PIONEER
ACADEMIC PUBLISHING LIMITED

Journal of World Economy
ISSN 2709-3999
www.pioneerpublisher.com/jwe
Volume 4 Number 4 August 2025

Creating Smart Manufacturing Based on AGI Twins and Interacting Intelligent Platforms

Evgeniy Bryndin[1]

[1] Research Center Natural Informatic, Novosibirsk, Russia
Correspondence: Evgeniy Bryndin, Research Center Natural Informatic, Novosibirsk, Russia.

doi:10.56397/JWE.2025.08.12

Abstract

Smart manufacturing using AGI twins and cross-platform management are advanced technologies that combine artificial general intelligence (AGI), digital twins and integration of various platforms to improve the efficiency and flexibility of manufacturing processes. AGI digital twins simulate real manufacturing processes, equipment and systems, allowing to predict failures, optimize operations and conduct scenario analysis. AGI digital twins can adapt to changes in the manufacturing environment, providing high accuracy and flexibility of management. Cross-platform management, firstly, ensures the integration of various systems and devices into a single management environment, secondly, centrally controls and coordinates all stages of production regardless of the technologies and platforms used, and thirdly, ensures real-time data exchange, increasing transparency and efficiency of decision-making. The use of AGI digital twins on a cross-platform basis allows you to create a flexible, scalable and smart manufacturing ecosystem. Such a solution helps to reduce downtime, improve product quality and reduce costs and provides the ability to quickly respond to changes in the market and customer requirements. Enterprises use AGI digital twins to model production scenarios and optimize logistics. Integration with management systems allows for automated production planning and control. The use of cross-platform solutions helps to unite factories, warehouses, and logistics chains into a single network.

Keywords: smart manufacturing, AGI digital twins, cross-platform management

1. Introduction

The creation of smart production based on AGI, twins and interacting intelligent platforms is aimed at transforming the industrial sector towards high automation, flexibility and intelligent adaptation. Below is an overview of the key components and methods for creating smart production.

1) AGI virtual models of physical objects, processes or systems in combination with AGI acquire the ability to autonomously learn, predict and optimize.

2) Interacting intelligent platforms provide data exchange, coordination of actions and joint decision-making between various components of production.

3) Key components of the system:

- AGI twins model equipment, lines and an entire workshop.

- Use sensory data and ontological information.

- Have the ability to self-learn and make decisions.

4) Cloud and local platforms:

- Provide storage, processing and exchange of data.

- Allow scaling of solutions.

5) Intelligent agents:

- Perform management, monitoring, planning.

- Interact with AGI doubles.

6) Integration of IoT and cyber-physical systems:

- Provide data collection and equipment management.

7) Methods and approaches.

Creation and implementation of AGI doubles:

- Develop virtual models based on data and sensor streams.

- Train models using AGI methods to predict failures, optimize processes.

Interacting platforms:

- Use of APIs, data exchange protocols and standards for system integration.

- Create distributed systems with autonomous agents capable of collaboration.

Self-learning and adaptation:

- AGI doubles are trained on current data, improving their models over time.

- Use of reinforcement learning methods to optimize decisions.

Centralized and distributed control:

- Create flexible systems capable of responding to changes in real time.

- Using cybersecurity to protect data and systems.

- Flexibility and adaptability: systems can quickly reconfigure to new conditions.

- Preventive maintenance: predict breakdowns and minimize downtime.

- Optimization of production: increase efficiency, reduce costs.

- Innovative opportunities: quickly launch new products and processes.

- Improving working conditions: automate dangerous and routine tasks.

8) Challenges and risks:

- Data and system security: the need to protect against cyberattacks.

- Ethical and legal issues: liability, privacy.

- Complexity of integration: combining different technologies and systems.

- Large investments: initial costs for development and implementation.

