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The Role of Application of Standards on Economic Growth and its Assessment: Case Study of Azerbaijan Republic

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Abstract

This study examines the effectiveness of standards on economic growth based on the data for Azerbaijan Republic by using regression analysis method. First and foremost, we have answered some questions, like 'what is standard? Why the standard is needed? etc." and investigated the essence of the standardization concept. Our goal is to evaluate the effects of the implementation of standards on the economic growth of Azerbaijan using world experience and to develop recommendations for the direction of the application of standards, to provide and support proposals for the improvement of the normative legal framework for the application of standards. To evaluate the effects of standards on economic growth in Azerbaijan, the Cobb-Douglas production function was used based on the data of the State Statistical Committee of the Republic of Azerbaijan and the Azerbaijan Standardization Institute. The research result confirm that the gas station standards had a positive impact on GDP, while the GOST standards had a negative impact. The cumulative effect of both is positive. Initially, we can say that increasing the number of standards by one percent increases GDP by 0.84%. Since there is no field assessment database, no such assessment was conducted.

Keywords: *Standartization, Economic Growth, GDP, GOST, Business Benefits.*

Introduction

Economic growth is fundamentally driven by a variety of mechanisms and processes that together lead to a more efficient use of input resources, promote higher levels of labor productivity, and create an overarching increase in competitiveness within various markets. These dynamic and interlinked mechanisms rest on the solid foundation provided by efficient economic infrastructures, which are critical in both supporting and facilitating such growth. An adequate, though often overlooked, element of economic infrastructure is composed of an extensive and intricate complex of standards, norms, and regulations that serve to govern economic interactions and establish benchmarks for quality and performance across various sectors.

The growth-related components of an economic system can be expected to have their collaborative foundations firmly underpinned by numerous sub-branches of standardization, which guide and influence practices across a wide array of sectors and industries. This essential and critically important relationship between standards and economic development must, therefore, not be disregarded or underestimated in any sense. The approach taken by Azerbaijan towards the application of standards in its ongoing journey to achieve sustainable economic growth and development has been thoroughly examined and is duly addressed in this research paper.

The primary aim of this comprehensive paper is to explore the ways in which, and whether, the role of standards application, when accurately and correctly assessed, can positively contribute to national economic growth in a substantial manner. A thorough review of both international and national studies is

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intended to provide extensive empirical and theoretical support to the multifaceted issues presented in this research paper, along with an in-depth discussion that wholly targets the current situation and contextual dynamics in Azerbaijan. The findings that emerged from this investigation reveal that the application of standards is significantly influenced by how initiatives are shaped by the large multitude of political, economic, sociological, and cultural actors, as well as by various situations and significant events that occur within the country.

Currently, developing countries, including Azerbaijan, are witnessing an emergence of a standards-related concept that is gaining not only traction but also growing importance in the broader economic landscape. This paper systematically examines the approach for assessing the current level of acceptance and implementation of standards in Azerbaijan, shedding light on their relevance and impact on economic progress. The critical research questions posed within this study are the following: What is the significance of the application of standards and certification, and what tangible benefits do they confer for the improvement and enhancement of economic development across the nation?

Moreover, we are going to try to determine the benefit of applying standards to society and in particular to the economy. Thereby, it is first necessary to answer some questions and clarify the concepts: (i) What is the standard? (ii) Why there is a need for standard? (iii) What is standardization? (iv) What is the difference between standard and standardization? (v) What is meant by the application of standard? (vi) The role and the significance of standards, the benefit of standardization?

While various authors have addressed these questions through diverse perspectives, we will undertake a reassessment of them.

Study of methodological basis for evaluating the role of the application standards in economic growth.

Studying international experience in assessing the role of application of standards in economic growth.

Standards, which have become an important part of international relations, play an invaluable role in ensuring product quality, building confidence in trade, facilitating the flow of goods and improving the development of the global market. Nowadays, faced with and ever-growing global market, increasing a country's competitive advantage and achieving economic efficiency depends not only on capital, labor, land and other factors of production, but also on comprehensive national power, which is the basis of technology, and the ability to transform technologies into standards.

Let's start with the concepts first:

Standards. Today, on an international scale, the concepts of standard and quality are proceeded in parallel. The standard is considered as one of the quality factors.

Standard (eng. Standard – norm, example) is used in the broadest sense of the word as an example, standard, model that is taken primarily in comparison with others. A standard is a regulatory document that establishes requirement for the quality and safety of products (works, services) intended mass use.

Standards are the distillation of the wisdom of people who have knowledge in their field and understand the needs of the organizations they represent such as manufacturers, sellers, buyers, customers, trade associations, users or regulators (International Organization for Standardization).

Standard – a normative document intended for repeated and general use, establishing norms, rules and recommendations on goods (work, service), the process associated with it (including the management system) and production methods, the application of which is voluntary (Law of the Republic of Azerbaijan On Standardization, 2019).

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Standardization –is an activity consisting of the process of preparation, adoption and application of normative documents intended for mass and repeated use, aimed at increasing the safety and quality of standardization objects (Law of the Republic of Azerbaijan On Standardization, 2019).

Standardization – is an activity aimed at achieving an optimal degree of order in a certain area by creating provisions for general and repeated use in relation to real or potential problems.

However, in the contemporary world of perpetual change and globalization, advancement in technology, the rise of new markets and goods require changes in standardization processes, and standardization itself demands knowing and observing laws and norms, their regulation and nationalization. Therefore, without standards, countries are unable to control their trade, economies, and international relations.

The main purpose of applying standards is to improve the quality of manufactured products (rendered services) based on the regulation of their production criteria. In the course of their work, specialists have to solve periodically recurring tasks: measuring and recording the quantity of products, drawing up technical and management documentation, measuring the parameters of technological operations, monitoring finished products and packaging, etc. The goal of standardization is to identify the best solution that is the most correct and economical approach among the options available to solve the current issues. The best way to attain discipline in any field is to make standards available to a large number of businesses and experts. The economic effect of regularization is possible through the joint and repeated use of the best solution to existing and potential problems.

Standardization used to mean that requirement had to be established for any indicator, but now requirements are imposed on processes, particularly management processes. Today, the standard has evolved from law to an enforcement tool, and the modern goal of standardization is to ensure sustainable development. Standardization is an important condition for the successful development of the national economy. Strict standards imposed by the competent government authorities on enterprises encourage them to operate more efficiently and produce safe and high-quality products. Standardization is one of the important factors of technical process both at the level of a single national economic system and in terms of the development of the world community. Therefore, some experts refer to standard-level international integration processes as a crucial component of the modern society's technological movement.

The objects of standardization are the goods (work, service), the process related to it (including the management system), and the production method.

