated information system should be implemented at the enterprise level, including support for the following tasks:

1. Support the management process for the management cycles selected for the organization

2. Planning of finances by principles of budgeting using projects (by products, markets, contracts,...)

3. Customer Planning and Accounting via CRM with Multi-Channel Customer Communication

4. The planning and practical organization of the production process should be in two areas: organizational (at least using PMBOK knowledge or Agile technology) and technical (specification, routing, warehouse and production accounting). Organizational planning and accounting should be carried out through Project Management, Technical through Production Management at least MRP

5. Internal resource exchange system to be implemented

6. Staff planning should take into account staff's performance of their regular activities and staff development opportunities

7. There should be a subsystem that supports the ability of mobile work of employees

8. The information modeling subsystem of the enterprise should be built in (by analogy with the building information modeling system currently existing in construction)

9. Interoperability with IoT platforms must be built in. In architecture of interaction the integration with the systems of servicing and repair (TOiR), the systems of technical processes (Industrial control system) and the ERP system of the enterprise has to be provided

10. At the level of enterprises (partners, executing customers), an electronic document management system (EDR) should be used

11. Aggregate all available information into the Business Analysis Subsystem (BI) for presentation in a convenient interface, for detailed examination and subsequent evaluation of the results. At the personnel level, it is necessary to create conditions for improving the professional level of employees, to educate the awareness of the level of responsibility for the result. Create working motivational schemes.

12. There should be an understanding of what personnel value settings are currently. What are the short-term and long-term personnel targets

13. Efforts to improve knowledge should be organized. A system of professional training, knowledge of project management should be created

14. The process of stimulating personal growth, responsibility, rationalization, transition to the level of project manager, the level of direction managers should be organized

In the process of budgeting, the emphasis is not on structural divisions (CFD) and budgets for them (operational budgets), but on projects, with the establishment of limits for project income and expenses (project calculation), and the appointment of project and project stage owners.

The project is not just additional analytics. This is the central control object. The characteristics of rigid planning change to more flexible planning - through the procedure of mandatory study of the reasons for changing the initial plans.

In terms of project management for new products or new markets, the model should include the possibility of using at least two PMBOK or Agile approaches, and in the regular production stage use the process approach or Agile. Approach analytics introduces an entity into activity that translates the process of activity to a higher level of management. Thus, activities begin to be managed using PMBOK knowledge sets or Agile technology, or other design methods. This model allows you to move away from a fairly rigid budgeting scheme to a flexible project management scheme. In such a situation, budgets become more realistic, as they are constantly under the control and control of the project team. The property of adaptability to the market increases. In addition, a mechanism is included for more complete involvement of project team members, manifestations of their initiative, especially this is manifested in the Agile method.

After the project is completed, you can organize further work with the project results by process type, depending on the specifics of the project results.

3. Big Data 5G Networks in Industry 5.0

Fifth-generation communication networks 5G with Big Data analysis and the Internet of Things (IoT) are designed to become one of the foundations of the 5.0 digital industry, the main driving force of which should be artificial intelligence (AI).

Standardization of technologies and decisions 5G has to come to the end by 2021 therefore term 5G designates so far only fragmentary decisions which in the future will be a part of full-scale decision IMT2020. Such solutions are already being deployed in different countries, but they are still local and test in nature, and do not provide all the planned functionality of IMT2020 standard networks.

The virtual reality service VR (Virtual Reality) immerses a person in a different world, affecting his sensory organs,

primarily vision (VR glasses). The augmented reality service AR (Augmented Reality) combines a real environment with virtual objects for the user. These services are suitable not only for entertainment, games, virtual communication in the body presence mode, but also can significantly improve the learning process, when students with the help of VR glasses can, for example, clearly see the internal structure of a person at a lecture on anatomy, a master in the workshop can study the assembly order of a complex unit, etc.

The 5G network, coupled with the technology of the Internet of Things IoT, with the help of industrial IIoT sensors (Industrial Internet of things), as well as with the help of artificial AI (AI, Artificial Intelligence) can significantly increase the degree of automation of production. At the same time, it becomes possible to analyze large volumes of heterogeneous data (Big Data) in real time and based on the findings (insights) and using machine and deep learning (Machine learning, Deep learning).