The creation of smart production based on AGI duplicates and interacting platforms is the next step in the evolution of industrial enterprises. This approach allows for an increase in automation, increased efficiency, reduced costs and sustainable development. Implementation requires strategic planning, investment and attention to security and ethics.

2. AGI Intelligence

AGI intelligence enables systems to perform a wide range of tasks at or above the human level. The key components of AGI intelligence include:

1) General Analysis and Understanding of Information:

- Ability to interpret a variety of data: text, images, sounds, sensory signals (Bryndin, E., 2024a).

- Understanding of context and semantic relationships.

2) Learning and Adaptation:

- Rapid acquisition of new knowledge and skills without the need for extensive preliminary training (Bryndin, E., 2025a).

- Adaptation to changing conditions and tasks in real time (Bryndin, E., 2025b).

3) Complex Problem Solving:

- Analytical skills to find solutions in uncertain and complex situations (Bryndin, E., 2022).

- Use of logic, deduction, and induction.

4) Creative Thinking:

- Generating new ideas, concepts, and alternative approaches.

- Innovative problem solving and creation of new products or methods (Bryndin, E., 2025c).

5) Language and communication interaction:

- Fluent understanding and generation of natural language.

- Effective interaction with people and other systems (Bryndin, E., 2023a).

6) Planning and forecasting:

- Developing strategies to achieve goals (Bryndin, E., 2024b).

- Modeling future scenarios and predicting consequences.

7) Reflection and cognitive skills:

- Ability to evaluate one's own knowledge and mistakes (Bryndin, E., 2024b).

- Continuous improvement of one's methods and approaches.

8) Emotional intelligence (optional, in promising models):

- Recognizing and responding to people's emotional states.

- Effective interaction and establishing trust.

These abilities make AGI a versatile tool capable of performing a wide range of tasks in various fields — from science and technology to art and interpersonal interaction. At present, the development of AGI is still at the stage of research and experiments. The creation of AGI systems with a full set of human intellectual abilities requires significant scientific research into the manifestation of the brain through consciousness, the mathematical Universe, the system of axioms of natural intelligence, and intellectual metalanguage.

2.1 Brain Manifestation Through Consciousness

Brain manifestation through consciousness is a complex topic that concerns how physiological processes in the brain manifest themselves in subjective experience and perception of reality. Here are the main ideas and concepts related to this issue:

1) Brain manifestation through consciousness. The neural networks of the brain, their activity and interactions create internal experiences, thoughts, feelings and perceptions. In this sense, brain manifestation through consciousness is the process by which physical processes are transformed into subjective experience.

2) Creational consciousness and manifestative brain. Consciousness exists as a more fundamental reality, and the brain is its manifestation or expression in material form. In this view, the brain is the way in which consciousness manifests itself and interacts with the physical environment.

3) Practical Manifestation of the Brain on the practical level, brain activity manifests itself in behavior, speech, movement and response to stimuli. These manifestations allow us to judge the internal state associated with brain activity.

4) In general, the manifestation of the brain through consciousness speaks of a close connection between the physical processes in the brain and subjective experience. By exploring and understanding this connection, scientists and philosophers seek to uncover the nature of human perception, thought, and self-awareness.

2.2 Mathematical Universe

The Mathematical Universe suggests that the entire world around us can be described using mathematical structures, formulas, and laws. Reality is essentially nothing more than a manifestation of mathematical principles, and all physical phenomena, from the movement of planets to quantum processes, can be explained through mathematics. This concept is supported by many modern theories, such as string theory or the hypothesis of the mathematical nature of the universe, which suggests that mathematics is the fundamental basis for the existence of everything that exists. The application of mathematics and its laws helps to understand the structure and structure of our universe on a formal level.

2.3 System of Axioms of Natural Intelligence

The system of axioms of natural intelligence is a set of fundamental postulates and principles underlying the understanding and modeling of human intelligence. Such axioms serve as a starting point for the development of theories, algorithms, and systems of artificial or natural intelligence, helping to define the basic properties, structures, and functions of mental processes. Within this system, provisions on the ability to learn, perceive, remember, solve problems, communicate in language, and reflect may be included. The construction of a system of axioms of natural intelligence contributes to the formalization of knowledge about how the human mind works and the development of technologies that imitate or support intellectual activity.

