A PLATFORM FOR BASIC SCIENCE AND INNOVATION IN SUSTAINABLE DEVELOPMENT

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Abstract

The UNESCO between July 2022 and July 2023 with collaboration global partners has celebrated International Year of Basic Sciences for Sustainable Development where recognizes that basic sciences are vital to achieving sustainable development and improving the quality of life for people around the World. In this regard, it was considered by the National Academy of Sciences of Azerbaijan reform in the system of innovative economy and organization of science: transition from classical projects to system projects. In this chapter is considered options of approach how basic science can be play important place in the future science development [1]. In the meantime, it is necessary to create appropriate environment for enhancement capacity building in basic science which has to be undertaken for future science jumping for achievement of high results.

Keywords

Basic science, development, capacity building, science and education, scientific commercialization

Introduction

The Azerbaijan National Academy of Sciences today contains:

- Department of Physical and Mathematical and Technical Sciences;
- Department of Chemical Sciences;
- Department of Earth Sciences;
- Department of Biological and Medical Sciences;
- Department of Humanities; and
- Department of Social Sciences.

Within the framework of such an infrastructure, it is intended to implement five main areas: the integration of fundamental science and other scientific fields:

Physical-mathematical and engineering sciences:

- development and implementation of functional materials with high efficiency;
- development of artificial intelligence technologies, cybersecurity and the sustainability of society in the context of digital transformations;
- development of scientific and theoretical foundations of energy security and energy conversion processes;
- development of methods and algorithms; and
- expansion of research in the field of nuclear physics and high energy.

Chemical sciences:

- increasing an efficiency of oil refining and petrochemical processes;
- development and production of low-tonnage chemical products, including specialized products;
- synthesis of physiologically active substances; and
- new topological materials, a sneak property for the creation of high-tech polymers.

Earth Science:

- monitoring of geophysical and geodynamic processes;
- global and regional environmental changes; and
- formation of global and regional environmental changes, mineral deposits.

Biology and Medicine:

- application of digital, bio-, nano- and postgenomic technologies;
- genomic, proteomic and metabolomic studies;
- problem solution in food and food security;
- human health and biodiversity;
- molecular genetic research of the population of Azerbaijan;
- biomedicine, neurobiological and gerontological research;
- methods of mechanization and artificial use intelligence in biology; and
- agriculture and medicine, green energy.

Humanities and social sciences:

- study of ethnogenesis, archelogy, ethnography, language, folklore, literature, ancient manuscripts, culture, art, national architectural schools, the history of the Azerbaijani people based on modern challenges, modern theoretical and methodological views, including Azerbaijani principles;
- writing the history of Azerbaijani literature on the concept of a new transformation, Azerbaijan's study of the scientific and theoretical foundations of the idea of Azerbaijanism; and
- concept of multiculturalism, studying various problems of philosophy of the world, conducting research in the field of oriental studies and Caucasian studies, sociology.

The report submitted by the Presidium of Azerbaijan National Academy of Sciences (ANAS), in particular, where the main scientific results reflected in the report, show once again that in the reporting period of the year fundamental scientific research was carried out, which laid the foundation for the continuous development of science in all fields. These results reflect the goal of UNESCO's decision to declare the Year of Basic Sciences for the 2022 International Progress for Sustainable Development at the Main Conference.

Achievements

The main goal of this solution is to demonstrate the decisive role of basic scientific research in the sustainable development of the World. Taking this approach into consideration Institute of Physics of the Ministry of Science and Education, the leading center for basic research in the field of physics, invited scientific and educational institutions to integrate efforts in this area. The purpose of joint activity is to support basic research projects that are important for the country. It has been identified development of semiconductor heterostructures used in high-frequency cycles and optoelectronics as a new direction of the Institute.

The concept of sustainable development consists of three main components:

- ecology;
- social; and
- economic.

Currently, ecological direction is considered one of the most important. This direction is based on the principle of harmonizing the natural needs of mankind with the natural capabilities of the biosphere. Ignoring this principle could lead to the situation described in the documents of the 1992 Rio de Janeiro Conference. It noted that "we can be the last generation to have a chance to save our planet." As a result, sustainable development is possible only when economic activity does not go beyond the ecological sustainability of the ecosystem.