Unmanned vehicles can act as part of a smart production service. It includes not only unmanned vehicles (driverless cars), but also unmanned tractors for smart agriculture (Smart Agriculture), unmanned trains, drones and other types of public and special transport. In addition, ADAS (Advanced Driver-Assistance Systems) driver assistance systems can be implemented on the 5G platform.

In large manufacturing companies in the 5.0 industry, the 5G network will allow you to use more industrial robots that perform various functions instead of people, as well as drones.

4. Realization of Technological Singularity by Cognitive Virtual Systems

Singularity is the feature of transition to higher-level patterns obtained by cognitive virtual systems based on the processing of accumulated smart big data by patterns of the previous level.

Cognitive ensembles of mobile diversified virtual agents have a well developed and replenished information model of the outside world due to the presence of BZ, reasoning and analysis of actions. Agent mobility is the ability to migrate across technology platforms in search of the necessary information to access analytical systems for analysis.

Cognitive ensembles contain a variety of mobile diversified agents distributed within the system, which migrate through it in search of relevant data, knowledge, procedures on technological platforms and analytical systems and co-operate to achieve their goals. The cognitive behavior of the agent is provided by the ability to take actions. The architecture of the cognitive ensemble allows to use self-learning agents, the principles of which are formed in the process of solving practical ones.

The interaction of agents establishes bilateral and multilateral partnership between the ensemble, technology platforms and analytical systems. It is a prerequisite for building virtual communities. Interaction is accompanied by mutual transformations of agents themselves and relations between them. The main characteristics of interaction are orientation, selectivity, intensity and dynamism:

1. crientation - positive or negative; cooperation or competition; cooperation or confrontation; coordination or subordination, etc.;
2. selectivity - interaction takes place between agents that in any way correspond to each other and the task. The agents may be bound in an ordinary relation and independent in another;
3. intensity - interaction between agents is not related to presence or absence, but is characterized by determined force;
4. dynamism - the direction of mutual actions can change over time.

Agent interaction analysis includes the following tasks:

- identification of the situation of interaction of agents;
- allocation of core roles and their distribution among agents;
- determination of the number and types of interacting agents;
- building a formal interaction model;
- defining a set of possible strategies for agents 'behavior;
- formation of multiple communicative actions.

Each agent has a limited set of knowledge needed to achieve his or her own and common goals. Commitments are one of the tools that enable you to organize the singular mutual actions of agents. They allow you to anticipate the behavior of other agents, predict the future and plan your own actions. The following groups of obligations can be distinguished: (a) obligations to other agents; B) the agent's obligations to the group; C) the group 's obligations to the agent; D) obligation of the agent to himself. The formalized presentation of goals, commitments, desires and intentions, as well as all relevant characteristics, forms the basis of the mental model of the online mobile diversified agent, which ensures its reasonable behavior.

Different forms of interaction between agents arise:

- simple cooperation, which involves integrating the experience of individual agents (assignment of tasks, sharing of knowledge, etc.) without special measures to coordinate their actions;

coordinated cooperation when agents are forced to coordinate (sometimes involving a special coordinating agent) in order to use resources and their own expertise effectively;

- productive collaboration where agents share resources or solve a common problem by sharing experiences without interfering with each other

A competitive model is used as a reasonable model for coordinating agents 'behaviour. In the process of teamwork of mobile diversified agents, many tasks are solved:

- recognition of the need for cooperation;
- selection of suitable partners;
- possibility of taking into account the interests of partners;
- organization of negotiations on joint actions;

- development of joint action plans;
- synchronization of joint actions;
- task decomposition and division of duties;
- identifying conflicting targets;
- competition for shared resources;
- formation of rules of conduct in the collective;
- training in collective behaviour, etc.

A feature of the collective behavior of mobile diversified agents is that their interaction in the process of solving private tasks (or one common) creates a new quality of solving these problems. To do this, mobile agents can leave the client server and change to the remote server to perform their actions, so that they can return. The use of mobile agents provides:

- reducing the time and cost of data transmission;
- expansion of limited local resources;
- coordination simplification;
- perform asynchronous calculations.