Formalization of human intelligence is the process of creating systematic, mathematical, and logical models that describe various aspects of human intelligence. This approach allows for objective analysis and comparison of cognitive abilities, such as logical thinking, creativity, emotional intelligence, social skills, memory, and learning. This task involves developing theories and algorithms that seek to represent complex mental processes in the form of formal structures and rules. This is important for the development of artificial intelligence, machine learning, and the creation of systems capable of imitating or supporting human thinking. Formalization of intelligence contributes to a deeper understanding of the nature of the human mind and expands the possibilities for its modeling and development.

Formalized axioms for the artificial general intelligence (AGI) model take into account many intellectual aspects: perception, learning, reasoning, initiative, motivation, erudition, adaptation, reflection, ontology of knowledge and skills, multimodality, ethical standards, safety and others. Below are the formalized basic axioms that serve as the basis for creating the AGI model.

1) Axiom of Universality (Generality).

The ability of AGI to learn and adapt to any tasks and environments, within its capabilities, given the appropriate data and resources. Formally, for any set of problems (T), there exists an algorithm \(A \) such that [forall t in T, quad text{AGI}(t) text{ can learn or solve } t text {using} A.]

2) Axiom of Perception and Sensory Data.

AGI is able to receive, interpret, and integrate sensory data from the environment. Formally, for any sensory system \(S), there exists a mapping [text{Perception}: S rightarrow text{StateSpace], where State Space is the space of the internal representation of the world.

3) Axiom of Memory and Knowledge Storage.

AGI has long-term and short-term memory for storing information and experience. Formally, there are many data structures (M_{short}) and (M_{long}) such that: [forall text{ event } e, exists text{ record } r in M_{long} cup M_{short}, text{ associated with } e].

4) Axiom of Reasoning and Planning.

AGI is able to formulate hypotheses, draw conclusions, and make plans to achieve goals. Formally, there is a logical system (L) such that [text{AGI} vdash text{goals} Rightarrow text{builds a plan } P text{that leads to the fulfillment of goals}].

5) Axiom of Self-Improvement of Erudition.

An erudite AGI continuously develops itself, improving its models and strategies. Formally, [text{Update}: text{AGI} rightarrow text{AGI}^{prime} quad text{such that} quad text{quality of task performance} uparrow].

6) Axiom of Ethics and Safety.

AGI must observe ethical principles and ensure the safety of interactions with people and the environment. Formally, for all actions (a \), [text{if } a text{ violates an ethical rule } R, text{ then } text{AGI}(a) text{ avoids or rejects } a].

7) Axiom of motivation.

AGI has internal or external motivations that can initiate actions in accordance with goals and values. Formally, [exists text{ motivation function } M, quad text{such that} quad text{ Action } a text{ is initiated by } M text{ given conditions } C].

These basic axioms give an idea of the intelligent characteristics of AGI. In reality, formalization accelerates the creation of a full-fledged practical model of AGI. The basic axioms are presented in an intelligent metalanguage.

2.4 Intelligent Metalanguage

Intelligent metalanguage serves as a tool for formalizing human intelligence, for reflecting on the structure, rules, and meaning of languages, as well as for formalizing concepts, axioms, logical connections, and rules of interpretation. In the context of science, logic, and linguistics, intelligent metalanguage allows for a precise and unambiguous description of the properties and rules of operation of the human intellectual abilities being studied, as well as for formulating hypotheses and theories about the nature of language and thinking. For example, mathematics and logic use special formal metalanguages to determine the properties of mathematical systems and formal languages.