Today, the technological environment is an extraordinary energy user. Thus, according to the international energy agency, in order to form a digital economy in 2025, the need for energy of the info-communication network will amount to 30% of the electricity produced in the world. Taking into account this fact an emergence of new energy technologies can only occur on the basis of fundamental research and based on this AMEA degree dated May 20, 2021 on the creation of Scientific Councils on "Alternative and Renewable Energy Sources." It contains:

- current scientific and technological problems;
- provision of flexible and professional discussions on scientific and organizational issues;
- problems of science and technology; and
- in order to provide scientific support for issues related to energy supply within the country, especially in territories liberated from occupation.

Along with the fundamental studies defined by the internal logic of the country's development, which create the possibility of timely assessment of the risks causing scientific and technological development, joint applied studies, which are their main organizers, should also be noted [2]. It should be indicated an opinion of famous scientists that there is no fundamental and applied science. All real science is applied. The difference is that some scientific results are applied immediately, and some - after 10 years or more.

The scientific environment is an exceptional area of activity, largely determined by the purpose of science related to the acquisition of new knowledge about the laws of nature and the laws of development of society. Nobel laureate Richard Feynman considered "the most important requirement for true fundamental science the need for integrity. This is a very difficult term to translate. Translations from the dictionary: integrity – wholes, safety, reliability and correctness of data, observance of ethical principles, honesty, high moral qualities. " These criteria are difficult to meet but grants and funding tend to get better minds. In addition, in modern science, serious scientific results can be obtained most often at the junctions of scientific areas by teams of specialists who represent different scientific disciplines.

Today we sometimes meet such thoughts that it is difficult to afford to invest in science, that supporting research is somehow a luxury in moments defined by needs. This is a fundamentally flawed approach. Science is more important for the prosperity, safety, health, environment and quality of life of all mankind.

The pandemic as a result of COVID has become a test of all mankind. Obviously, this is a cause for concern and requires increased combat readiness to minimize risks. It is necessary to use all the resources necessary to quickly and effectively respond to events related to the pandemic. Fundamental sciences in the field of medicine play an important role in this matter, which has been achieved in this area. Thanks to such an achievement, humanity will learn the importance and invalidity of the achievements of basic and applied sciences.

It should be indicated that the pandemic has demonstrated the importance of achievements not only in the field of medical science, but also in many scientific areas, requiring the integration of a number of scientific disciplines.

There is one aspect needed to be pointed out: the ability to address public health issues of this magnitude depends heavily on the work of the scientific and medical community. And this is another example of why we cannot allow a slowdown in the development of science.

It is important to consider that US President George Herbert Walker Bush in his speech in the National Academy of Sciences Annual Meeting taken place in April 27, 2009 stressed that the Federal Funding for Physical Sciences as part of Gross Domestic Product has fallen by almost half in the last quarter of a century. As he noted, over and over again we have allowed us to deny a tax loan for research and experiments, which helps businesses grow and innovate. The consequence of this facto is not immediately heard, it finds its non-negative not immediately, but after some time. In certain situations, we miss the fallacy of this approach, which is very difficult to fix and sometimes with tragic consequences.

It should be noted that some of the world's leading countries have committed themselves to leading the world in the field:

scientific and technical innovations;

- invest in education;
- scientific research;
- engineering;
- set a goal to achieve space technology and science; and
- engaging all citizens in this historic mission.

Countries that invest more in the development of fundamental and applied science are growing and growth indicators share of national income. As Bush noted in his speech: I am here today to set this goal: we will allocate more than 3 percent of our GDP for research and development. We will exceed the level achieved at the height of the space race, through policies that invest in basic and applied research, create new incentives for private innovation, promote breakthroughs in energy and medicine, and improve education in mathematics and science [3].

This is the greatest commitment to scientific research and innovation in the world:

- the basic science opens an opportunity to create solar cells as cheap as construction paint;
- green buildings that produce all the energy they consume;
- training software effective as a personal tutor prosthetics are so advanced that you can play the piano again;
- artificial intelligence and machine learning; and
- expanding the boundaries of human knowledge of ourselves and the world around us.

The desire for the development of basic science contributed to prosperity and success. The commitments we make today will contribute to our success in the bugbear. This is how we will ensure that our children and their children look back at the work of our generation as one that has defined progress and ensured the prosperity of future generations. These actions begin with a historical commitment to basic science and applied research, from the laboratories of prominent universities to the implementation of innovative ideas.

It should be considered that the study of a specific physical, chemical or biological process may not pay off within a year, decade or at all. And when this happens, the awards are often widely shared, they are used by those who bear its costs, as well as those who did not contribute to the process at all.

That is why the private sector tends not to invest enough in basic science, and why the public sector should invest in this kind of research - because while the risks can be large, so can the rewards for the economy and society as a whole.

