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Digital Transformation in Higher Education in Algeria: Policies and Strategies

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Abstract:
This study aims to examine the policies and strategies adopted by Algeria in the field of digitalization within higher education and scientific research institutions. Through its higher education policies, Algeria seeks to keep pace with the global transformations imposed by digitalization by adopting strategies that focus on developing technological infrastructure, promoting e-learning, and modernizing university governance methods. Digital platforms for education and management (such as the PROGRES system) have been established, and the use of Learning Management Systems (LMS) such as Moodle has been generalized. In addition, scientific research in fields such as artificial intelligence and cybersecurity has been encouraged, along with the creation of university incubators and innovative projects to better link universities with the digital economy. Despite these efforts, challenges remain, particularly ensuring digital equity among universities and developing human resources capable of mastering digital tools. The study concludes that the success of these policies requires a comprehensive vision that integrates technological, pedagogical, and governance dimensions, enabling Algerian universities to adapt to the demands of the global knowledge society

Keywords*: Higher Education – Digitalization – Innovation – Policies*

Transformation numérique dans l'enseignement supérieur en Algérie : politiques et stratégies

Résumé :
Cette étude vise à examiner les politiques et stratégies adoptées par l'Algérie dans le domaine de la numérisation au sein des établissements d'enseignement supérieur et de recherche scientifique. À travers ses politiques en matière d'enseignement supérieur, l'Algérie cherche à suivre le rythme des transformations mondiales imposées par la numérisation en adoptant des stratégies axées sur le développement des infrastructures technologiques, la promotion de l'apprentissage en ligne et la modernisation des méthodes de gouvernance universitaire. Des plateformes numériques pour l'éducation et la gestion (telles que le système PROGRES) ont été mises en place, et l'utilisation de systèmes de gestion de l'apprentissage (LMS) tels que Moodle s'est généralisée. En outre, la recherche scientifique dans des domaines tels que l'intelligence artificielle et la cybersécurité a été encouragée, parallèlement à la création d'incubateurs universitaires et de projets innovants visant à mieux relier les universités à l'économie numérique. Malgré ces efforts, des défis subsistent, notamment celui d'assurer l'équité numérique entre les universités et de développer des ressources humaines capables de maîtriser les outils numériques. L'étude conclut que le succès de ces politiques nécessite une vision globale intégrant les dimensions technologiques, pédagogiques et de gouvernance, permettant aux universités algériennes de s'adapter aux exigences de la société mondiale de la connaissance.

Mots clés *: Enseignement supérieur – Numérisation – Innovation – Politiques*

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Introduction :

Higher education and scientific research institutions play a pivotal role in achieving sustainable development and fostering innovation across various fields. They serve as the beacon for preparing new generations and building the knowledge base that contributes to improving quality of life and promoting economic and social progress. With rapid technological advancements and the increasing demands of global markets, the importance of anticipating the prospects of these institutions to meet future requirements has become evident.

The higher education sector worldwide is undergoing profound transformations due to the digital revolution and the advancements in information and communication technologies. Digitalization is no longer merely a technical option but has become a strategic necessity for preparing human capacities capable of integrating into the knowledge economy. In this context, Algeria has adopted a set of policies aimed at the digitalization of higher education, with the objective of improving the quality of training, facilitating access to knowledge, and enhancing university governance. These efforts have been reflected in the expansion of digital infrastructure, the adoption of e-learning systems, the integration of artificial intelligence, and the digitalization of administrative and pedagogical management. However, these policies continue to face challenges, including insufficient infrastructure, the digital divide between institutions, and the need to train faculty members and students in digital competencies. Hence, the significance of studying this topic lies in understanding the reality of

digitalization in Algerian universities and exploring its future prospects. Accordingly, the research problem posed in this study is:

What is the importance of digitalization in higher education in Algeria?

The study is structured into four main axes:

- Axis 1: Defining the key concepts of the study
- Axis 2: The importance of digitalizing higher education and scientific research in Algeria
- Axis 3: National policies for the digitalization of higher education in Algeria
- Axis 4: Prospects and strategies for developing higher education and scientific research

1. The Conceptual Framework of the Study

1.1. The Concept of Education:

Education is a communicative activity aimed at stimulating learners' motivation and facilitating the learning process. It involves a set of activities and decisions taken by the teacher or the learner within the educational context. It is also considered a field of study that focuses on teaching methods, techniques, and the organization of educational situations in which students interact to achieve the desired objectives. Furthermore, education is a deliberate design or structuring of the learning environment in such a way that it leads to learning or to the management of learning under the supervision of the teacher.