Modern intelligent metalanguages are used to describe, analyze, and model artificial intelligence systems, including general-purpose systems (AGI), as well as to formalize knowledge, logic, rules, and structures in various fields of science and technology. They allow the creation of universal descriptive frameworks, ensuring interaction between various system components and promoting the development of more complex and flexible intelligent solutions. Some examples of modern intelligent metalanguages and approaches:

- OWL (Web Ontology Language) — ontology languages used to model knowledge within the Semantic Web and artificial intelligence.

- RDF (Resource Description Framework) — a standard for representing metadata and related information.

- Logic-based metalanguages — such as Description Logics, used to formalize knowledge and ontologies.

- Models based on languages such as JSON-LD or YAML — for describing data structures and metadata in a flexible and extensible form.

- Formal modeling languages such as UML, used in systems engineering and design of complex systems.

Modern intelligent metalanguages continue to evolve, integrating new ideas from formal methods, machine learning, natural language processing, and cognitive science, making them an important tool for building complex, adaptive, and explainable intelligent systems.

Using metalanguage to formalize human intelligence promotes a deeper understanding and systematization of knowledge, thinking, and communication based on AGI.

Let us highlight the main principles that are used in developing the AGI model.

1) Understanding and modeling the surrounding world:

- AGI should be able to model the surrounding reality, predict events, and draw conclusions.

- The model should include an understanding of physical, social, and abstract aspects of the world.

2) Language ability and communication:

- AGI should have the ability to understand and produce natural language to effectively interact with people.

3) Multimodality and integration:

- AGI should process and integrate information from various sources (visual, auditory, textual, and others).

4) Efficiency and resource management:

- AGI should make optimal use of computing resources and energy.

5) Self-awareness and metacognition:

- Ability to reflect and evaluate one's own state and thought process.

6) Flexibility and resilience:

- Ability to adapt to new conditions and maintain performance under change.

7) Continuous evolution:

- AGI should have mechanisms to expand its capabilities and knowledge without losing stability.

These principles are guidelines and hypothetical foundations used by scientists and engineers to design AGI. In practice, their implementation requires significant research and technical advances based on the intelligent AGI metalanguage.

AGI metalanguage is a formal language used to describe, model, and analyze systems with general-purpose intelligence comparable to human intelligence. Such a metalanguage serves as a tool for defining the structures, rules, and concepts needed to build and understand AGI systems, and to discuss their properties, behavior, and interactions. Key characteristics of an AGI metalanguage include:

1) Generality: capable of describing a wide range of tasks, knowledge, and skills inherent in human intelligence.

2) Abstractness: allows modeling concepts, paradigms, logical relationships, and strategies.

3) Multilevel: includes the levels of description needed for complex analysis of AGI systems.

4) Flexible and extensible: adapts to new knowledge, methods, and architectures in field of AGI.

In the context of AGI development, a metalanguage helps formalize requirements, architectures, learning algorithms, and metadata, ensuring coordination between different components of the system and promoting a deeper understanding of the mechanisms of general intelligence. Using an AGI metalanguage promotes a deeper understanding and effective development of complex information systems and intelligent technologies.

3. AGI Twin Communication

AGI twin communication refers to the creation and use of virtual digital replicas that facilitate interaction, knowledge and data sharing, and collaboration to achieve common goals. This approach has the potential to expand AGI capabilities, improve efficiency, and enable more complex interaction scenarios. The following are key aspects related to AGI twin communication:

1) AGI twins:

- Can function independently or in teams (Bryndin, E., 2025c).

- Can simulate specific aspects of human intelligence or perform specialized tasks (Bryndin, E., 2025c).

2) Communication formats and mechanisms:

- Data transfer via API protocols, interprocess communication, or distributed systems.

- Use of information exchange standards such as JSON, Protocol Buffers, or custom-built formats.

3) Collaborative learning and knowledge sharing:

- AGI twins can share training data, analysis results, or strategies to accelerate the evolution of the overall system.

