

Technological transformation in Algeria and its implications for sustainable development

التحول التكنولوجي في الجزائر وتداعياته على التنمية المستدامة

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Received date: 13 / 11 / 2025

Acceptance date: 01 / 12 / 2025

ملخص:

يعتبر الانتقال من الاقتصاد الصناعي إلى اقتصاد المعرفة من أهم سمات هذا العصر، وذلك نتيجة التحولات السريعة في طرق التفكير والإنتاج، مما يجعل الكثير من الدول النامية تبحث عن النقلة الحضارية من خلال إحلال التكنولوجيا في كل القطاعات والميادين باعتبارها الركيزة الأساسية الأهم في التنمية، حيث أنها من متطلبات الوصول إلى التقدم والرفاه الاجتماعي فهي تلعب دورا هاما في تطوير الممارسات والاستراتيجيات التنموية، لهذا سعت الدولة الجزائرية في بداية السبعينات من القرن الماضي لتحويل المجتمع الجزائري من مجتمع زراعي إلى مجتمع صناعي يعتمد على الصناعات المصنعة الثقيلة وبكفاءات جزائرية وهذا من خلال الاعتماد على التكنولوجيا الحديثة التي تعتبر القوة الدافعة نحو تحقيق التنمية المستدامة والقوة الأساسية في إحداث التغيير على جميع المجالات والقطاعات .

من هذا المنطلق نطرح التساؤل التالي: هل ساهم التحول التكنولوجي في إحداث التنمية المستدامة في الجزائر؟

الكلمات المفتاحية: التكنولوجيا، التحول التكنولوجي، التنمية المستدامة، الفجوة الرقمية

Abstract:

The transition from an industrial economy to a knowledge-based economy is considered one of the most significant characteristics of the modern era. This shift results from rapid transformations in modes of thinking and production, prompting several developing countries seek a civilizational leap through the integration of technology across all sectors and fields, as it represents a fundamental pillar of development. Technology is among the essential prerequisites for achieving progress and social welfare, playing a vital role in the development of practices and developmental strategies.

In this context, the Algerian state, since the early 1970s, has sought to transform Algerian society from an agricultural society to an industrial one based on heavy industry and

manufacturing industries operated by national competencies. This effort relied on modern technology as the driving force toward achieving sustainable development and as the major catalyst for change across all sectors and domains.

From this standpoint, the following question arises: Has technological transformation contributed to achieving sustainable development in Algeria?

Key words: Technology, Technological Transformation, Sustainable Development, Digital Divide

Introduction:

The contemporary society is witnessing a continuous increase in reliance on technology in various fields because of the rapid transformation and progress that the world is witnessing today at an increasing rate where technological transformation has become an imperative necessity, as the world 's strength today is based on the possession of technology and knowledge, and this is what prompted Algeria to keep pace with this transformation by relying on imported technology in an effort to build an industrial base along with global economic developments, and it has relied on this strategy since the dawn of independence to advance the national economy and achieve comprehensive development.

Sustainable development is the strategic goal that Algeria seeks, especially in light of the internal situation and global transformations, as it is obligated to achieve the goals of sustainable development in the economic, social and environmental dimensions to balance the Algerian competencies, which also represent one of the major challenges of the modern Algerian state.

It also represents the technological transformation which is the cornerstone of the new system adopted by the Algerian state after independence (heavy industries), that relied upon by the state in the events of sustainable development, but this strategy did not succeed in the desired civilizational shift because of several functional and socio-cultural obstacles. Therefore, we seek in this article to identify the contributions of technological transformation in promoting sustainable development and the obstacles

that prevent it through the problematic question: the problem of sustainable development and the obstacles to technological transformation in Algeria

Importance of the study:

The importance of this study is represented in the following points:

a- The importance of technological transformation in the strategy of government (digital government) at the grassroots level and local communities, since it has been classified as one of the most important components of sustainable development in Algeria.

- b- Algeria's active role in promoting local development through the adoption of imported technology.
- c- Manifestations of promoting sustainable development.
- d- Sustainable development is the most important driver of the national economy.

Objectives of the study:

- a- Attempting to know the nature of the relationship between technological transformation and sustainable development in Algeria.
- b- Studying the Reality of Technological Transformation in Algeria
- c- Knowledge of functional barriers to technological transformation.
- d- Revealing the extent to which technological transformation contributes to promoting sustainable development.

