American Journal of Applied Science and Technology

VOLUME Vol.05 Issue 10 2025
PAGE NO. 89-94
DOI 10.37547/ajast/Volume05Issue10-18

Analysis Of Technological Innovations And Advanced Technologies

B.J. Khursanov

Acting Associate Professor, Fergana State Technical University, Fergana, Republic of Uzbekistan

Received: 26 August 2025; **Accepted:** 22 September 2025; **Published:** 24 October 2025

Abstract: This article analyzes the importance of introducing technological innovations and advanced technologies into production systems, their impact on efficiency, and their role in creating competitive products. Innovative technologies allow enterprises to increase their technical potential, rationally use resources, and reduce production costs. The article also discusses the role of digital technologies, automation, artificial intelligence, 3D printers, and energy-saving equipment in modern industry. The introduction of advanced technologies has been analytically substantiated to increase the sustainability of production processes, product quality, and environmental safety.

Keywords: Technological innovation, advanced technologies, digital manufacturing, automation, artificial intelligence, efficiency, competitiveness, energy efficiency, modernization, industrial development.

INTRODUCTION:

At the current stage of the development of the world economy, competition in the market for mechanical engineering products is intensifying, because mechanical engineering is the basis of the economy - the main creator of capital. Various machines and equipment, vehicles, tools and aggregates, in the process of their operation, become the main capital of the economy and increase the country's production capacity. In order to maintain market share in an environment of increasing competition, mechanical engineering enterprises must solve a number of problems - to introduce new types of complex products with new consumer properties to the market and to improve their quality [1,2].

The purpose of the study

Our country occupies one of the leading positions in the world in terms of reserves and many types of minerals. At the same time, there is currently a serious lag in key economic indicators. Human capital, the quality of social institutions account for only 14% of the factors of economic development. The slow development of the real economy of our country does not allow it to take its rightful place in the world market.

Further development of the economy can only be achieved in conditions of sustainable development, the introduction of modern, innovative, advanced technological production. Sustainable development (SD) [1,2,3,4]:

- development that does not impose additional costs on future generations;

- development that ensures the continuous reproduction of productive capacity for the future, simple or expanded;

- development in which humanity must live only at the expense of natural capital.

The function of sustainable development:

$Ft (L, K, N, I) < Ft+1(L, K, N, I)$

Here:

L - labor resources, intellectual potential;

K - production potential, modern technologies, equipment, tools;

N - natural resources;

I - institutional factor, management capital;

t - time.

Natural resources (N) and relatively low-skilled (L) labor play a key role in the structure of the economy of Uzbekistan.

In the developed countries of the world, Gross Domestic Product (GDP) is created with the help of knowledge-intensive information technologies (I) and

a highly skilled workforce. This means that with less resource consumption, there is an increase in the volume of production of goods and services. Deep processing of raw materials to obtain products with high added value is relevant for the economy. This macroeconomic approach can be implemented through the creation of natural product chains (NPCs) [5,6,7,8,9].

For example, TMZ for oil: Oil → Petroleum products (gasoline, kerosene) → High molecular weight compounds (rubber…) → Plastic products (e.g. tires…).

At each stage of the TMZ, the processed products become more expensive (from 1 ton of crude oil, which costs 6,000 M soums / ton, plastic products can be obtained at a price of 80,000-100,000 M soums / ton). Such processing requires further development of technologies that create added value from the raw material direction of the economy, based on high scientific knowledge and high technologies. That is, the reason for its economic weakness is a very significant delay in the modernization of technological production [10,11,12,13].

METHODS

Therefore, the tasks of the economy at present are:

1. Formation of human capital as a special factor of economic development. (The greatest success is achieved by investing in people - education, new technologies and equipment, new knowledge related to organization and management).

2. Use of new technologies, new / improved technological processes.

3. Introduction of products with new consumer properties.

4. Improvement of production management, introduction of principles of economic institutional management [14,15,16,17].

RESULTS

Today, the formation of added value in the structure of the industry occurs mainly at the expense of raw material complexes, that is, the pace of economic growth is determined by external economic factors - prices and the situation on the foreign market for raw materials.