- Implementation of collective learning mechanisms, where the knowledge of one agent helps others.

4) Distributed systems and cloud platforms:

- Use of cloud infrastructures for scaling and high availability.

- Providing synchronous or asynchronous information exchange between twins.

5) Security and ethics:

- Protection of transmitted information from unauthorized access.

- Ensuring transparency of interaction and control over data exchange.

6) Application examples:

- Cooperative robots or virtual assistants interacting to perform complex tasks.

- Models for supporting decision-making in real time.

- Educational systems and simulations, where different AGI twins model different scenarios.

7) Challenges and prospects:

- Ensuring data consistency and integrity.

- Development of communication standards and interaction protocols (Bryndin, E., 2025d).

- Scalability and management of a large number of twins.

Information communication between AGI twins is an important element in the development of the collective and distributed artificial intelligence section, allowing for the creation of more flexible, scalable and powerful systems.

4. Collective Communication of AGI Digital Twins

Collective Communication of AGI Digital Twins combines advanced artificial intelligence technologies, virtual representations, and social interaction. Below is a brief description and key aspects of this topic:

1) AGI and Digital Twins:

- AGI (Artificial General Intelligence) is capable of performing any intellectual tasks inherent to a human.

- Digital Twins are virtual models of real objects or systems created for modeling and interaction on a digital platform.

2) Collective Communication of AGI Digital Twins:

- Interaction between several AGI digital twins for joint problem solving.

- Creation of networks of digital twins that interact with each other and with people, forming collective systems.

- Providing knowledge sharing, coordination of actions, and joint learning.

3) Use Cases:

- Modeling complex systems (e.g., cities, ecosystems) using ensembles of digital twins.

- Support for real-time decision-making based on collective data.

- Creation of virtual AGI ensembles of digital twins for performing multi-tasking projects.

4) Technological and ethical aspects:

- Ensuring reliability and security during interaction of collective AGI digital twins.

- Ethical issues of control and responsibility for the actions of digital twins (Bryndin, E., 2024c).

- Issues of privacy and data protection in collective communication systems.

5) Development prospects:

- Improving the capabilities of collective AGI digital twins for complex tasks.

- Integration with human society and increasing the efficiency of collaboration.

- Possibility of creating self-developing systems that learn from collective data.

5. Building an AGI Platform

Building an AGI platform requires a multidisciplinary approach that combines machine learning, cognitive science, neuroscience, linguistics, and other disciplines. The key steps and aspects to consider when developing such a platform are listed below:

1) Research and conceptualization:

- Define the goals and requirements of AGI.

- Analyze existing technologies and approaches (e.g. deep learning, symbolic systems, hybrid models).

2) System architecture:

- Design a modular architecture that allows integrating different components (language understanding, perception, planning, learning).

- Implement memory and self-reflection mechanisms.

3) Learning and development:

- Create training environments and data to develop intelligence.

- Use reinforcement learning, unsupervised learning, and other approaches.

4) Cognitive integration:

- Implement elements that mimic human perception, reasoning, learning, and interaction.

5) Ethical and security aspects:

- Development of security protocols and ethical standards.

- Ensuring transparency and controllability of the system.

6) Testing and iterations:

- Continuous testing of the platform for performing tasks that imitate human intelligence.

- Iterative improvement based on the results.

7) Technological infrastructures:

- Use of powerful computing resources (clusters, cloud platforms).

- Development of software and tools for development and testing.

8) Leading AI Agent Platforms:

AGI Layer

Best for: Orchestrating AGI ready agents across teams and tools (Fulton, M., 2025).

Expertly crafted prompt-chaining workflows that automate ChatGPT and other LLMs with web/browser tool execution agilayer.com+1agilayer.com+1.

Supports multi-agent orchestration, reasoning, planning, and memory integration.

Seamlessly connects to browsers, APIs, and enterprise systems—ideal for internal tools and scalable agent pipelines.