First: The conceptual dimension of the study

1. Concept of technology:

Technology is an ancient Greek word derived from two words (TECHNO), meaning technical skill, and the word (LOGOS) means science or study, and thus the term technology means the organization of technical skill. The concept of technology has been associated with industries for over a century and a half, which means a technology that has been attributed to techniques, the science of skills or the arts, i.e., the study of skills logically to perform a specific function.

Gilbert defined technology as "the systematic application of scientific knowledge, or knowledge organized for practical purposes". (Jamal, 2015, p. 15)

From the previous definition, we conclude that technology is a structured, knowledge-driven method, in which we use all the possibilities available in effective ways to accomplish the desired work, with a high degree of mastery. It is also known as "information and knowledge used in inventions, innovations and continuous improvements" (Al-Najjar, 2014, p. 25)

Hazel Henderson defined technology as "human knowledge and its applications in order to achieve the forests and goals of individuals, it encompasses the technology of designing political and economic systems and software" (Daoud, 2007, p. 96)

2 The concept of technological transformation:

It is defined as "the process of introducing, improving and developing activities in a manner that differs from their status quo to better achieve the objectives" (Daoud, 2007, p. 96)

Through this definition, we conclude that technological transformation is carried out for the purpose of changing and developing processes is to achieve the desired goals.

Technological transformation also refers to "modifications in the systems and methods of work used in the execution of the work of the organization, and therefore may include the introduction of new technology in production or in a new system in the sorting and selection of new individuals, or the use of advanced methods in evaluating the performance of workers" (Abbas, 2002, p. 200)

This definition suggests that technological transformation is a set of modifications in labor systems and the human resource that has the skill to control this technology.

And it is also "the creation of new technical knowledge or equipment used in production processes, which contribute to improving the quality of production and marketing, reducing costs and increasing productivity" (Dessler & Ahmed Sayed , 2003, p. 296)

Thus, through the previous set of definitions of technological transformation, we can define it as a change in various equipment and methods by introducing recent equipment used in production processes that lead to the development of new methods of doing administrative and industrial work to improve the quality of production and serving the citizens.

3. Sustainable development:

It is development that respects natural resources and ecosystems, supports life on earth, and ensures economic development without neglecting the social goal that is manifested in the fight against poverty, unemployment, inequality, and the search for justice. (Rida & Muhanna , 2009, p. 489)

That means the management and distinctive use without waste or delay in investing in basic natural resources such as soil and water with the continuous maintenance and rehabilitation of the investment process. The use of these resources coupled with human development of various types, whether living, health, educational, recreational or cultural to reassure the current and future humanitarian requirements of the population through network of responsible institutions, in accordance with the multiple technologies and the modern economic and technological possibilities are socially acceptable. (Ali, 2022)

And so, sustainable development means the strategic effort of management that is in the service and well-being of society in order to achieve a balance between the economic, social and environmental fields.

Second: Effects of technological transformation on sustainable development:

1 Positive effects:

It can be said that technological transformation takes the form of knowledge, information, behavior and a shift in thinking patterns.

- Fast performance and economical time management.
- creating new jobs and overcoming unemployment (replacing foreigners with local workers).
- Internal and external economic increases.
- It increases export opportunities and opens new markets.
- Employing and exploiting national factors of production (raw materials, money, land and labor) . (Al-Najjar, 2014, pp. 13-14)

2 Negative effects:

Technological transformation affects the range of products, services and operational processes. Besides new products and services can be added or deleted, and new operational processes can be added or replaced by new arts.

Technological transformation in the size and scope of production processes and the shape and characteristics of products and services.

The absence of a digital culture is among the reasons that do not help creativity and innovation, which increase the fight against change, in turn, causes administrative and organizational problems that hinder the good functioning of the public facility.

For instance, the use of information technology and electronic computers has replaced manual and mechanical work. This entails getting the work done in a short time, at a lower cost and with stronger competition: (Al-Najjar, 2014, p. 54)

Third: The reality of technological transformation in Algeria and the problem of sustainable development.

The policy followed in Algeria was aimed at achieving an increase in production and thus building solid and integrated foundations for the economy, depending on imported technology.