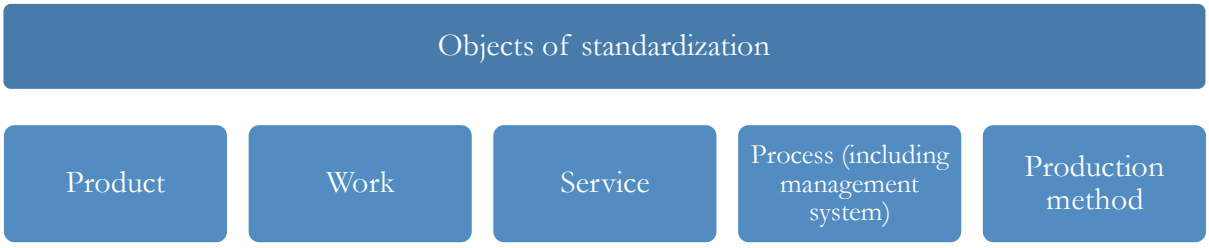

Figure 1. Objects of Standardization

Types of standards. Standards are classified in different forms depending on the subject. Figure 2 can be shown as an example:

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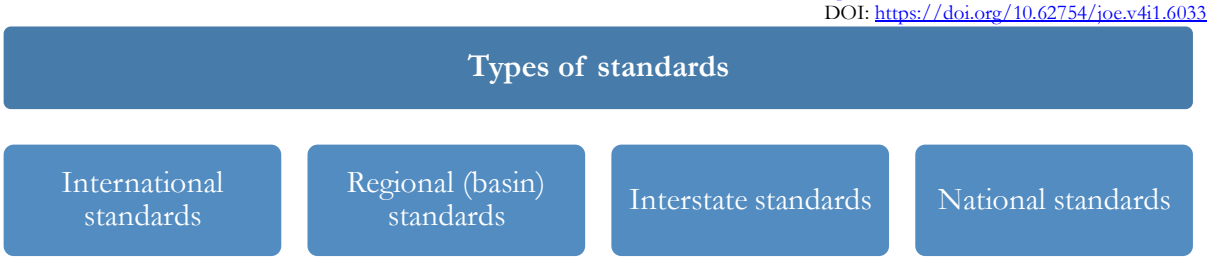

Figure 2. Types of Standards

As for the legislation of the Republic of the Azerbaijan, state standards mean mandatory and recommended requirements.

The Law of the Republic of Azerbaijan "On Standardization" defines the following as the goals and principles of Standardization (Law of the Republic of Azerbaijan On Standardization, 2019).

Table 1. Goals And Principles of Standardization in Azerbaijan

The Law of the Republic of Azerbaijan "On Standardization"	
Purpose	**Principles**
▪ Creation of conditions for free movement of standardization and elimination of unnecessary technical barriers in international trade; ▪ Improving the quality of goods (service, work), related processes (including management system), production method and skills of staff in order to increase competitiveness in domestic and foreign markets; ▪ Ensuring the technical, technological and information compatibility of goods and their spare parts, as well as mutual replacement; ▪ Saving resources and reducing production costs by eliminating the variety of goods and their spare parts and their mutual replacement; ▪ Ensuring support for the requirements and expectations of consumers regarding goods (services, works), reflected in the relevant goods, as well as formation of trust in the quality of goods (works, services) and obtaining reliable information about the quality of goods (services, works), goods (services, prevention providing consumers with false information about safety and quality of work); ▪ Adaptation of state standards to international standards and consideration of	▪ Voluntary participation of all interested parties on equal terms in the standardization process; ▪ Preparation and adoption of normative documents on standardization based on the consensus of interested parties; ▪ Transparency of standardization; ▪ The use of international and regional standards in the preparation of state standards and their adaptation to those standards; ▪ Application of scientific and technical achievements, knowledge, advanced experiences and technologies in the preparation of regulatory documents on standardization; ▪ Non-contradiction of normative documents on standardization; ▪ Ensuring the system and complexity of standardization; ▪ Preventing the preparation of normative documents on standardization that will harm the life or health of people, the environment, property and the interests of the state; ▪ Consideration of consumer expectations and market requirements; ▪ Meeting the needs of producers and consumers; ▪ Preventing the priority of personal interests over general interests;

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the interests of the national economy in regional and international standardization; ▪ Supporting the efficient application of innovations and the high-tech products; ▪ Ensuring efficient use of natural and energy resource; ▪ Protection of the state's interest during procurement.	▪ Compliance of normative documents on standardization with the technical regulations of the Republic of Azerbaijan; ▪ Voluntary nature of standards.

Source: (Law of the Republic of Azerbaijan On Standardization, 2019)

On the basis of this, standardization norms can be defined as rules designed to ensure the economic stability and defense capability of the country, technical and information compatibility, security and replacement of all types of resources. Put it differently, standardization directly affects every facet of sustainable development, including the advancement of technology, environmental preservation, public health and safety, and the elimination of trade barriers. Development of production, healthcare, ecology is regulated by legal and legislative norms.

In this sense, the standards include requirements for the development of an enterprise's business strategy. There are 4 stages of standardization work.

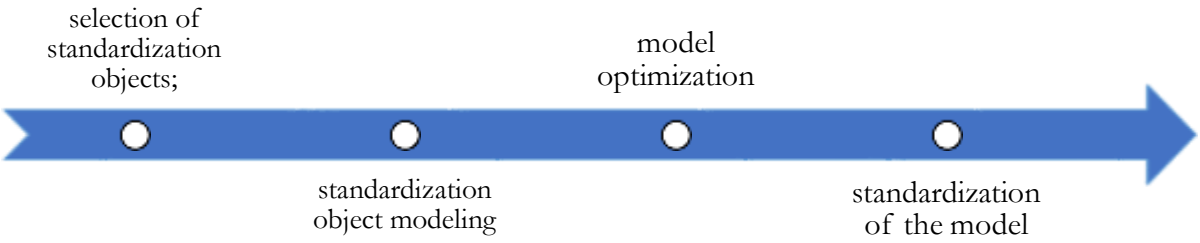

Figure 3. Stages of Standardization

The direct result of standardization is primarily a normative document. The use of normative document is a method of regulation in any field. Therefore, a normative document is a means of standardization.

Regulatory documents in the field of standardization include state standards, standards, standards applied in accordance with the law, including technical conditions (Law of the Republic of Azerbaijan On Standardization, 2019).