In such conditions, the main problem of the country's economy is the innovative and technical re-equipment of enterprises, and the dominant factor that creates the necessary conditions for this is the strengthening of the role of the country's scientific and technical potential and the development of mechanical innovation [18,19,20].

Special attention should be paid to improving the designs, production technologies, and raw materials used in mechanical engineering products, as they not only account for a large part of the cost of products, but also determine the properties of materials and their consumption [21,22,23].

For example,

1. The Russian-made EO-2621 excavator weighs 9 tons more than the Poklein (Germany) excavator of the same class,

2. The KB-405-2 tower crane is up to 26 tons heavier than its German counterpart, the Reiner tower crane,

3. The T-130M tractor weighs 730 kg more than its American counterpart, the D-7P tractor,

4. A KAMAZ truck consumes 3 tons of fuel per year to transport a load that is more than its own weight [1,2,3,24,25,26].

This is based on the problems observed in the practice of mechanical engineering technology and materials science, as well as in the field of mechanical engineering design, and in general, the problems of achieving full competitiveness in technological development. To ensure competitiveness in global and national markets, it is necessary to develop technologies based on the latest achievements of science, that is, to emphasize and actively engage in innovative activities.

The long-term goals of the development of science and innovation in the Republic of Uzbekistan are set out in two key government documents - the “Strategy for the Innovative Development of the Republic of Uzbekistan for 2019-2021” and the “Concept for the Development of Science until 2030” [1,2,27,28,29,30].

Factors of modern technology. Technology - art, craft, science - a set of knowledge about the methods and means of implementing production processes.

The main task of modern technologies is to increase the competitiveness of products in the world market. High-tech production allows you to obtain products with a new set of properties. The level of competitiveness of modern (high) technologies should be assessed by 3 factors:

1. Economic efficiency;

2. Quality of manufactured products;

3. Flexibility of the production process.

Table 1. Key factors of modern technologies

High efficiency	Scientific

Systematicity	Strength/Technical support
Stability and reliability	Provision of highly qualified personnel
Structural-parametric	Computerized
optimization	technological environment
Mathematical modeling	Ecological cleanliness

Economic efficiency - competitiveness in terms of economic indicators (labor productivity, cost, resource intensity, energy intensity, etc.).

Quality - a set of properties and characteristics of a product or service that make it possible to meet specific needs.

Production flexibility - the ability to quickly "re-adjust" the technological process, produce a new type of product, change its quality [2,3,31,32,33].

The concept of technology and types of industry. Translated from the Greek "techno" - skill, art; "logos" - science, teaching. So, literally "technology" is the science of craftsmanship. Technology is a set of knowledge about methods and means of conducting production processes in order to process natural products into finished products (consumer goods and means of production).

Technology also reveals the sequence of processes for changing the state, properties, and form of an object of labor in the production of a product. Therefore, technology is a description of production that reveals the essence, methods, and sequence of obtaining materials, semi-finished products, and products with specified properties and parameters from raw materials [3,4,34,35,36].

The diversity of industry also determines the types of technology. The development of technology is carried out mainly in production sectors (mechanical engineering technology, instrument-making, construction production, chemical production, etc.). Therefore, the technology of industrial production is determined by the characteristics of the sectors.

According to objective factors, the modernization of the industrial sector based on technological innovations is considered one of the main driving factors, out of 121 new technological products (technical results) created in the sectors of the real economy, 103 belong to the industrial sector [1,2,3,37,38].

Distinctive features of mechanical engineering

The role of industrial production in the economy is determined by the following:

- Over the past 100 years, industrial production has increased more than 50 times, 75% of which in the last 70 years.

- 350 million people work in the world's mechanical engineering sector.

- Shortage of all types of resources and, as a result, their price increases: Labor resources (increase in wages: in the automotive industry, 1 hour of work costs ~ more than 20 USD); Production equipment (the cost of a tandem press at the UzAuto Motors plant is ~ 100 million USD, so 1 job costs ~ 100 thousand USD); In the service sector of mechanical engineering, 7.5%~10% of workers work in auxiliary processes; Production is maximally computerized.Sanoat qiymatlari zanjiri juda ko'p sonli bog'lanishlardan iborat (ishlab chiqarish, dasturiy ta'minot, integratsiya, yig'ish, dilerlar, xizmat ko'rsatish tarmog'i) va uning ishtirokchilari doirasi juda keng [1,2,3,39,40,41].