Since independence, Algeria has tried to fill the gap in its structure, especially those structures related to the industrial sector, in an effort to achieve development and get rid of the negative effects of French colonialism, which controlled the management of

its options, especially its industrial ones, and to restore its balance, Algeria tried to implement several economic reforms to return the

National economy on the road and achieve sustainable development. In the end, during all these transformations, Algeria sought to keep pace with technological development through the manufacturing policy, in which it relied on importing ready-made factories without taking into account the historical and cultural specificity of Algerian society. This made it lose the first two times by importing these factories with huge money, and it was not the first technology. This caused a second

loss represented in the maintenance of these factories, which again requires the use of foreign competencies to maintain these factories again. In the same context, he says of the results of the importation of industrial technology are that "industrial units are scattered throughout Algeria, but the industrial spirit has not gone into any one of them) (Djamel, 1997) , this can be attributed to the fact that Algeria, in view of the inevitability of technological transformation, did not take into account the nature of the appropriate technology and in line with its industrial conditions, in addition to the lack of society that is undergoing several transformations in light of globalization.". (Hamzawy, 2016)

Within the framework of the above, development has become a necessary process to move different and developing societies to an advanced stage, and some societies may succeed in achieving this goal. The reason for this is that officials in these societies rely on economic entrances alone as a means to achieve development at faster rates, ignoring the role and effectiveness of other entrances that make up society, such as (morale, participation, social responsibility...). (Abdel-Latif, 2011, p. 76)

and this success is like a mirage because the real actor in this process is local human capital that has not been at the level of these profound transformations in the ways and means of production, so the failure is due to not paying attention to this aspect that gives development strength and effectiveness to achieve the goals and objectives it seeks.

And therefore, development is to employ all efforts for the benefit of all, where it includes all sectors. It is a process of directed change through which the needs of individuals are satisfied... Studies emphasize the importance of the human factor in development, as they confirm that economic progress in developing countries is based mostly on human investment and not on capital...". (Abdel-Latif, 2011, p. 135)

And the real investment today is to train and train Algerian competencies on modern technology to access the knowledge society, " in light of the talk about technological transformation and its applications to a productivity tool that leads the pace of entry towards a post-industrial society, the knowledge society and its industry, the digital divide is thrown between those who know and the tools to exploit it, and those who do not have it and lack its tools ..." (Mozzi, 2009, p. 07).

Finally, the technological transformation contributes to overcoming the obstacles of social activities to work efficiently with what technological means give it with the innovations of science in this field, so Algeria has restructured the administrative system and activated it during the past years, the state has created some ministries, including the Ministry of the Knowledge Economy, emerging institutions and small enterprises, as well as the Ministry of Digitization and Statistics because of the importance of this technology in the development process, and the need to make efforts to enhance the state's capabilities to benefit from it and shift towards a knowledge-based society.

Fourth: The obstacles to technological transformation in Algeria.

1. Functional constraints of digital technology in the Algerian institution.

The main functional constraints of digital technology in Algerian institutions include: the weakness of technological infrastructure and Internet networks, the high cost of digital systems and devices, the lack of qualified human competencies and training, the resistance of employees to change and the difficulty of adapting to them, and the absence of a supportive legislative and legal environment. In addition, cybersecurity threats.

1.1. Technical constraints and lack of technological infrastructure (IT Infrastructure).

The technological dimension (administrative and technical dimension) is among the secondary dimensions of sustainable development, to achieve this development, "it is necessary to shift from resource-intensive technology to information technology, and this means a shift from dependence on productive capital to reliance on human and social capital, and therefore sustainable development can only occur" (Ali, 2022, p. 280), so it is not possible to talk about a qualitative leap in the absence of modern technology in all fields without exception.