1.2. The Concept of Higher Education:

Higher education is a process that aims to provide individuals with a certain level of knowledge and expertise. It focuses on supplying learners with information that

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qualifies them for professional life, whether by enhancing their general knowledge or by deepening their understanding of the surrounding environment. It also seeks to develop learners' intellectual abilities, foster their skills, and enable them to acquire both general and specialized knowledge, thereby achieving the required professional competence.

2. The Concept of Scientific Research:

Scientific research is defined as "a method of inquiry through which solutions to specific problems can be reached by means of comprehensive and rigorous investigation of all verifiable evidence and data related to the problem."

3. The Concept of the University:

The university is defined as "a productive institution that enriches knowledge, develops technologies, and prepares human capacities, benefiting from the accumulated scientific heritage of humanity in various scientific, administrative, and technical fields."

4. The Concept of Digitalization:

Digitalization is "an electronic process of generating digital codes, either through a document, a physical object, or through analog electronic signals. It is the process by which information is transformed from its traditional format into a digital form, whether this information consists of images, textual data, audio files, or any other format."

5. The Smart University :

The smart university is a highly efficient and effective educational institution that brings about a scientific revolution in the acquisition and management of knowledge, as well as in the production and reception of interactive information. It is considered a powerful tool for transforming contemporary life, as it offers highly competitive and quality educational programs through an e-learning environment and supports the concept of lifelong learning.

The smart university relies on several fundamental components and requirements that cannot be fragmented, and must be managed as a unified whole in an intelligent manner:

- **Smart Campus (S-Campus):**
  - Smart and modern facilities and buildings (S-Building)
  - Smart IT infrastructure (S-IT Infrastructure)
  - Digital culture (Digital Culture)

- Smart Human Resources (S-People): trained personnel with essential digital skills
- Smart Learning Environment (S-Educational Environment)

The importance of the smart university lies in its role as a cornerstone of sustainable development by building human capital through the preparation of graduates with high qualifications and skills capable of driving a scientific revolution that ensures excellence and competitiveness within the highly competitive higher education landscape.

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Additionally, it enhances the value of higher education and improves the overall quality of learning.

In conclusion, it must be recognized that smart education is no longer a choice but a necessity. The question is no longer whether it can be achieved, but rather within what timeframe it can be accomplished.

2. The Importance of Digitalizing Higher Education and Scientific Research in Algeria

The digitalization of higher education represents a strategic choice imposed by the accelerating technological transformations worldwide. The integration of digital tools and interactive platforms into the university system has become a central instrument for improving the quality of teaching and learning. Its importance can be summarized as follows:

2.1. Fostering Innovation and Development

Higher education and scientific research are among the main drivers of innovation and creativity, as modern economies rely on knowledge and technology to achieve progress. Renewal, innovation, and creativity are fundamental pillars of societal advancement, forming the very foundation of social transformation and development. Behind every new discovery lie tireless efforts, continuous intellectual engagement, and persistent work contributed by scientists and creative geniuses throughout history. They dedicated themselves to constructing humanity's intellectual edifice, one building block at a time, without fatigue, hesitation, or complaint, often facing a lack of societal understanding of their ideas.

It is in the university's interest to develop its activities, improve its outreach, and enhance its image by embracing diverse initiatives. Digitalization supports scientific research and innovation by facilitating access to international journals and scientific databases, and by enabling researchers to analyze vast amounts of data (big data) through the use of artificial intelligence. Moreover, digitalization encourages innovation and creativity through virtual laboratories, digital incubators, and AI tools, which allow students in Algeria to develop innovative projects. This process contributes to the formation of digital entrepreneurs capable of creating added value for the economy.

2.2. Preparing Human Capital

Universities play a central role in equipping students with the skills required for the labor market while fostering their problem-solving abilities and creativity. As noted, "the university assumes a pioneering role in providing a human base capable of absorbing, adapting, and developing modern technologies. However, mastery of these technologies can only be effective if accompanied by both quantitative and qualitative growth in human capital. No country can pursue a progressive policy in science and technology unless it possesses the human capacity with the appropriate levels, qualifications, and technical expertise to carry out tasks efficiently and successfully."

Human capital is the cornerstone of scientific research, its methods, and the application of its outcomes. It is also the foundation of creativity and innovation, which are themselves the essence competitiveness. Furthermore, the human element is the key factor in organizing and

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coordinating the various material and human components of production, making it the most critical form of capital

Higher education is considered the main source for developing advanced skills in human resources, being one of the key pillars of socio-economic development. Comprehensive development cannot be achieved without building a qualified human base capable of absorbing modern technologies and adapting them to serve both society and the economy. In this regard, universities play a central role in shaping human capital equipped with scientific knowledge, practical abilities, and technical expertise, which are crucial for the success of research, development, and innovation strategies.