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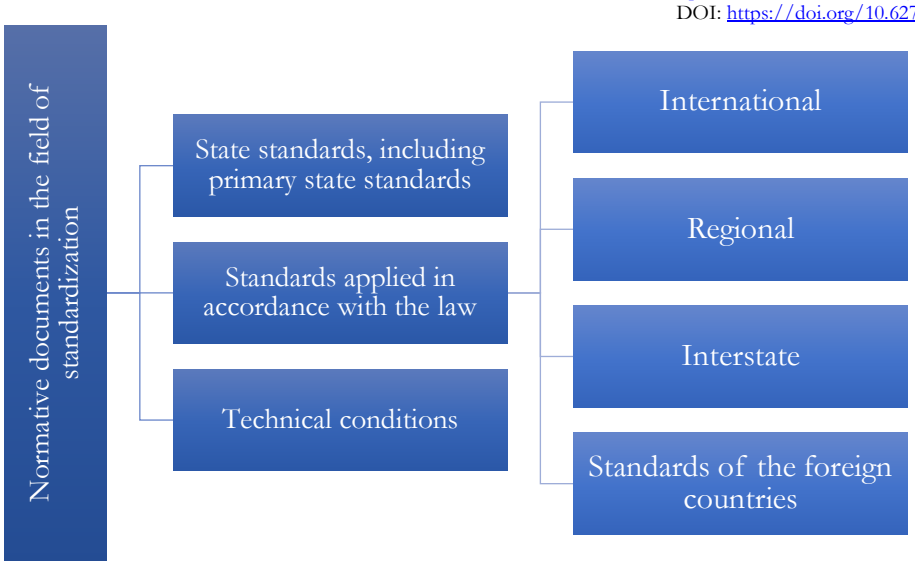
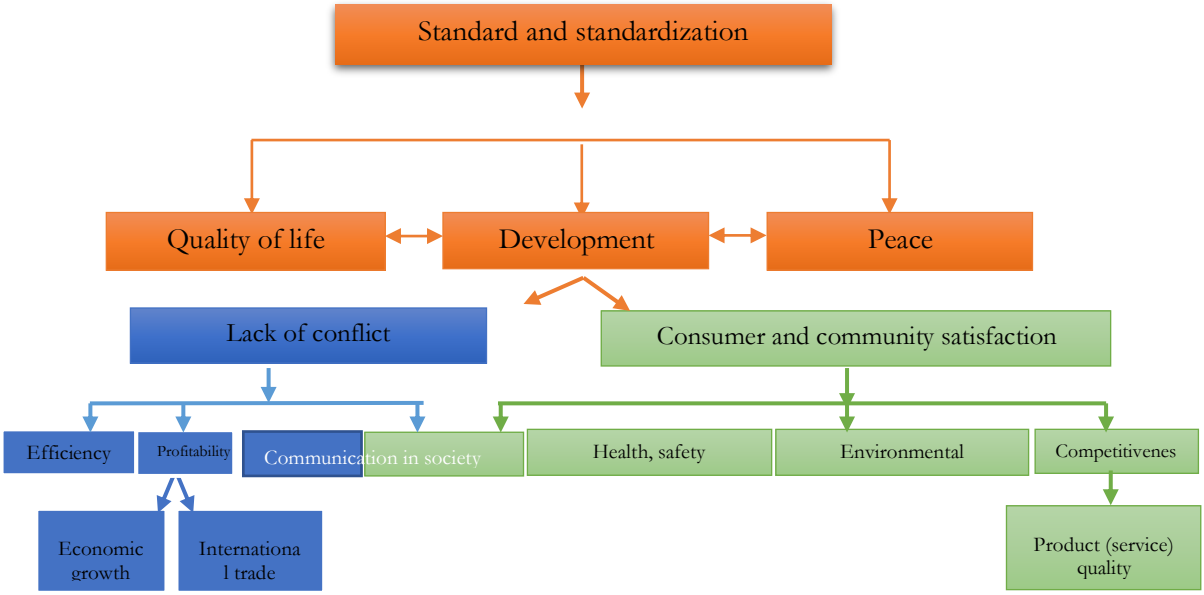


Figure 4. Normative Documents in the Field of Standadization

Since it is not possible to apply international experience and standards to local conditions in any directions and at any level, international cooperation requiresthe adaptation of rules to international and national standards in order to carry out coordinated standardization activities. Standardization, which is one of the fields of economy, is one of the pillars of sustainable development of society and economy. Standards lead to economic growth by ensuring a quality standard of living, security, international trade and economic cooperation, and environmental protection (Figure 5).

Figure 5. Impact of standardization on economy and society



Experience shows that, when quality management and strategy are applied, standardization processes result in higher production volumes and lower product costs as well as the long-term growth of the business.

In the standardization process, technical regulation is used along with standards.

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Technical regulation is the legal regulation of relations related to the definition, adoption and application of mandatory requirements for goods, associated processes and production methods, as well as conformity assessment (Law of the Republic of Azerbaijan "On technical regulation", 2019).

It is considered to be significant to have international standards, or common laws between nations, and to lower their expenses in order to promote mutual action. All of these contributes to the growth of competitiveness, standard of living and economy.

Numerous countries, including Germany, Great Britain, Canada, Austria, and France have studied the impact of standardization on economic growth. According to the results of the study, the impact of standardization on the growth of the Gross Domestic Product (GDP) was a 27%, and the impact on the growth of labor productivity was 30%. (Rodionov, 2021).

According to the United Nations Economic Commission for Europe (UNECE), "The Global Community generally recognizes the importance of standardization for the economy and society". The examination of global experiences shows that "changes, which are a constant phenomenon, require certain dynamics of processes in the field of standardization" and "no state can build its economy without standards and economic relations with other countries within the framework of civilized, mutual benefit" (UNECE, Razdel 2. Vygody standartizatsii dlia obshchestva [Section 2: Benefits of standardization for society], 2022).

Advantages of Standards

The application of standards has technological, economic and social benefits. The benefits facilitate the removal of barriers to international trade, improve production efficiency, and regulate the specification of goods and services. Compliance with the international standards guarantees consumers the reliability and environmental friendliness of the product.

Benefit of the Standards to Business

Standards, especially international standards, are mechanisms and guidelines that help in the resolution of significant business issues. Standards assist businesses enter new markets, boost their productivity, and ensure the effectiveness of their operations. The benefits are presented in Figure 6.

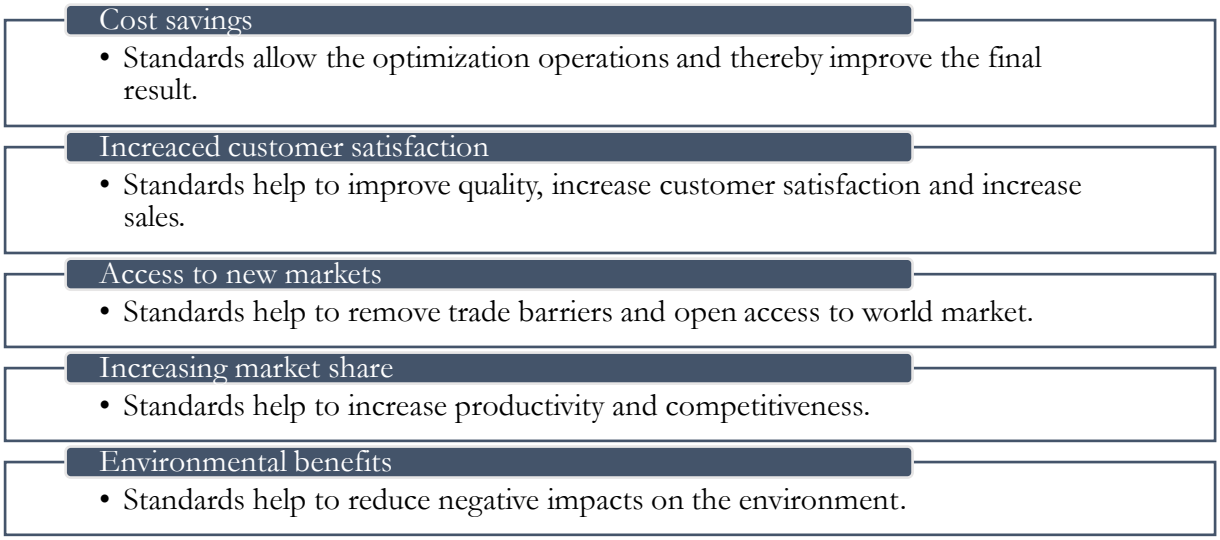

Figure 6. Business Benefits of Standards

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The Benefit of the Standards to Society

The International Standards Organization (ISO) has produced more than 19.500 standards for good and services that testify of their quality, safety and compliance with international standards. The environment and the maintenance of health are supported by standards. (UNECE, Razdel 10. Standarty sistem menedzhmenta [Section 10: Management system standards]).

Figure 7. The Benefit of Standards to Society

As we have stated, ensuring sustainable development is the modern goal of standardization. Considering that international experience and sustainable development are based on standards, let's examine the elements of sustainable development.