1.2 Devices: We are talking here about the range of means and equipment that are used in production, service and other processes for the purpose of achieving added value, and among the devices are modern technologies such as social media, artificial intelligence, virtual reality, remote learning, smart applications and all devices that use artificial intelligence (AI) technologies to perform complex tasks that require human-like capabilities and robots. Networks are an interconnected system that connects physical components (such as hardware) and software (such as operating systems) to facilitate communication, data transmission, and resource sharing, and includes basic components As for computers, servers, routers, and protocols (such as communication rules), which are not available, they do not guarantee the smooth flow of information, and the inability of these networks to enable functions such as cloud computing, remote communications, cybersecurity, and the emergence of major problems in small local networks that are, in turn, far from complex global networks such as the Internet, there are other obstacles, including that the Algerian Telecom Company, which still

monopolizes the service of providing fixed telephone lines, including fiber-optic connectivity, which is the service that currently allows the best connection to the Internet, this company, like other public companies, is based on non-competitiveness " (El-Nour, 2023, p. 19)

2 Financial constraints: These include:

- The cost of using the Internet.
- Lack of financial resources allocated to the infrastructure needed to implement electronic management, especially the establishment of networks and the development of devices.
- Lack of resources available to senior management.
- Lack of provision of financial allocations needed for training and qualification processes to implement electronic management.
- channeling funding to the most urgent.
- Lack of financial resources for institutions.
- Weak financial incentive system for employees in electronic work.
- Failure to carry out an economic feasibility study for the requirements of applying electronic management and its equipment. (Al-Qahwach, 1, p. 175)

2. Human handicaps:

Human resources play an important role in the conduct of the affairs of organizations, so the integration of technology with human resources management works to increase their efficiency, increase the interaction of employees and communication processes between them, in addition to changing the work procedures and skills required by human resources management or all members of the organization. In a local study of 50 Finnish companies, all executives stressed the importance of the role of knowledge management in valuing the competencies of the organization, and 72% of them considered that it has an important role in human resources development and in saving time and money, and this confirms the necessity of interaction between the human element and the technological element, where the human element, with the help of technology can adapt to the requirements of change (Battat, 2018, p. 99) , so the obstacles to implementing the digital strategy in these organizations can be due to:

1 - Lack of digital skills: A lack of digital skills (the digital divide) is the difference between the digital skills needed to perform modern jobs efficiently and the current skills that workers have.

This lack results from the rapid development of technology and the increased demand for specialized skills such as data analysis, cybersecurity, and cloud computing, while

many employees and workers lack the necessary training and experience, which negatively affects the productivity of organizations and digital transformation

2 - Resistance to change: It is the resistance of employees to change and shift towards digital systems, and the difficulty of their acceptance of new changes, and more precisely, the reluctance of people to adapt to changes or reject them in public or in private, caused by fear of the unknown, a desire to maintain the status quo, a lack of communication, conflicts of interest, or routine and habit.

3- Poor awareness: The lack of awareness of the importance and benefits of digital technology among some employees and management makes the process of engaging in digital transformation, face difficulties, and the lack of awareness of the importance of digital transformation is a major challenge in many institutions, as it reduces the enthusiasm of individuals and institutions to adopt modern technology, and pushes them towards resisting change, which hinders development efforts and returns

performance rates.

4 - Security Obstacles: Cybersecurity threats are the largest threats ever, which require a secure technological infrastructure to protect data, and among the security obstacles are also:

- Great fears among dealers with departments of the success of one of the attempts to penetrate the administration with which they deal, and that the penetration of their data by deletion or destruction, or exploiting it in illegal acts.
- Lack of software to control intentional intrusions.

_ Information security challenges encompass a wide range of elements, some of which are technical, related to the technical systems, software and hardware used, and others are related to individuals and administrative bodies based on electronic management around the world." (Iman & Ateeq, 2025, p. 351)

Finally, technology constraints are problems related to technological infrastructure, as weak Internet networks and dependence on old devices, in addition to Financial obstacles such as the high cost of hardware and software, and the lack of funding for digital projects. And there are human challenges, such as the lack of skills and competencies for workers, lack of awareness and acceptance among users, as well as regulatory and legal obstacles, such as the absence of legislation supporting the digital environment.

Conclusion:

Based on the aforementioned indicators, we find that the technological transformation in Algeria is an inevitable necessity for the state, its institutions first, and society second, To adapt and engage in it because of its importance, as the technological transformation would provide innovative and creative new job opportunities that contribute to the development of work methods, operations and electronic operations for institutions besides, the state increases exportation opportunities and opens new markets... All these advantages of technological transformation contribute to promoting sustainable development, providing basic needs, and achieving a qualitative leap.

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