Compared to other sectors, the mechanical engineering industry is characterized by:

– the highest level of internal research and development - 45% of enterprises,

– the highest share of new product introduction - 74% of enterprises,

– the second place after chemical and petrochemical enterprises in the introduction of new technologies (40%),

– carrying out internal research and design work - 45% of enterprises,

– the highest share of new product introduction - 74% of enterprises,

– the second place after chemical and petrochemical enterprises in the introduction of new technologies (40%),

– a high level of purchase of new equipment - 55% of enterprises,

– training and retraining of personnel - carried out in 46% of enterprises,

– the number of enterprises engaged in the acquisition of patents and licenses in all sectors is small, and in mechanical engineering it is 8% [1,2,4,42,43].

Features of the essence of innovation:

- The constant change of machine-building

products in connection with scientific and technological progress and global competition.

- Reduction of the life cycle of products and the stages of research, design and development of new products.

- The presence of a large number of various technological operations in the production process.

- High level of scientific intensity and structural complexity of the final product and the duration of technological preparation of production.

- The release of a new product at leading world enterprises is associated with large volumes of preliminary production (according to foreign researchers, up to 7-10% of sales).

- The need for strong personnel and a developed material and technical base of research and design activities (their importance is determined by the share of the cost of the experimental and laboratory base in the company's fixed assets)**.** As a result of the negative development of external and internal processes in the company, the costs of introducing technological innovations increase and it suffers significant losses [1,4,7,9,44,45].

The share of innovative products in any country can be high only with the appropriate level of development of education, science and import of technologies.

CONCLUSION

Technological innovations and advanced technologies are one of the most important development factors of the modern economy. They allow for the automation of production processes, efficient use of resources, improvement of product quality and environmental safety. Today, innovative approaches play a decisive role in creating competitive economic systems. In particular, digital technologies, artificial intelligence, automated control systems and energy-efficient equipment contribute to the sustainable and environmentally friendly development of industrial sectors. The introduction of advanced technologies into production processes not only increases efficiency, but also reduces errors related to the human factor, increases economic efficiency and strengthens the competitiveness of enterprises.

Proposals

1. Strengthening scientific and research activities - it is necessary to expand cooperation between higher education institutions, research centers and industrial enterprises to create new technologies and adapt them to local conditions.

2. Accelerating digital transformation - increasing efficiency through the introduction of IoT (Internet of Things), artificial intelligence and "Big Data" technologies in production processes.

3. Using energy-efficient technologies - expanding the use of energy-saving, waste-reducing and recycling systems in production.

4. Developing human resources - establishing a system of regular training and advanced training of technical and engineering specialists in advanced technologies.

5. Ensuring environmental safety - reducing the negative impact on the environment by complying with environmental standards in production processes and implementing waste-free technologies.

REFERENCES

1. "Innovation-2024" Sbornik nauchnyx statey Mejdunarodnoy nauchno-prakticheskoy konferentsiyu Tashkent, 2018, 296 p.
2. Агентство по инновациям и развитию [Электронный ресурс] URL: http://www.innoros. ru/.
3. Афонин В.Л. и др. Обрабатывающее оборудование на основе механизмов параллельных структур. - М. : Изд - во МГТУ Станкин , Янус, 2016. - 452с
4. Базаров Б.М. Модульные технологии в машиностроении. - М. Машиностроение , 2018 - 368с
5. Крыжановский В.А. , Кузнецов Ю.Н. , Валявский И.А. Технологическое оборудование с параллельной кинематикой . - Кировоград , 2004. - 449с.
6. Кузнецов Ю.М. Агрегатно - модульное технологическое оборудование. Справочник в 3-х частях. Ч.3. М.: - Имекс, 2014 . 442с . ,
7. Mamarizayev, I., & Abdunazarov, A. (2022). Multi-stage bubble extractor with increased contact time. Eurasian Journal of Academic Research, 2(7), 112-116.
8. Komilova, K. (2022). Texnologik jarayonda qo ‘llaniladigan qurilmalar tahlili. Eurasian Journal of Academic Research, 2(7), 106-111.
9. Хурсанов, Б. Ж., & Алиматов, Б. А. (2020). Экстракционное извлечение редких металлов из отвалов ГОК. Universum: технические науки, (6-1 (75)), 42-45.
10. Khursanov, B. J., & Abdullaev, N. Q. (2022). Influence on efficiency of gas quantity extraction