The life cycle model of mobile diversified agents includes the following steps:

- processing of new messages;
- definition of rules of conduct;
- performance of actions;
- updating the mental model according to the specified rules;
- planning of actions based on preferences and utility.

The mental model includes a description of the purposes, preferences, usefulness, obligations and capabilities, and rules of conduct of agents. Based on this model, different types of intelligent mobile diversified agents are selected.

In Russia there are systems of agents Autonomy and Web Compass, designed for intelligent communication and processing of information on the Internet.

When using mobile agents, a number of serious problems must be solved, including: the legality of ways to move agents over the network; verification of agents (e.g. protection against problems); respect for private property rights; maintaining confidentiality of information; overpopulation of network of agents; compatibility between the agent code and the firmware of the network machine.

The main efforts to improve the mindfulness of online mobile diversified search agents on the Internet are aimed at developing models of knowledge representation, methods of inference of new knowledge, models of reasoning and methods of agent training to ensure full interaction of mobile smart agent ensembles with technological platforms and analytical systems.

4.1. Cognitive Virtual System Preferences

Cognitive virtual system achieves preference-based goals. To identify preference on a plurality of objects A is to specify a plurality of all those pairs of objects (a, b) for which object a is preferable than b. When a preference is identified, the following approaches are possible 1, 2.

1. Unconditional table-based approach.

We will fill in the table according to the principle:

Aij = 1 if the ith object is better than the j object;

Aij = 0 if the ith object is worse than the j object.

2. Logical approach.

The approach comprises three stages:

- private criteria for preference selection are identified;
- table of "alternatives-private criteria" is drawn up, which specifies for each alternative the values of quantitative private criteria or the rank of qualitative criteria;
- critical rule is chosen to determine the best alternative.

Since the private criteria under consideration are qualitative, they are given ranking (by preference) rather than quantitative. Rank scores can be considered as scores. On the basis of them, it is necessary to determine the preference. For this purpose, a decisive rule is created. For example, points 1, 2, 3.

1. Absolute preference. Alternative ai is preferred to alternative aj if, for all particular criteria, ai is preferred or equivalent to aj. Absolute preference has the property of transitivity (if A is preferred to B and B is preferred to C, then A is preferred to C).

2. Majority rule preference. Alternative ai is better than aj if the number of private criteria by which ai is better aj is greater than the number of criteria by which ai is worse aj.

3. The criterion of the highest sum of points. Instead of quantifying private criteria, it is possible to set their rank values. The rank value is treated as a score, with the lowest score being 1 for the worst value and the highest score for the best value. The preference criterion is then formulated as: alternative ai is better than alternative aj if the sum of the score estimates for ai is greater than for aj

When using the rule preference criteria or the sum of scores, an additional requirement is often imposed on the alternative - the absence of a private criterion with the worst value. Such alternatives are immediately excluded from consideration.

With a large number of alternatives and particular criteria, it becomes difficult to directly determine the best alternative by the majority criterion because of the difficulty of calculating the number of best and worst criteria for each alternative. In this case, a preference table should be drawn up to identify the best alternative.

According to the rule of majority and absence of the worst value, a preference table for alternatives is drawn up: if alternative b is preferable to a, then at the intersection of row b and column a, 1, otherwise 0 is set.

4.2. Useful Choice of Cognitive Virtual System

Useful choice of cognitive virtual system is a functionality that determines preferences on some set of possibilities by the utility criterion. The cognitive virtual mind develops the ability to highlight the properties and functions of entities regardless of the different conditions in which they are observed, relying on useful choices. The better the cognitive virtual mind begins to distinguish similarities with other adjacent entities, the sooner it gains the skill of generalizations. The logical method as a practical acceptance of the use of logical laws and rules in a particular kind of mental activity of the cognitive virtual mind turns them into

an algorithm of logical rational thinking. When logical techniques are used, it turns general logic into application logic. For this purpose forms a set of reasonable possibilities: situations that may arise in a virtual application environment. Also forms a set of originations - execution of rules and operations in the virtual application environment. And forms set of cognitive functions capable of solving the problem of promotion from the starting situation to the target situation. The path of promotion to the target state is built according to the rules and operations of generation in the applied virtual environment by cognitive functions, using methods of analogy, similarity, combination of available solutions and increase of sensitivity of artificial intelligence. In this way of intellectual activity, the cognitive virtual mind establishes reasonable targeted sequences, forming a new knowledge in the mental model by analysis, synthesis, analogy, comparison, induction, derivation and creative ensembles from well-trained artificial neural networks to achieve the desired goal in dialogue with a professional expert.