Suited for both prototype experimentation and enterprise deployment, with built-in AGI acceleration workflows (like GPT-4 and AutoGPT compatibility).

Lindy

Best for: No-code multi-agent workflows across marketing, support, operations.

Highlights: 2,500+ integrations (Pipedream), 4,000+ data connectors, praised as "less like a tool and more like a team" (lindy.ai).

OpenAI Operator

Best for: Developer-focused custom agents.

Highlights: Flexible API orchestration, multi-step workflows—ideal for technical teams (multimodal.dev).

IBM watsonx

Best for: Enterprise-grade AI solutions with customizability.

Highlights: Fine-tuning, private data control, strong governance—designed for regulated industries (en.wikipedia.org).

Move works

Best for: IT/HR support with enterprise integration.

Highlights: NLU-powered automation in Slack/Teams/ServiceNow; recently acquired by ServiceNow for $2.9B (multimodal.dev, en.wikipedia.org).

SnapLogic Agent Creator

Best for: Workflow automation & data integration.

Highlights: Visual workflows, hybrid cloud support, connects AI agents with enterprise systems.

Fuse Base

Best for: Internal portals with AI assistant support.

Highlights: Customizable AI agents, uses Model Context Protocol for deep integrations.

Amelia

Best for: Conversational AI in customer service and contact centers.

Highlights: Generative and cognitive intelligence; proven deployments in large enterprises.

Building AGI platforms is a long-term project that requires collaboration between leading scientists and engineers, as well as significant resources. It is important to remember the need for an ethical approach and responsibility when developing such systems.

6. Creation of Integrative Intelligent Digital Platforms

Creation of integrative intelligent digital platforms is a complex process of developing modern information systems that combine various technologies and data to ensure automation, analytics and decision-making in various fields of activity (Raatikainen, P., 2025; Bhutada, T., 2025; ONEiO Cloud, 2025). The key aspects and stages of this process are presented below:

1) Requirements and goals analysis:

- Defining the tasks and functions of the platform

- Identifying key users and stakeholders

- Assessing business processes and information needs

2) System architecture and design:

- Designing a modular, scalable architecture

- Integrating various data sources (databases, IoT devices, cloud services)

- Ensuring protocol compatibility and standardization

3) Using modern technologies:

- Artificial intelligence and machine learning for analytics and forecasting

- Big Data for processing large and heterogeneous data

- Cloud computing for flexibility and availability

- APIs and microservices for integration with external systems

4) Intelligent functions:

- Automatic data processing and analysis

- Recommendation and decision systems

- Predictive analytics and scenario modeling

- Intelligent monitoring and management

5) Security and data management:

- Information protection and compliance with privacy standards

- Access management and authentication

- Ensuring reliability and fault tolerance

6) Implementation and testing:

- Gradual integration of components

- User training and system setup

- Conducting test runs and refinement

7) Support and development:

- Monitoring platform operation

- Updating technologies and expanding functionality

- Ensuring scalability and adaptability to new requirements

8) Application examples:

- Intelligent production management systems

- Cloud platforms for data analysis in medicine or finance

- Intelligent urban information systems (smart city)

- Solutions for automating logistics and supply chains

Creating integrative platforms requires interdisciplinary knowledge in the field of information technology, data, systems engineering and business processes, as well as continuous innovation to improve the efficiency and competitiveness of organizations.

7. Creating AGI Smart Factories

Creating AGI smart factories is a complex and promising process that includes several key aspects:

1) Research and development of AGI:

- Developing universal algorithms that can learn and adapt to different tasks without the need for specialized models.

- Using learning methods with a small amount of data, as well as reinforcement learning and self-learning.

2) Integration with industrial infrastructure:

- Implementing AGI in production management systems, logistics, maintenance and other key processes (Othman, A., 2024).

- Creating interfaces for AGI interaction with equipment, sensors and existing automation systems.