process. Eurasian Journal of Academic Research, 2(6), 321-324.

11. Khursanov, B. J., & Honkeldiev, M. A. (2022). Energy-saving bubble extractor with extended contact time. Eurasian Journal of Academic Research, 2(6), 115-117.

12. Khursanov, B. J. (2022). Methods for calculating the economic efficiency of new technology. World Economics and Finance Bulletin, 10, 112-116.

13. Хурсанов, Б. Ж., & Алиматов, Б. А. (2020). Экстракционное извлечение редких металлов из отвалов ГОК. Universum: технические науки, (6-1 (75)), 42-45.

14. Khursanov, B. J. (2022). Extraction of rare metals from mining dumps in bubbling extractors. American Journal Of Applied Science And Technology, 2(05), 35-39.

15. Хурсанов, Б. Ж., & Алиматов, Б. А. (2022). Исследование Взаимного Уноса Фаз В Барботажном Экстракторе С Увеличенным Временем Контакта. Central asian journal of theoretical & applied sciences, 3(5), 28-33.

16. Дусматов, А. Д., Ахмедов, А. Ў., Абдуллаев, З. Ж., & Гапаров, К. Г. (2022). Междуслоевые сдвиги двухслойных комбинированных пластин и оболочек с учетом усадки композитных слоев. Oriental renaissance: Innovative, educational, natural and social sciences, 2(4), 133-141.

17. Xursanov, B., Latifjonov, A., & Abdulhakov, U. (2021). Application of innovative pedagogical technologies to improve the quality of education. Scientific progress, 2(7), 689-693.

18. Xursanov, B., & Abdullaev, N. (2021). Fundamentals of equipment of technological processes with optimal devices. Scientific progress, 2(7), 679-684.

19. Xursanov, B., & Akbarov, O. (2021). Calculation of gas volume in the mixing zones of extended contact time barbota extractor. Scientific progress, 2(7), 685-688.

20. Алиматов, Б. А., Соколов, В. Н., Салимов, З. С., & Хурсанов, Б. Ж. (2003). Исследование распределения капель по размерам в многоступенчатом барботажном экстракторе. Журнал прикладной химии, 76(8), 1309-1311.

21. Karimov, I., Boykuzi, K., & Madaliyev, A. (2021). Volume-Surface Diameters of Drops in Barbotaj Extractor. International Journal of Innovative Analyses and Emerging Technology, 1(5), 94-99.

22. Xursanov, B. J., Mamarizayev, I. M. O., & Akbarov, O. D. O. (2021). Operation of mixing zones of barbotage extractor in stable hydrodynamic regime. Scientific progress, 2(8), 170-174.

23. Xursanov, B. J., Mamarizayev, I. M. O., & Akbarov, O. D. O. (2021). Application of constructive and technological relationships in machines. Scientific progress, 2(8), 164-169.

24. Xursanov, B. J., Mamarizayev, I. M. O., & Abdullayev, N. Q. O. (2021). Application of interactive methods in improving the quality of education. Scientific progress, 2(8), 175-180.

25. Isomidinov, A., Boykuzi, K., & Khonnazarov, R. (2021). Effect of Rotor-Filter Device Operation Parameters on Cleaning Efficiency. International Journal of Innovative Analyses and Emerging Technology, 1(5), 100-105.

26. Isomidinov, A., Boykuzi, K., & Madaliyev, A. (2021). Study of Hydraulic Resistance and Cleaning Efficiency of Gas Cleaning Scrubber. International Journal of Innovative Analyses and Emerging Technology, 1(5), 106-110.