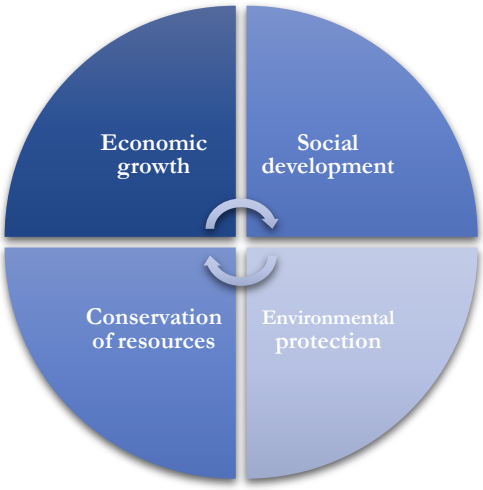

Figure 8. An Integral Part of Sustainable Development

Three elements of sustainable development (economic growth, social development, and environmental protection) have been acknowledged in the majority of texts. (Tsentr Korporativnoi Meditsiny, 2020) (United Nations, 2022) (Chepnyx, Iu. B & Smirnov, I. G, 2020). Nevertheless, some authors (Chepnyx, Iu. B & Smirnov, I. G, 2020) also include "conservation of resources" as the 4th element regarding sustainable development.

Economic growth depends on the stable operation of the enterprise. Thus, the enterprise is the cornerstone of sustainable development, and the sustainability of the enterprise determines the sustainability of the territory (Chepnyx, Iu. B & Smirnov, I. G, 2020) (DIN: Gesamtwirtschaftlicher Nutzen der Normung, 3 Bände, 2000).

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The standards adopted in this field have a great impact on the development and quality of all four elements in the structure of sustainable development. System management allows the company to grow because of the methodical approach, continuously improve management, and introduce new techniques and products into production. This in itself gives an advantage in any business function.

Table 2. Advantages of Applying Standards

Business functions	Advantages
Production organization and administrative management	Reduction of energy consumption and expenses, energy saving, prevention of fines by control bodies.
	Prevention of environmental pollution fines in accordance with the requirements of the ISO 14000 family of standards developed by the International Organization for Standardization regarding environmental management, which exists to help minimize the negative impact on the environment
	Risks of exposure to dangerous factors are reduced with the help of the labor protection management system. Prevention of accidents, occupational and other risks and fines that may occur based on action plans in emergency situations
Constructor and technological works	Increasing the efficiency of construction and technological works, reducing the number of errors and costs
	Selection of technical solutions, prevention of increase in number of designer and technological works
Purchases	Reduction of risk, cost and time in the selection of raw materials, purchase of fuel and equipment
	Increasing the efficiency of the exchange of procurement information and the rapid conclusion of contracts based on standardized documents and technical specifications.
	Reduction in the cost of work due to the versatility and interchangeability of equipment parts
Production	Reduction of equipment downtime and technical support costs due to the quality of purchased raw materials and spare parts
	A decrease in the likelihood of controversial situations in the field of the number of failures, production costs, quality and operation due to effective management of production and quality. Lower management costs due to simpler management
Marketing and sales	Increasing the volume of sales and income due to the opening of new markets
	Increasing the efficiency of negotiations due to the reduction of the time to reach an agreement with business partners
Service	Implementing a quality management system improves the quality of production, distribution, and service while also reducing external quality losses. Also, the quality management system increases the efficiency of control during the inspection and acceptance of materials and reduces internal costs by 10%.

Source: (Chepnyx, Iu. B & Smirnov, I. G, 2020)

In this regard, it can be seen that the application of standards in the enterprise is one of the important factors affecting sustainable development. The indicated changes lead to the following results:

Increase in consumer loyalty;

Increasing the efficiency of production activity;

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Sustainable financial results;

Increasing the efficiency of management;

Constant introduction of new technologies, new materials;

Improving issues in the field of labor protection, employee education and professional training;

Improvement of environmental protection;

Increasing savings on used materials;

Creating a positive image of the enterprise in the eyes of the public.

These factors influence both each type of resilience and resilience in general. Especially:

Increased consumer loyalty contributes to market stabilization: one of the factors supporting the preservation (and possible expansion) of markets is the presence of regular buyers.

Increasing the efficiency of production activities contributes of the sustainability of production, since as the efficiency of the use of resources increases, costs that do not generate value are reduced.

The stability of financial results corresponds to financial and economic stability, since the stability of financial activity means both stable payments to the business of the enterprise and the correctness of the economic policy pursued at the enterprise. This is expressed in particular by the reduction of the "leverage" ratio (the ratio of the amount of debt funds to the fixed capital and reserves), which indicates the increase of the fixed capital and the bringing of the autonomy indicator of the common means of optimal values.

The financial independence ratio (the ratio of the company's capital and reserves to total assets) may be another indicator. Improved management efficiency contributes to organizational and managerial stability, as the implementation of management decisions requires less time, resource inputs and reduces the probability of error. In addition, enterprises with effective management are usually attractive for investment, as the investor is then guaranteed a return on investment.

Constant application of new technologies and new materials contributes to the innovative growth of the enterprise, in fact, such application can only be carried out on the path of innovative development.

All these types of sustainability are compatible with economic growth, which is a component of sustainable development. Improved health and safety issues and training and development opportunities for workers contribute to social sustainability, thus the second pillar of sustainable development demonstrates the sustainability of social development. Improved environmental protection contributes to environmental sustainability, the third pillar of sustainable development. Reducing waste and saving resources will lead to improved recycling, the fourth pillar of sustainable development.

However, deficiencies in the management of the enterprise can also be observed. Sometimes the focus is on only one factor of sustainable development - economic growth. Other factors are ignored, such as the environment or social development is partially ensured, but sustainable development can be achieved not only by improving social development, but also by working on climate change, for instance by implementing energy management standards.

Sustainable development of the enterprise is possible only if the system approach is used, since it is only this approach to the development of the enterprise that allows to assess all the regularities of interrelations and changes, to calculate the consequences of decisions and thus avoid mistakes on the path of development.

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To measure the impact of sustainable development on the economy, let's first consider its quantitative indicators (Table 3).

To calculate the impact of sustainable development on the economy at the enterprise level, the indicators of economic growth structure are mainly taken into account.

Table 3. Quantitative Indicators of Sustainable Development

The composition of sustainable development	Type	Composition	Indicators
Economic growth	Production stability	- efficient use of resources; - efficiency of production activities.	- labor productivity; - material and energy intensity of the product; - defect rate; - production cycle time.
	Market stability	- production expansion; - increasing competitiveness; - expansion of the sales market.	- production volume; - volume of sales; - percentage of consumer loyalty.
	Financial and economic sustainability	- financial and economic activities; - solvency.	- profit; - profitability; - the volume of capital investments; - the amount of fixed and working capital; - the share of production areas in the total value of real estate owned by the enterprise; - debt service ratio; - capital investments as a percentage of total costs; - income from own sources as a percentage of gross income.
	Organizational-management stability	- management efficiency; - investment attractiveness.	- availability of a certified management system (systems) at the enterprise (quality management, environmental management, labor protection management); - Having a properly structured management system in place; - Extent of third-party investments with the requirements of the ISO 22301:2012 standard.
	Innovation growth	- new technologies; - new production methods - new product.	- the number of new technologies implemented; - number of applied inventions and rationalization proposals; - range update percentage; - rate of depreciation of fixed assets; - equipment upgrade percentage; - average age of equipment.