3) Ensuring safety and ethics:

- Developing mechanisms for controlling and monitoring AGI to prevent errors and undesirable consequences.

- Taking into account ethical aspects in automation and decision making.

4) Ensuring flexibility and scalability:

- Creating systems that can scale and adapt to changes in production.

- Use of cloud and IoT technologies to enhance capabilities.

5) Continuous learning and improvement:

- Enable AGI to continuously learn from new data and experiences.

- Implement self-learning and self-improvement methods.

The potential benefits of creating AGI for smart factories include increased efficiency, reduced costs, improved product quality, and faster adaptation to market changes (Heerey, M., 2025). However, it is also important to consider the security, ethics, and governance of such systems.

8. AGI Digital Twins Assets Management

AGI Digital Twins Assets Management covers modern approaches and technologies related to automation, optimization and control of production processes using artificial intelligence and virtual models. Below is a detailed description and key aspects:

1) Basic concepts:

- AGI capable of performing a wide range of tasks, including managing complex systems.

- Digital twins: virtual models of real objects, equipment or production lines, allowing monitoring, simulation and optimization of processes.

2) AGI Digital Twins Assets Management:

- Automation of production processes using AGI for planning, control and optimization of equipment operation.

- Digital twins collect data from equipment, and AGI analyzes it to predict breakdowns, plan preventive measures.

- Flexible production environment, automatic reconfiguration of lines and resources based on data analysis and company goals.

3) Technological components:

- IoT devices and sensors: collecting data on the condition of equipment and the environment.

- Cloud platforms and analytics: big data processing and modeling.

- Artificial intelligence and machine learning: process optimization, automated decision making.

- Virtual models (digital twins): simulation and testing of scenarios without risk to real production.

4) Benefits and challenges:

- Increasing efficiency and reducing costs.

- Increasing flexibility and adaptability of production.

- Improving product quality and reducing the time to introduce new products.

- Challenges: ensuring data security, integration with existing systems, high level of investment.

5) Ethical and management aspects:

- Responsibility for decisions made with the help of AGI.

- Ensuring transparency and trust in automated systems.

- Training personnel in new technologies and management of intelligent systems.

6) Development prospects:

- Integration of AGI digital twins into fully autonomous production chains.

- Development of self-managing systems capable of self-regulation and self-learning.

- Implementation of AGI digital twins of Industry 4.0 to create smart factories.

The implementation and application of digital twins in industry marks a paradigm shift in approaches to innovation, maintenance, and product release in various industries (Bryndin, E. G., 2023b; Bryndin, E. G., 2024d; Dilmegani, C., 2025). Digital twins, a key element of Industry 4.0, have proven themselves to be more than just a technical achievement; they represent a fundamental shift towards creating a more reliable, sustainable, and efficient manufacturing ecosystem. Their ability to offer predictive maintenance, real-time monitoring, and accurate modeling has significantly reduced costs and downtime, while increasing operational efficiency and without interrupting daily processes. AGI digital twin assistants have driven innovation in product personalization and design, allowing manufacturers to accurately and quickly adapt to ever-changing market needs.

9. Conclusion

The future of smart AGI manufacturing promises to revolutionize industry and manufacturing, opening up new opportunities for increased efficiency, flexibility, and sustainability. Creation of fully autonomous smart factories capable of independently adapting to changing demand and market conditions. AGI digital twins will be constantly improving, providing, firstly, dynamic optimization of processes and equipment use, secondly, connection of all devices and systems into a single network, allowing AGI to receive and process huge amounts of data in real time, thirdly, increasing the accuracy of control and decision-making based on data analysis. Rapid reconfiguration of lines and production processes to produce unique or small series of products. Using AGI for the rapid development of new products and solutions. Optimization of resource use, reduction of waste and energy consumption. Implementation of environmentally friendly technologies and materials using intelligent analysis. Application of standards and protocols for safe and ethical operation of AGI in the production environment. Creation of platforms uniting manufacturers, suppliers, and customers for collaboration and innovation. Development of "Production on Demand" and "smart contracts" models based on blockchain technologies.