No one can predict which new applications will be born from basic research, such as:

- new treatments in our hospitals;
- new sources of efficient energy;
- new building materials;
- new types of crops that are more resistant to heat and drought;
- new approach of basic studies in the photovoltaic field to develop solar panels;
- new approach of basic research in physics to achieve production of the CAT scans;
- new approach of application of Einstein equations in modern GPS technology for the geo-positioning systems based on satellite technology.

The US views the approach in such a way that it doubles the budget of key institutions, including the National Science Foundation, the main source of funding for academic research; and the National Institute of Standards and Technology, which supports a wide range of activities - from improving health information technology to measuring carbon pollution - from testing smart network designs to developing advanced manufacturing processes.

As the result budget doubles funding for the Department of Energy's Office of Science, which builds and operates accelerators, colliders, supercomputers, high-energy light sources and means to make nanomaterials - because the nation's potential for scientific discovery is determined by the tools it provides to its researchers.

It is necessary to indicate that any country's renewed commitment will depend on more than just public investment. This commitment extends from the lab to the market. So, the state budget makes tax credits for research and experimentation permanent. This is a tax credit that returns two dollars to the economy for every dollar that is subsequently spent, helping companies afford the often high costs of developing new ideas, new technologies and new products.

It should be noted that by making this loan permanent, it enables businesses to plan projects that create jobs and economic growth. This fact plays a significant role in stabilizing society as a whole [4].

Secondly, in no area will innovation be more important than the development of new technologies for the production, use and saving of energy - this is why leading countries tend to commit to developing a clean energy economy of the 21st century.

Our future on this planet depends on our willingness to address carbon pollution. And our future depends on our willingness to accept this challenge as an opportunity to lead the world in striving for new discoveries through the development of the fundamental sciences.

It should be noted that the existing competition between the United States and the former Soviet Union was the source of the development of science and technology in the world as a whole. It should be noted that the launch of the first satellite by the Soviet Union was a stunning factor for the Americans. They accepted that challenge. And just a few years later, a month after his speech at the 1961 Annual Meeting of the National Academy of Sciences, President Kennedy boldly declared before a joint session of Congress that the United States would send a man to the moon and return him safe and sound to Earth. The ambition of the United States presented by the President of the country was realized. This was achieved thanks to a successful superposition of fundamental and scientific and humid achievements of the United States. The US scientific community rallied behind the implementation of this goal and took up its achievement. And it didn't just lead to the first steps on the moon. This would lead to giant jumps in the development of many branches of science and technology. This Apollo program created technologies that improved:

- sensors for hazardous gas testing;
- energy-saving building materials; and
- fire-resistant fabrics used by firefighters and soldiers.

Considering the requirements of the modern world, the following goals of popularizing science can be distinguished: the presentation of up-to-date proven scientific information adapted for the perception of people with different levels of education and qualifications:

- formation in public opinion of the scientific picture of the world as an integral part of the general culture;
- clarification in society of the role of science in the modern world and its influence on the lives of people and the associated increase in the prestige and social attractiveness of research work; and
- increasing the level of natural science and humanitarian education of graduates of schools and universities, scientific and educational work with schoolchildren and young generation.

Up to date stage of the development of world processes is distinguished by their high dynamism, inconsistency and ambiguity. The transformations taking place are sometimes dual in nature, can be interpreted as both negative and positive. In such conditions, it is tempting to pay more attention to the problems of the current moment, while promising tasks are the lot of time when the country will emerge from the recession. However, this approach is strategically unjustified. The current situation is largely due to the lack of orientation towards long-term goals, a proper assessment of possible risks and threats, the problem of import substitution began to be perceived as relevant only after the introduction of the food embargo. For example, the definition of the perspective of the agro-industrial complex implies the need to create and adopt a strategy for the socio-economic development of the industry.

More broadly, huge investments in this era have been made in science and technology in particular in basic sciences, in education and in funding scientific research. All this gave rise to a huge surge of creativity, the benefits of which were incalculable. Today we are reaping the fruits of the achievements that were achieved in those years of scientific and technological renaissance.

But energy and energy resources are a universal question. Humanity faces a goal of reducing carbon pollution by more than 80 percent by 2050. This could be achieved by doubling the capacity to produce renewable energy over the next few years - expanding the production tax credit, providing credit guarantees and providing grants to spur investment. There must be new efforts to ensure the competitiveness of solar and other clean energy technologies.

There are aspirations to make renewables a lucrative type of energy. It is necessary to create resources so that scientists can focus on this most important area. At the same time, it is necessary to find a source of creative potential that will be used by researchers and entrepreneurs.