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Social development	Social environment of the enterprise	- health protection and labor protection; - education and vocational training.	- amount of social payments and share in total expenses of the enterprise; - number of days of incapacity for work; - the number of ill people; - the number of disabled people who died; - the presence of occupational diseases; - qualified staff; - the number of retrained employees; - the amount of funds allocated for the organization of personnel training and retraining and their share in the total costs of the enterprise.
Ecology	Environmental sustainability	- environmental improvement.	- volume of harmful emissions; - concentration of fine suspended solids (PM2.5) and suspended solids (PM10); - NO2 (nitrogen dioxide) and CO2 (sulfur dioxide) concentrations; - share of unprocessed emissions; - noise pollution; - relative change in the number of native species.
Stock savings		- use of technologies with low demand for labor and material consumption	- volumae of waste; - share of waste for processing; - volume of consumed water, electricity and heat energy, air, metal; - the amount of saved resources; - the amount of energy received from alternative sources.

Source: (Chepnyx, Iu. B & Smirnov, I. G, 2020)

Exploring Methodologies for Assessing the Role of Standards Implementation in Economic Growth

In addition, some multinational enterprises maintain their competitive advantage by participating in international standards to support their operations.

The strategic importance of standards is now widely recognized and emphasized in academia as well as in industry and the service sector. It is to mention that at the end of the last century, the German Institute for Standardization (Deutsches Institut für Normung - DIN) pointed out that standards are "the main driving force of economic development" and emphasized that standards are an internal mechanism and that "standards can shorten the time difference" between technological innovation, diffusion and adoption" and emphasized that updating standards accelerates technological innovation. As Blind K. (Blind K., The Economic of Standards: Theory, Evidence, Policy., 2004) notes, trade value shows a positive relationship with standards. In addition, researchers studying this area have conducted empirical studies and found that standards have become an important contributor to economic development. Also, (Swann et al., 1996) conducted a study on a similar topic. These researchers also found that national standards have a positive impact on UK import and export trade (Haimowitz J., 2007) (Zheng, 2006) (Standards, Innovation and the Australian Economy, 2006) (Zazhigalkin A.V., 2014) (Maksimova və b., 2015) (Zazhigalkin, 2021), according to the research results, both national standards and international standards have a positive effect on economic growth, but this effect differs in different sectors.

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At present, the study of the impact of the standard on economic growth is mainly concentrated on one-sided studies. Few scholars have opened the black box of standards affecting economic growth and demonstrated that there is a reciprocal relationship between standards development and economic growth. On the other hand, while there is a fair amount of research on the impact of standards in developed countries using developed countries and some countries that have bilateral trade with them as examples, there is very little research on the impact of standards on developing country economies. (Gastev, 1972) (DIN: Gesamtwirtschaftlicher Nutzen der Normung, 3 Bände, 2000) (Blind K., The Economic of Standards: Theory, Evidence, Policy., 2004).

Methodology

Today, standardization and its impact on the development of the country, evaluation of the effectiveness of standardization activities are very relevant. This is due to the link between standardization and scientific and technological progress. Standardization helps to improve the quality of products and save public resources, protect against low-quality products, works and services, etc. Therefore, many developed countries use the production model in assessing the impact of standardization on the economy. (Chepnyx, Iu. B & Smirnov, I. G, 2020), (Miotti H., 2009) (Rodionov, 2021) (Haimowitz J., 2007) (Zazhigalkin, 2021) (Zazhigalkin A.V., 2014).

Standardization in the studies was assessed at 3 levels (micro, macro, meso): For now, let's look at macro-level estimates of the impact on a country's economic growth. As we mentioned earlier, the basic elements of the methodologies for researching the impact of standardization on the economy are similar. The methodologies are based on the Cobb-Douglas production function: the dependence of economic growth on factors of production (Blind K., The Economic of Standards: Theory, Evidence, Policy., 2004):

$$Y(t)=A(t)\ [F(K(t), L(t)] \qquad \textbf{(1)}$$

where: Y(t)- GDP at time t, K(t)- material costs, L(t)- labor force.

Technical progress contradicts the law of diminishing marginal productivity of labor and capital.

$$A(t)= F(Z(t)) \qquad \textbf{(2)}$$

Here: A(t) - technological progress, Z(t) - technological knowledge.

Given this outcome the formula is,

$$GDP= Z*K^{\alpha}*L^{\beta} \qquad \textbf{(3)}$$

Here: K - price of fixed assets, L - labor resources, α, β - elasticity coefficient, Z - coefficient of scientific and technological progress (Zazhigalkin A.V., 2014).

The composition of technical progress (A(t)) consists of 3 factors:

technological knowledge formed in the country;

export of technological knowledge abroad;

diffusion of technological knowledge.

If we logarithmize the presented formulas,

$$Y(t)= a+ \alpha K(t)+ \beta I(t)+ \gamma Pat(t)+ \delta Ex(t)+ \delta St(t)+ \delta Dum(t)+ U(t) \qquad \textbf{(4)}$$

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Here: Y(t) economic growth (GDP), K(t) fixed capital, I(t) number of employees, Pat(t) patent fund, St (t) number of standards, Ex(t) number of licenses, Dum(t) shocks, U(t) are other factors.

According to the results of calculations with the presented model for countries, the standards have a positive effect on economic growth. As the pool of standards expands, the diffusion effect of technological knowledge increases and economic dynamism intensifies (Zazhigalkin, 2021) (Blind K., The Economic of Standards: Theory, Evidence, Policy., 2004).

Table 4. Comparative Table of Economic Impact of Standards Implementation by Countries

	Standardization organizations	Research	Year	Research period	Flexibility by standard (%)
Germany	DIN	The Economics Benefits of Standardization	1999	1961 – 1990	0.07
Great Britain	BSISCC	The Empirical Economics of Standards	2005	1948 –2001	0.054
Canada	SCC	Valeur economique de la normalisation	2007	1981 –2004	0.356
Australia	CIE	Standards, Innovation and the Australian Economy	2007	1962 –2004	0.17
France	AFNOR	Impact economique de la normalisation	2010	1950 – 2007	0.12
New Zealand	SNZ	The Economic Benefits of Standards to New Zealand	2010	1987 – 2009	0,1 (0,054)
Northern European Countries	Menon Economics	Influence of Standards the Nordic Economies	2018	1976 – 2014	0.7
Russia	RST	Zazhigalkin A.V., Development of the national standardization system in the conditions of the formation of a new technological structure	2021	2005 –2018	0.13

Given that standards are information, they affect the technological application of products and services. In practice, staff use the standards document as an important source of information on the current state of the art (Blind K., The Economic of Standards: Theory, Evidence, Policy., 2004). Hence, the number of domestic stock standards is used as an input indicator in the model.

Then

$$Sci(t) = \sum_{i=t-\infty}^{i=t} St(i) - \sum_{i=t-\infty}^{i=t} W(i) \qquad (5$$

Here:

Sci(t) – t volume of standards fund at the end of the period,

St(i) – i standard issue printed in,

W(i) – i number of standards abolished in.

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Sci(t) at the end of its period, the standard "residual" serves as an output flow coefficient for the economy during time interval t according to the proposed model.

In this model, the coefficients can be increased. Many scientists have tried to do this, but lack of data or the feature-rich nature of some standards has prevented it. In this manner, the number of standards publications by year is shown as the focus.

The model presented varied from factor to factor and was not adequate between countries in making the calculations (Haimowitz J., 2007) (Miotti H., 2009) (Zazhigalkin, 2021). Yet studies show that small changes in the model over a short period of time lead to price volatility. So, depending on the number of standards, the elasticity coefficient is sensitive to the selected period segment.

On the other hand, the same application of the research conducted for countries raises some problems:

Empirical application of growth theory can yield different results depending on the data used and the characteristics of the estimation model; statistik problemlər;

Quantification of knowledge index.