In general, the future of smart AGI smart manufacturing is an integrated, self-learning and adaptive ecosystem that can radically improve industrial productivity, quality and sustainability. Such systems will form the basis of smart cities, smart factories and global supply chains of the future.

References

Bhutada, T. (2025). *Enterprise integration platforms: Making your business systems click*. https://exalate.com/blog/enterprise-integration-platform/

Bryndin, E. (2022). Multi-agent intelligent ensembles with professional competencies, pattern recognition and decision making. *Britain International of Exact Sciences Journal*, *4*(3), 172–181.

Bryndin, E. (2023a). Ensembles of intelligent agents with expanding communication abilities. *Acta Scientific Computer Sciences*, *5*(2), 44–49.

Bryndin, E. (2024a). Creation of multimodal digital twins with reflexive AGI multilogic and multisensory. *Research on Intelligent Manufacturing and Assembly*, *2*(1), 85–93.

Bryndin, E. (2024b). Creation of multi-purpose intelligent multimodal self-organizing safe robotic ensembles agents with AGI and cognitive control. *COJ Robotics & Artificial Intelligence (COJRA)*, *3*(5), 1–10. https://doi.org/10.31031/COJRA.2024.03.000573

Bryndin, E. (2024c). Formation of reflexive generative A.I. with ethical measures of use. *Research on Intelligent Manufacturing and Assembly*, *3*(1), 109–117.

Bryndin, E. (2025a). Self-learning AI in educational research and other fields. *Research on Intelligent Manufacturing and Assembly*, *3*(1), 129–137.

Bryndin, E. (2025b). Formation of motivated adaptive artificial intelligence for digital generation of information and technological actions. *Research on Intelligent Manufacturing and Assembly*, *4*(1), 192–199. https://doi.org/10.25082/RIMA.2025.01.006

Bryndin, E. (2025c). Formation of motivated adaptive erudite AI twin with reflexive multimodal ontology by ensembles of intelligent agents. *Research on Intelligent Manufacturing and Assembly*, *4*(2), 272–282. https://doi.org/10.25082/RIMA.2025.02.004

Bryndin, E. (2025d). International standardization safe to use of artificial intelligence. *Research on Intelligent Manufacturing and Assembly*, *4*(1), 185–191.

Bryndin, E. G. (2023b). Formation of a platform economy with an energy equivalent on the technological platform of the BRICS commonwealth. In *International scientific and practical conference "Scientific, technological and innovative cooperation of the BRICS countries"* (Issue 1, pp. 418–420). INION RAS.

Bryndin, E. G. (2024d). Sovereign intellectual platform economy on the BRICS+ platform. In *BRICS countries: Development strategies and cooperation mechanisms in a changing world: Proceedings of the Second international scientific and practical conference (June 5–7, 2024): Part 1* (pp. 443–447). Moscow Publishing House UMC.

Dilmegani, C. (2025). 15 digital twin applications/use cases by industry in 2025. https://research.aimultiple.com/digital-twin-applications/

Fulton, M. (2025, June). Cutting edge trends in AGI & AI agents. https://agilayer.com/cutting-edge-trends-in-agi-ai-agents-june-2025/

Heerey, M. (2025). Smarter factories, smarter futures: Manufacturing in 2025 and beyond. https://www.automation.com/en-us/articles/january-2025/smarter-factories-smarter-futures-manufacturing

ONEiO Cloud. (2025). Key enterprise integration patterns and platforms.

Othman, A. (2024). The rise of AGI: How industries will be transformed and what to expect after the summer of 2025 [Presentation]. https://doi.org/10.13140/RG.2.2.15215.55200

Raatikainen, P. (2025). *State of integration solutions in 2025*. https://www.oneio.cloud/blog/state-of-integration-solutions