4.3. Cognitive Method Search of Regularities

Process of cognitive search of regularities consists of two stages:

1. Cognitive analysis of experimental data.
2. Identification of regularities by forecasting methods by results of the analysis.

The cognitive analysis of data uses mathematical methods and algorithms, the systems of data processing and technology of visual representation of data.

Cognitive methods of the analysis of data: statistical methods, methods of computer mathematics, optimizing methods, expert methods, synergetic methods, methods of indistinct sets, methods of fractal mathematics, methods of conflict situations.

Algorithmic systems of data processing: subject-oriented analytical systems, the systems of the statistical analysis, the trained neural networks, associations on analogies, trees of decisions, evolutionary programming, algorithms of search, the system of visualization of multidimensional data.

Methods of the forecast of situations: the determined forecast, the statistical forecast, a method of program forecasting, a method of heuristic forecasting, temporary ranks, extrapolation method, expert method, the forecast on the basis of linear regression, the interpreted method, the case analysis, the synergetic analysis, the evolutionary statistical forecast.

The tasks solved by cognitive methods of the analysis of data: detection and assessment of the hidden regularities, detection and assessment of influence of the hidden factors, assessment of the current situation, the forecast of development of the situation, formation and optimization of the operating decisions.

4.4. Data Processing Languages and Digital Systems of Modelling

Language of statistical researches R contains a wide range of various functions (temporary ranks, forecasting, classification, a clustering) and allows to carry out profound analytics: identification of the facts, entities or objects; to define subject; to carry out classification.

The Python language contains means of statistical modelling and processing of big data flows.

The MATLAB language contains means of processing of stream information, the analysis of the obtained and predicted data in the field of scientific research.

Deductor — the analytical platform developed by the BaseGroup Labs company. The most demanded analysis algorithms (trees of decisions, neural networks, the self-organized cards, etc.) are built in Deductor, there are tens of ways of visualization and integration into a set of sources/receivers of data is provided.

In system technologies which on the basis of uniform architecture allow to pass all stages of creation of the analytical platform are applied: from creation of storage of the models given before automatic selection and visualization of the received results.

SAS Enterprise Miner is the software product developed for the purpose of creation of exact predictive and descriptive models on the basis of large volumes of information.

The software of STATISTICA uses algorithms of access to data, their transformations and creation of predictive models.

4.5. Cognitive Technology of Search of Regularities

The machine technology at which the computer analyzes experimental data and writes its own program of detection of statistical regularities is cognitive technology.

The cognitive machine technology helps to take new regularities effectively.

Mathematicians of the DeepMind company have developed an algorithm of machine learning IMPALA which allows separate parts of system to study performance of several tasks at once, and then to exchange data among themselves.

On the basis of similar algorithms, temporary ranks and the systems of modelling Deductor, SAS Enterprise Miner and STATISTICA it is possible to receive set of the regularities and data sufficient for creation of models of nanostructures with necessary parametrical and structural resonant properties.

5. Conclusion

In anticipation of the upcoming Industry 5.0, two worlds should be considered together: the virtual world, realized by knowledge, and the real world, realized by skills. The virtual world of knowledge is based on an ontological methodology based on a world of virtual agents capable of generating new data based on available information. This integration covers all stages of the industry 5.0 lifecycle. Humanity has highly accurate automated systems with cognitive skills for critical thinking of the human brain. The world community can gradually move to the formation and management of industry 5.0 through the cognitive technological mind with the help of

ensembles of intelligent agents, digital twins and automated systems with artificial intelligence. High efficiency of formation and management of industry 5.0 will be achieved mainly by means and methods of artificial intelligence and related processes with technological singularity, integrated into a single information virtual space.

A mind with artificial intelligence in virtual space is not an exogenous force over which humans have no control. Developers are responsible for its evolution, in the decisions it will make daily. We must seize the opportunity and achievements we have to shape the mind with artificial intelligence in virtual space and guide it towards a future that reflects our shared goals and values.