Patent and standards factors are also taken into account in this function:

$$GDP= A*K^{\alpha}*L^{\beta}*ST\ (t)^{\varepsilon}*PAT(t)^{\delta} \quad \textbf{(6)}$$

Because finding patents from data is difficult lets leave:

$$GDP=A*K^{t}*L^{\beta*}\ ST\ (x)^{\varepsilon} \quad \textbf{(7)}$$

Applying this model to Azerbaijan statistics were collected and calculations were made.

Development and Assessment of a Database for Evaluating the Impact of Standards Implementation on Economic Growth

Compilation of possible statistics on the application of the standards.

We use the Cobb-Douglas production function to estimate the impact of standards on economic growth in Azerbaijan. Information from the State Statistics Committee of Azerbaijan and the Azerbaijan Standardization Institute are used for this purpose.

The model for Azerbaijan will have the following form:

$$GDP= Z*K\alpha*L\beta*ST\varepsilon \quad \textbf{(8)}$$

Here:

K is the availability of basic industrial-production funds, L is the employed population, ST is the applied standards, α, β, ε is the elasticity coefficient, Z is scientific and technical progress.

The following steps were performed during data processing:

- Catalogs of Azerbaijani Standards (AZS) (Annex 1) and International Standards (IS) (Annex 2) used as standards in Azerbaijan were obtained from https://e-standart.gov.az/StandardClassification/Index;

- AZS and GOST catalogs were also purchased from the Foundation of the Azerbaijan Standardization Institute;

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- Inconsistencies were discovered by comparing catalogs;

- The canceled standards were removed from the catalogs, and the catalogs were again compared and refined;

- The valuation period and the balance for that period are determined;

- On the basis of these catalogs, the number of gas stations and GOSTs and the number of commutators by year were calculated (changes and originals are indicated, balances by year are calculated);

- Based on the cumulative number of gas stations and GHOs by year, the Total Standard Quantity by year was calculated;

- A time series of the application of the standards was found for the years 1995-2023 (Table 5).

Table 5. In Total, the Standards Applied in Azerbaijan for the Years 1995-2023

Information on AZS			Information on GOSTs		Total standard number
Year	Number by years	Cumulative number	Number by years	Cumulative number	
1995	0	3	205	665	870
1996	1	4	247	912	1159
1997	1	5	198	1110	1308
1998	3	8	143	1253	1396
1999	3	11	65	1318	1383
2000	6	17	81	1399	1480
2001	28	45	179	1578	1757
2002	0	45	243	1821	2064
2003	33	78	103	1924	2027
2004	6	84	81	2005	2086
2005	72	156	85	2090	2175
2006	41	197	92	2182	2274
2007	42	239	56	2238	2294
2008	40	279	48	2286	2334
2009	48	327	123	2409	2532
2010	82	409	42	2451	2493
2011	106	515	145	2596	2741
2012	95	610	413	3009	3422
2013	61	671	326	3335	3661
2014	131	802	403	3738	4141
2015	65	867	111	3849	3960
2016	11	878	94	3943	4037
2017	0	878	87	4030	4117
2018	0	878	23	4053	4076
2019	5	883	98	4151	4249
2020	17	900	133	4284	4417
2021	35	935	88	4372	4460
2022	66	1001	12	4384	4396
2023	58	1059	n/a	n/a	0

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- The other indicators needed in the model (GDP, availability of main industrial-production funds, employed population) were taken from the website of the State Statistics Committee of Azerbaijan (State Statistical Committee of the Republic of Azerbaijan, 2024) and processed (Annex 3-9).

- The GDP deflator is calculated relative to the previous year.

- The data is combined into a general table.

Since the data on the main industrial-production funds refer to the year 2000, the calculation period is taken from this year.

Table 6. Total Baseline Data For 2000-2023.

Year	GDP, in million manats	Availability of basic industrial-production funds, at the end of the year, million manats	Employed population (thousands)	Change in GDP deflator, %, in percentage compared to the previous year	GOST Cumulative count	AZS cumulative number	Total standard number
	GDP	LABOR	FOND	DEF_UDM	GOST	AZS	ST
2000	4718	18140	3856	112	665	3	668
2001	5316	20960	3891	103	912	4	916
2002	6063	22315	3931	103	1110	5	1115
2003	7147	25412	3973	106	1253	8	1261
2004	8530	29046	4017	108	1318	11	1329
2005	12523	33803	4062	116	1399	17	1416
2006	18746	40641	4111	111	1578	45	1623
2007	28361	50183	4162	121	1821	45	1866
2008	40137	54736	4216	128	1924	78	2002
2009	35602	61437	4272	81	2005	84	2089
2010	42465	66660	4329	114	2090	156	2246
2011	52082	74186	4375	123	2182	197	2379
2012	54744	84262	4445	103	2238	239	2477
2013	58182	95451	4521	100	2286	279	2565
2014	59014	110678	4603	99	2409	327	2736
2015	54380	124008	4672	91	2451	409	2860
2016	60425	169120	4760	115	2596	515	3111
2017	70338	182789	4822	116	3009	610	3619

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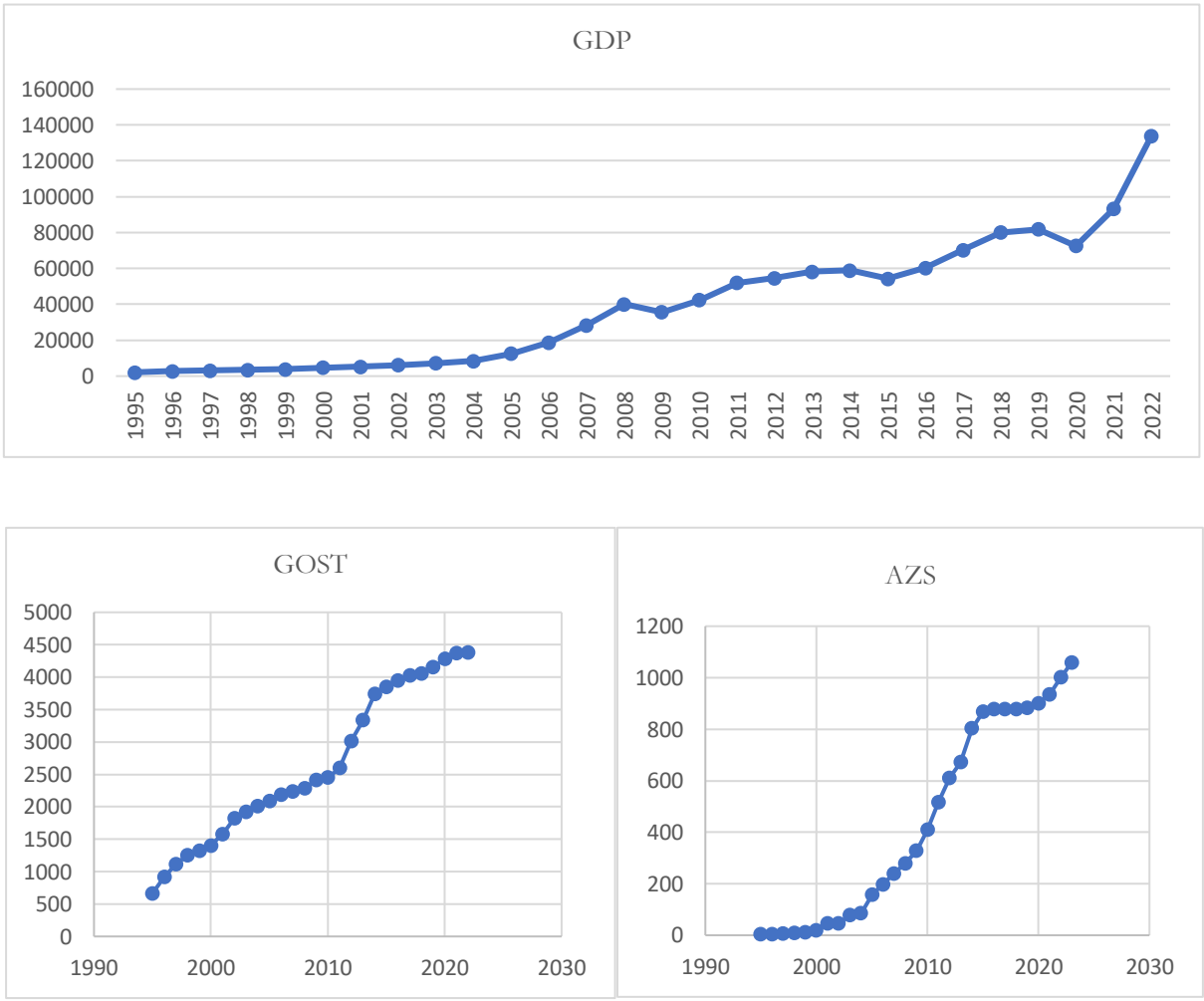
2018	80092	198970	4879	112	3335	671	4006
2019	81896	227221	4786	100	3738	802	4540
2020	72578	240694	4721	93	3849	867	4716
2021	93203	259275	4831	122	3943	878	4821
2022	133826	n/a	4901	137	4030	878	4908
2023	n/a	n/a	3856	n/a	4053	878	4931