But it is important to note that this approach has the potential to offer people the opportunity to be more active participants in the prevention and treatment of their diseases. We must maintain patient control over these records and respect their privacy. At the same time, we have the opportunity to offer billions and billions of anonymous data points to medical researchers who can find evidence in this information that can help us better understand the disease.

History also teaches us that the greatest successes in any field, and in medicine, among other things, were achieved thanks to scientific breakthroughs, whether it is the discovery of antibiotics or the improvement of public health practices, smallpox and polio vaccines and many other infectious diseases, antiretroviral drugs that can bring AIDS patients back to productive lives, pills that can control certain types of blood cancer, and many others.

With recent advances - not just in biology, genetics and medicine, but in physics, chemistry, computer science and engineering - we can make tremendous progress in disease control in the coming decades. That is why states should be interested in the development of science and technology and should intend to increase funding for national research institutes, including industry and private development research centers and centers of excellence.

In terms of environmental science, it will require strengthening our weather forecasting, observing the Earth from space, managing land, water and forest resources and managing our coastal zones and oceanic fisheries. This requires a new approach to the development of fundamental work and scientific research, including the development of new methods, taking into account the challenges of fundamental work. It is necessary to introduce a culture of achievement in the field of artificial intelligence, machine learning, big data etc. Should work reporting around the world. Science has no boundaries. It is obvious that technology and innovation are developing faster and more efficiently in terms of costs when sharing information, costs and risks. Many of the tasks that will help us solve the problems of science and technology are global in nature, which requires the integration of joint efforts.

It is undoubtedly necessary to significantly improve achievements in mathematics and science by raising standards, modernizing scientific laboratories, updating the curriculum and creating partnerships to improve the use of science and technology in our universities. Set a task to improve the training and teaching staff, as well as to attract new and qualified teachers of mathematics and science, so that they better involve students and revive and motivate students to these subjects.

Yes, scientific innovation gives us a chance to prosper. It has given us benefits that have improved our health and our lives - improvements that we take for granted. But it gives us something more. Science makes us reckon with the truth as best we can.

Some truths fill us with awe. Others make us question longstanding views. Science cannot answer every question, and, indeed, sometimes it seems that the more we abandon the secrets of the physical world, the more modest we should be. Science cannot supplant our ethics, our values, our principles, or our faith. But science can inform these things and help lay down these values - these moral feelings that faith - can make these things work - to feed a child or heal the sick to be good stewards of this Earth [5].

We are reminded that with each new discovery and new force, she bears a new responsibility; that fragility, the very specificity of life require us to overcome our differences and solve our common problems, preserve and continue the desire of mankind for a better world.

Patterns for clarification

The Nobel Prize is a prestigious association prize established by Alfred Nobel on November 27, 1895 and announced on December 30, 1896 in Stockholm. It should be noted that this award is considered an advocate of fundamental science of world scale and the most powerful source supporting it.

As you know, the scientific fields covering the Nobel Prize:

- Nobel Prize in Literature;
- Nobel Prize for in Physiology or Medicine;
- Nobel Prize in Physics;
- Nobel Prize in Chemistry; and
- Nobel Peace Prize.

It is interesting to present examples of the results obtained by Nobel Prize winners in scientific fields. Here are examples of the first Nobel Prizes in various fields.

Wilhelm Konrad Roentgen is a German physicist. Known for the discovery of X-rays. The area of research in which he is interested: the connection between piezoelectric and pyroelectric properties, electrical and optical phenomena. Discovered X-rays, created the first X-ray tube. The discovery of X-rays greatly influenced all fields of science. A unit of X-rays and gamma rays was named in his honour.

Jacobus Henricus van't Hoff is a Dutch chemist. Winner of the Nobel Prize in Chemistry. In 1901, the Nobel Committee declared Vant-Goff the first laureate in chemistry. Chemical dynamics, which he discovered as the reason for receiving a diploma award (Chemical dynamics is a science that studies the role of chemical reactions in the development, conduct, speed, equilibrium and its change, electrolytic dissociation, third-party effects. Each of these processes takes place in a certain volume and under pressure. A special area of the science of physical chemistry is called the "foundations of thermodynamics." All of the above chemical areas are based on the laws of chemical thermodynamics) and osmotic pressure in liquids (which means pressure from osmotic to passport, that is, for example, the smell of a plant through this pressure attracts water from the soil to itself). Presenting the Vant-Goff Prize on behalf of the Swish of the Royal Academy of Sciences, Odner called him the founder of stereochemistry and one of those who worked in the field of chemical dynamics, and also stressed that the scientist's research provides extremely important results for the science of physical chemistry.