27. Алиматов, Б. А., & Хурсанов, Б. Ж. (1998). Расчет величины отстойной зоны барботажного экстрактора. Науч. техн. журн. Ферг. политехн. ин-та. Фергана, 1(2), 86-89.

28. Alimatov, B., & Khursanov, B. (2020). Analysis of droplets size distribution and interfacial surface during pneumatic mixing. Asian Journal of Multidimensional Research (AJMR), 9(6), 165-171.

29. Алиматов, Б. А., Соколов, В. Н., & Хурсанов, Б. Ж. (2001). Влияние газосодержания на производительность барботажного экстрактора по тяжелой жидкости. НТЖ ФерПИ, Scientific-technical journal (STJ FerPI), 2, 93-94.

30. Ахунбаев, А. А., Туйчиева, Ш. Ш., & Хурсанов, Б. Ж. (2020). Учёт диссипации энергии в процессе сушки дисперсных материалов. Universum: технические науки, (12-1 (81)), 35-39.

31. Дусматов, А. Д., Хурсанов, Б. Ж., Ахроров, А. А., & Сулаймонов, А. (2019). Исследование напряженно деформированное состаяние двухслойных пластин и оболочек с учетом поперечных сдвигов. In Энерго-ресурсосберегающие технологии и оборудование в дорожной и строительной отраслях (pp. 48-51).

32. Мирзахонов, Ю. У., Хурсанов, Б. Ж., Ахроров, А. А., & Сулаймонов, А. (2019). Применение параметров натяжного ролика при

теоретическом изучении динамики транспортирующих лент. In Энерго-ресурсосберегающие технологии и оборудование в дорожной и строительной отраслях (pp. 134-138).

33. Алиматов, Б. А., Садуллаев, Х. М., Каримов, И. Т., & Хурсанов, Б. Ж. (2008). Методы расчета и конструирования жидкостных экстракторов с пневмоперемешиванием.

34. Khursanov, B. J. (2022). An Innovative Approach to the Design of Technical and Technological Processes of Production. Eurasian Research Bulletin, 11, 15-19.

35. Khursanov, B. J. (2022). The Factors of Ensuring Sustaining Manufacturing Competitiveness. Eurasian Journal of Engineering and Technology, 9, 93-100.

36. Yusupova, N. X., & Nomoanjonova, D. B. (2022). Innovative technologies and their significance. Central asian journal of mathematical theory and computer sciences, 3(7), 11-16.

37. Mamarizayev, I., & Abdunazarov, A. (2022). Multi-stage bubble extractor with increased contact time. Eurasian Journal of Academic Research, 2(7), 112-116.

38. Khursanov, B. J. (2023). Factors of Preparation of HighQuality Clinker in Rotary Kilns. Eurasian Research Bulletin, 17, 73-77.

39. Khursanov, B. J., & Mirzaev, D. B. (2023). Use of digital technologies in improving educational processes of technological machines and equipment specialists. Science and innovation, 2(Special Issue 3), 565-567.

40. Khursanov, B. J. (2023). An innovative approach to the design of technical and technological processes of agricultural products production and increasing the technical level. European Journal of Emerging Technology and Discoveries, 1(2), 93-100.

41. Tojimatovich, K. I., & Jurakuziyevich, K. B. (2023). Hydrodynamics of fluid transmission capacity of bubble extractor filter. European Journal of Emerging Technology and Discoveries, 1(2), 80-85.

42. Khursanov, B. J. (2023). Improvement of Educational Processes in Specialized Subjects Based on Digital Technologies. European Science Methodical Journal, 1(3), 18-23.

43. Б.Дж. Хурсанов. (2023). Методы анализа технологических систем переработки энергии. Евразийский исследовательский вестник, 21, 87-92.

44. Хурсанова Бойкузи Журакузиевич. (2023). Гидродинамика перемешивания жидкостей в барботажных экстракторах. European Journal of Interdisciplinary Research and Development, 21, 161–166.

45. Khursanov, B. J. (2023). Natural geographical and geoecological problems and their solution. International Journal of Advance Scientific Research, Germaniya,3(11), 296-301.