At the end, the dynamics of GDP growth and AZS and GOST were analyzed.



Graph 1. GDP, GOST And AZS Growth Dynamics

Processing And Analyzing the Collected Data

Each part of the formula is logarithmized and converted to linear form. Then the Cobb-Douglas model with logarithmic coordinates:

$$\text{In (GDP)} = \text{In(A)} + \alpha \text{ In (LABOR)} + \beta \text{In (FOND)} + \varepsilon \text{ In (ST(t))} + \varepsilon \qquad \textbf{(9)}$$

Table 7. Data Are in Logarithmic Values

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Year	LN(GDP)	LN(LABOR)	LN(FOND)	LN(GOST)	LN(AZS)	ST
1995	7,665	8,192	n/a	6,499	1,098	6,504
1996	7,913	8,212	n/a	6,815	1,386	6,820
1997	8,057	8,214	n/a	7,012	1,609	7,016
1998	8,143	8,216	n/a	7,133	2,079	7,139
1999	8,236	8,238	n/a	7,183	2,397	7,192
2000	8,459	8,257	9,805	7,243	2,833	7,255
2001	8,578	8,266	9,950	7,363	3,806	7,392
2002	8,709	8,276	10,012	7,507	3,806	7,531
2003	8,874	8,287	10,142	7,562	4,356	7,601
2004	9,051	8,298	10,276	7,603	4,430	7,644
2005	9,435	8,309	10,428	7,644	5,049	7,716
2006	9,838	8,321	10,612	7,687	5,283	7,774
2007	10,252	8,333	10,823	7,713	5,476	7,814
2008	10,600	8,346	10,910	7,734	5,631	7,849
2009	10,480	8,359	11,025	7,786	5,789	7,914
2010	10,656	8,373	11,107	7,804	6,013	7,958
2011	10,860	8,383	11,214	7,861	6,244	8,042
2012	10,910	8,399	11,341	8,009	6,413	8,193
2013	10,971	8,416	11,466	8,112	6,508	8,295
2014	10,985	8,434	11,614	8,226	6,687	8,420
2015	10,903	8,449	11,728	8,255	6,765	8,458
2016	11,009	8,467	12,038	8,279	6,777	8,480
2017	11,161	8,480	12,116	8,301	6,777	8,498
2018	11,290	8,492	12,200	8,307	6,777	8,503
2019	11,313	8,473	12,333	8,331	6,783	8,523
2020	11,192	8,459	12,391	8,362	6,802	8,553
2021	11,442	8,482	12,465	8,382	6,840	8,576
2022	11,804	8,497	n/a	8,385	6,908	8,591
2023	n/a	n/a	n/a	n/a	6,965	6,965

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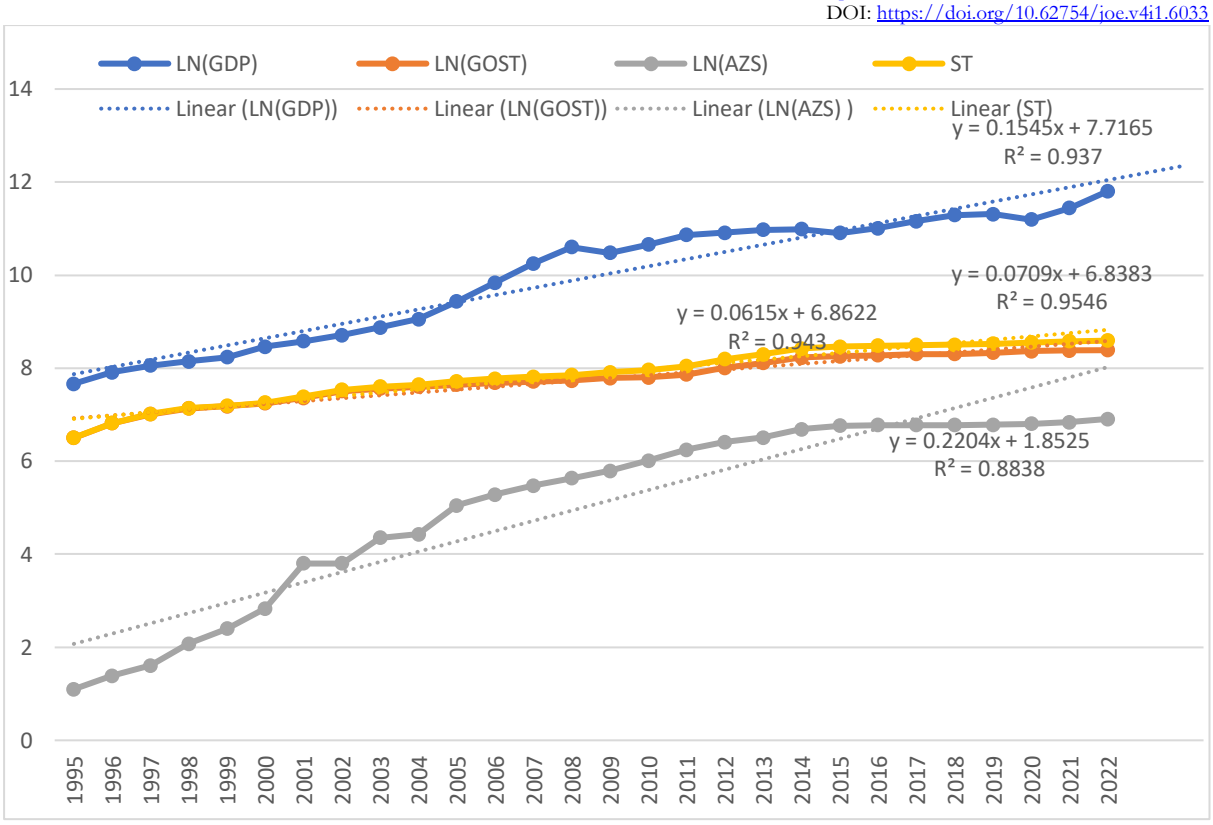

Graph 2. Growth Dynamics Of GDP, AZS, GOST and ST

Measuring the Impact of the Implementation of Standards On GDP

The processing was conducted using regression analysis "Microsoft Excel".