Emil Adolf von Behring is a German chemist, winner of the 1901 Nobel Prize in Medicine and Physiology. During his military service, Bering began to conduct various experiments with the aim of combating infectious diseases. Disinfectants and antiseptics were underdeveloped at the time. His main experiments were related to tetanus and diphtheria diseases. Bering studied these diseases together with the Japanese scientist Shibasaburo Kitasato. In the course of the study, it turned out that antibodies to bacteria are formed in the blood of those who died from the disease. Then, as a result of the study of mice and rabbits, they discovered the possibility of recovery of other animals with the help of antitoxins formed in the blood of sick animals.

In 1891, the first diphtheria vaccine began in a Berlin hospital. Many of them recovered.

Rene Francois Armand Prude was known for his conservative position in relation to literary forms and genres. In the book "Literary Testament" (1900), he advocated the traditions of classical French poetry, expressed a critical attitude to free art, the search for symbolists and decadence literature. In 1901, he won the first Nobel Prize in Literature.

Jean-Henry Dunant - world famous Swiss benefactor, businessman, first Nobel laureate. In 1863, he, along with his friends, decided to create an organization to help the wounded around the world. These emblems, transported by sanitary workers and their miniature means, indicate that the workers of the Golden Cross and the Golden Bear are not military personnel. Since 1869, the Golden Cross began to help victims of floods, earthquakes, epidemics, famine and other disasters around the world.

Ragnar Anton Kittil Frisch is a Norwegian economist. In 1969, together with Jan Tinbergen, he was first awarded the Nobel Prize in Economy. Ragnar Frisch is one of the economists who played an important role in shaping the modern economy conducted research on mathematical explanation, called new economic concepts. The role of Ragnar Frisch in creating econometric models for social accounting and economic planning of the modern state is great.

Let's pay attention to the Nobel Prizes of our time.

Donna Strickland is a Canadian physicist working in laser physics and nonlinear optics. He together with Gerard, invented a method to increase fine pulses. 2018 Nobel Prize in Physics.

Francis Hamilton Arnold is an American scientist, engineer and scientist who has made a significant contribution to the development of oriented evolution of enzymes. Winner of the 2018 Nobel Prize in Chemistry.

Ōsumi Yoshinori is a Japanese cytologist. The main work is autophagy. This process involves the destruction and repetition of cell components.

Denis Mukengere Mukwege is a congregational gynecologist and pastor. He founded the Pantsi Hospital in Bukhava, where he treated women attacked by armed rebels. In 2018, Mukwege and Iragli were awarded the Nobel Peace Prize for "efforts to end sexual violence as a weapon of war and armed confrontation."

William D. Nordhaus is an American economist. Winner of the 2018 Nobel Prize in Economy. Nordhaus is known for his activities in integrating climate change into long-term macroeconomic analysis, as well as leading contributions to environmental economics.

When considering the activities of the Nobel Prize winners, they were awarded for their contribution to fundamental science. Nobel Prizes, dedicated to peace, literature and the economic sphere, are also scientists awarded fundamental apple results.

When Nobel laureates qualify for the activities of the first and coinciding with our era of laureates, then from time to time there is a tendency to remove results from fundamental science. Here you can see a tendency towards the synthesis of sciences and their relationship, including technologically, to achieve scientific production. This trend makes it difficult to see what results in the future will have a positive or negative impact on scientific activities. It is just obvious that the development of science covering any industry is determined by basic science. This laid the foundation for the future of world science to become uncertain.

Conclusion

What approach of the basic science is needed to be selected and taken into attention in order to achieve expected results? It always takes a vital place to understand and find out pointed out questions “what, when and how” which make possible to put the right way line for problem solution. There is no doubt that basic science is the main platform for maintaining and creating fundamental principles embracing all aspect with coming end for the human life. It is obvious that science is only source impacting for developments and improvement of existing environment of human society in all areas. So, it demands to consider place and importance of the basic science in our life.

An analyse of the current achievements in the basic science is the subject of this chapter. It has been learned and provided arguments where basic science plays significant role in all areas of human life. In the meantime, it has been demonstrated importance of basic science in achievement of expectations for technological developments in the future. At the same time it demonstrates importance of responsibility of decision makers in creation of positive environment for the basic science and science commercialization which directly linked all the spheres of human life.

Today circumstances and conditions demand to take care of the basic science for the future of the.

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