To do so, however, we must develop a comprehensive and world-wide view of how the artificial virtual mind must influence our lives and change our economic, social, cultural and human environment. There has never been a time of greater intellectual capability and greater potential danger. Today's leaders are beginning to think strategically about artificial intellectual capabilities that help shape our future.

We need to shape a future that works for all of us, putting people first and empowering them. In a humane form, a cognitive virtual mind can indeed have the potential to robotic humanity's life. And as a complement to the best parts of human nature - creativity, governance - it can elevate humanity into a new collective consciousness based on shared goals. We can make it happen.

References

[1] *Evgeniy Bryndin.* Formation of Technological Cognitive Reason with Artificial Intelligence in Virtual Space. *Britain International of Exact Sciences Journal, Volume 2, Issue 2, May 2020.* Page: 450-461.

[2] *Evgeniy Bryndin.* Development of Artificial Intelligence by Ensembles of Virtual Agents with Mobile Interaction. Automation, Control and Intelligent Systems**.** *Volume 8; Issue 1*. 2020. Pages: 1-8.

[3] Evgeniy Bryndin. Cognitive Robots with Imitative Thinking for Digital Libraries, Banks, Universities and Smart Factories. *International Journal of Management and Fuzzy Systems*. V. 3, N. 5, 2017, pp 57-66.

[4] *Evgeniy Bryndin.* University Creative Mobility Inside Yourself and in Interaction with Social Environment. *Social Science Learning Education Journal, Vol 4, No 10, 2019. Page: 35 – 38.*

[5] *Evgeniy Bryndin.* Supercomputer BEG with Artificial Intelligence of Optimal Resource Use and Management by Continuous Processing of Large Programs. *International Journal of Research in Engineering, Vol. 1, Issue 2, 2019. Pages: 9-14.*

[6] *Evgeniy Bryndin.* Social Cognitive Smart Robots: Guide, Seller, Lecturer, Vacuum Cleaner, Nurse, Volunteer, Security Guard, Administrator. *Communications.* Volume 7, Issue 1. 2019. Pages: 6-12.

[7] *Evgeniy Bryndin.* Human Digital Doubles with Technological Cognitive Thinking and Adaptive Behaviour. *Software Engineering, Volume 7, Issue 1,* 2019. P. 1-9.

[8] *Evgeniy Bryndin*. Robots with Artificial Intelligence and Spectroscopic Sight in Hi-Tech Labor Market. *International Journal of Systems Science and Applied Mathematic*, V. 4, № 3, 2019. *Pages: 31-37.*

[9] *Evgeniy Bryndin.* Increased Sensitivity and Safety of Cognitive Robot by Development of Professional and Behavioral Skills. *International Journal of Research in Engineering. Volume-2, Issue-1, 2020.* Pages: 14-21.

[10] *Evgeniy Bryndin.* Collaboration of Intelligent Interoperable Agents via Smart Interface. *International Journal on Data Science and Technology, Vol. 5, № 4. 2019. Pages: 66-72.*

[11] *Evgeniy Bryndin*. Digital technologies of the industry 4.0. / Chepter 10, C. 201-222, Book: *Computer Science Advances: Research and Applications.* USA: Nova Science Publisher. 2019. 252 pages.

[12] *Evgeniy Bryndin.* Mainstreaming technological development of industrial production based on artificial intelligence. *COJ Technical & Scientific Research*, 2 (3). 2019. Pages: 1-5.

[13] *Evgeniy Bryndin*. Financial Turnover of Cyclical Economy by Reinvesting in Ecological Production of Its Savings. *J. Resources and Environmental Economics. Volume 2, №. 1. Singapore: Syncsci Publishing.* 2020. Pages: 96-101.

[14] *Evgeniy Bryndin.* Increase of Safety Use Robots in Industry 4.0 by Developing Sensitivity and Professional Behavioral Skills. American Journal of Mechanical and Industrial Engineering. *Volume 5, Issue 1, 2020.* Pages: 6-14.

[15] *Evgeniy Bryndin.* Formation Smart Data Science for Automated Analytics of Modeling of Scientific Experiments. *American Journal of Software Engineering and Applications. Volume 8, Issue 2, 2019. Pages: 36-43.*