Variance analysis								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	5,00	20,51	4,10	163,21	0,00			
Remainder	16,00	0,40	0,03					
Итого	21,00	20,91						
	Coefficients	*Standard error*	*t-statistics*	*P-value*	*Bottom 95%*	*Top 95%*	*Bottom 95%*	*Top 95,0%*
Y-intersection	-151,40	182,59	-0,83	0,42	-538,47	235,66	-538,47	235,66
Variable X 1	4,58	3,59	1,28	0,22	-3,03	12,18	-3,03	12,18
Variable X 2	0,25	0,72	0,35	0,73	-1,28	1,78	-1,28	1,78
Variable X 3	-2,78	0,71	-3,91	0,00	-4,28	-1,27	-4,28	-1,27
Variable X 4	0,79	0,09	8,86	0,00	0,60	0,98	0,60	0,98
Variable X 5	0,07	0,09	0,76	0,46	-0,12	0,26	-0,12	0,26

As a result of regression analysis, the period is determined.

Regression statistics					

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Multiple R	0,943911				
R-squared	0,890969				
Normalized R-squared	0,872797				
Standard error	0,356693				
Observations	22				
Analysis of variance					
	df	*SS*	*MS*	*F*	*Significance F*
Regression	3	18,71424	6,23808	49,03008	7,2871E-09
Residue	18	2,290134	0,12723		
Total	21	21,00437			

	Coefficients	**Standard error**	**t-statistics**	**P-value**	**Bottom 95%**	**Top 95%**	**Bottom 95%**	**Top 95%**
Y-intersection	4,879	58,393	0,083	0,934	-117,801	127,560	-117,802	127,560
LN (LABOR)	-1,229	8,209	-0,149	0,882	-18,477	16,018	-18,477	16,0187
LN (FOND)	0,805	0,607	1,326	0,201	-0,470	2,082	-0,470	2,082
ST	0,836	1,267	0,659	0,517	-1,827	3,499	-1,827	3,499

Cobb-Douglas model with logarithmic coordinates:

$$IN(GDP)= 4,9-1,23*In\ (LABOR)+0,80In\ (FOND)+0,84IN\ (ST) \quad \textbf{(10)}$$

When the value of R2 (0.89) approaches 1, the model is considered correct.

We exponentialize the obtained function and obtain the Cobb-Douglas production function:

$$GDP= A*LABOR^{-1,23}*FOND^{*0,80*}ST^{0,84} \quad \textbf{(11)}$$

The resulting model shows an increasing volume effect because the sum of the elasticity coefficients ($\beta+\varepsilon=1.64$) is greater than 1. This demonstrates that when FOND and ST increase at a certain rate, GDP increases at a higher rate. When the resulting (ε) standards elasticity coefficient increases the stock of standards by 1%, GDP increases by 0.84%.

The database of standards and the results of preliminary assessments in the program "MS Excel" in the attachment is presented to your attention.

It should be noted that the time series of fixed assets starts from 2000. Initially, the indicators were estimated in nominal terms.

Regression statistics								
Multiple R	0,99							
R-squared	0,98							

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Normalized R-squared	0,98							
Standard error	0,15							
Observations	22,00							
Analysis of variance								
	df	*SS*	*MS*	*F*	*Significance F*			
Regression	5,00	20,62	4,12	173,38	0,00			
Residue	16,00	0,38	0,02					
Total	21,00	21,00						
	Coefficients	Standard error	*t-statistics*	*P-value*	*Bottom 95%*	*Top 95%*	*Bottom 95%*	*Top 95%*
Y-intersection	-145,87	177,66	-0,82	0,42	-522,48	230,74	-522,48	230,74
LN(LABOR)	4,25	3,49	1,22	0,24	-3,15	11,65	-3,15	11,65
LN(FOND)	0,28	0,70	0,40	0,70	-1,21	1,77	-1,21	1,77
LN(GOST)	-2,68	0,69	-3,88	0,00	-4,15	-1,22	-4,15	-1,22
LN(AZS)	0,78	0,09	8,95	0,00	0,59	0,96	0,59	0,96
t	0,07	0,09	0,76	0,46	-0,12	0,25	-0,12	0,25

According to the results of the assessment, the gas station standards had a positive impact on GDP, while the GOST standards had a negative impact. The cumulative effect of both is positive. Initially, we can say that increasing the number of standards by one percent increases GDP by 0.84%. Since there is no field assessment database, no such assessment was conducted.

Given that the average annual growth in the number of standards during the time period under study is 5.57%, the impact of national standardization on economic growth is about 5.52%. This shows that the average annual efficiency of standardization for the period 2000-2022 is 21.59 million manats in monetary terms.

The elasticity coefficients obtained for capital labor and standard indicate the intensity of the impact of these factors on GDP. In other words, the coefficients of economic growth corresponding to certain factors characterize the degree of significance of individual factors in the growth of the resulting indicator.

A negative elasticity coefficient indicates a decrease in the utilization of this factor. Mainly, the coefficient of capital factor elasticity is negative. It also shows that capital growth does not lead to GDP growth.

Conclusion and Findings

The research has attempted to explore the role of application of standards on economic growth and to assess the role of application of standards on the economic growth of the Azerbaijan Republic.

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Upon reviewing the article, a series of significant results and some groundbreaking aspects implied by the studies have been underscored. Hence, like other productive factors, standard spillovers may affect the economic efficiency of an economy, and the proper diffusion of international standards may indeed lead to positive long-run growth effects. As the knowledge stock of an economy rises, the returns from its accumulation may decrease, implying that alternative sources of growth should be also sought. Standards provide additional opportunities beyond their main functions and can enhance the quality, competitiveness and novelty of exports. Therefore, it is found that, in light of this, the growth induced by standard related to increases in product quality is particularly welcomed. A further intriguing question is whether the results described above may be extended to other transition economies as well. This seems highly probable, especially since they have been integrated into world markets and their trade has risen faster than global exports.

- The Cobb-Douglas macroeconomic production function adopted by The Federal Ministry of the Interior and Community of Germany in 2000 was used as a basis. Nevertheless, only the standard was accepted as a scientific index, the license and R&D were not accepted (due to lack of information).

- The value of R2 (0.89) approaches 1. This shows that the quality of the model is high, which means that the regression specifically captures the relationship between the independent indicators (capital, labor, standard) and the dependent indicator (GDP).

- There is an increasing effect in the resulting model because the sum of the elasticity coefficients is greater than 1. This FOND ST is increasing at a certain rate, which means that GDP is increasing at a high rate.

- A 1% increase in the elasticity coefficient of the standards fund causes a 0.84% increase in GDP. Thus, the contribution of national standardization to economic growth is 5.52%.

- The result obtained is in line with the result obtained by other countries, even higher (this refers to the calculation period). The obtained result also shows that the generally applied standards have a positive effect on technical progress. Hence the impact on economic growth is largeAccording to the research results of other countries, the impact of standardization on economic growth is 0.3-0.9%, while for standard reserves, the elasticity is 0.05-0.4%.

- The applied Cobb-Douglas model permits the estimation of the total economic contribution of standards to the economy, as well as the corresponding amounts of budgetary funding.

To assess the contribution of standards to the industry, to identify priorities for the development of standardization, to identify areas less affected by standardization, and to investigate ways to address identified problems, it is necessary to conduct an economic assessment.

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