In this context, digitalization has become a pivotal tool in preparing human capital within the higher education system. It no longer focuses solely on the transmission of knowledge, but has also reshaped teaching, training, and research practices. This is reflected through:

- Providing students with essential skills such as programming, data analysis, and digital platform management.
- Preparing them to work in environments driven by technology and artificial intelligence.
- Introducing new disciplines aligned with labor market demands, such as artificial intelligence, cybersecurity, and big data, enabling students to gain practical experience through digital simulations and virtual workshops.
- Promoting self-directed and lifelong learning by granting access to global educational content through open platforms.

2.3. Supporting Sustainable Development:

Universities and higher education institutions play a vital role in achieving the United Nations Sustainable Development Goals (SDGs) for 2030. Specifically, SDG 4 emphasizes ensuring inclusive and equitable quality education. However, the impact of higher education extends beyond this goal to encompass all SDGs through teaching, research, and student-led initiatives. These institutions act as incubators for innovative ideas and projects, offering creative solutions to global challenges such as energy, environment, and health. Thus, higher education and scientific research actively contribute to social, economic, and environmental development, positioning universities as key agents of positive change both nationally and internationally.

3. National Policies for the Digitization of Higher Education in Algeria

In recent years, Algeria has intensified its efforts to digitize the higher education and research sector, considering it a strategic step to keep pace with global technological transformations and to ensure the quality of university education. These policies have been reflected in several key areas:

3.1. Generalization of Digital Infrastructure:

The state has worked to strengthen the technical framework of universities and research centers by connecting them to the National Research and Education Network (ARN), creating digital platforms to manage student and faculty affairs such as the PROGRES system, in

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addition to equipping institutions with computer labs and high-quality internet services.

3.2. Distance and Online Learning:

Most Algerian universities have adopted Moodle systems as platforms for e-learning. Furthermore, national platforms for distance education were launched, particularly during the COVID-19 pandemic. This digital system has been consolidated as a complementary tool to face-to-face learning, thus increasing flexibility in the educational process.

3.3. Digital Governance in University Management:

This policy included the digitization of various administrative operations such as university registrations, graduation certificates, and scholarship management. Electronic signatures and digital transactions were also adopted in some institutions, alongside the creation of a centralized information system for pedagogical and administrative management, ensuring transparency and efficiency in university governance.

3.4. Integration of Artificial Intelligence and Emerging Technologies:

Universities aim to encourage research and training in modern fields such as artificial intelligence, cybersecurity, and big data. Innovative projects have also been incorporated within university incubators for the benefit of students and entrepreneurs. These initiatives are part of preparing a generation capable of creativity and of keeping up with global digital transformation.

3.5. Promotion of Open Education and Digital Resources:

National digital libraries have been launched and connected to universities, in addition to providing open platforms for educational resources (OER) that allow unrestricted access to scientific knowledge. This policy also encourages electronic scientific publishing and digital journals as part of strengthening the position of Algerian research in the international academic arena.

4. Prospects and Strategies for Developing Higher Education and Research Institutions in Algeria

4.1. Strengthening International Cooperation

- International cooperation in higher education institutions represents one of the fundamental pillars for developing higher education systems and keeping pace with global challenges. This can be achieved through partnerships with international universities and research centers, thereby enhancing the quality of education and research through several dimensions, including:
- **International agreements and partnerships:** Signing cooperation agreements with global universities and educational institutions to exchange students and faculty members, and to implement joint programs in scientific research and technological development.
- **Academic exchange programs:** Launching student exchange programs to broaden cultural and academic horizons, and hosting international professors and researchers to foster knowledge and expertise exchange.
- **International accreditation of curricula and programs:** Adopting curricula and programs aligned

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with global standards to ensure that institutions meet international accreditation requirements.

- **Technology and innovation:** Using technology to enhance distance learning, connect institutions globally, and support joint research in innovation and modern technologies.
- **International funding and grants:** Benefiting from international funding opportunities to develop institutional infrastructure, while allocating budgets to strengthen cooperative activities with external partners.
- **Cultural and linguistic diversity:** Offering multilingual academic programs to facilitate international cooperation, while fostering intercultural understanding by integrating students from diverse backgrounds.
- **International conferences and forums:** Organizing and hosting international conferences to exchange ideas and best practices, while encouraging researchers to participate in global scientific events to strengthen the institution's reputation.
- **Support for joint research:** Establishing joint research centers with international institutions and providing platforms for global knowledge and innovation exchange.

International scientific cooperation programs constitute an essential tool for knowledge and technology transfer. These include partnership agreements signed by the Ministry of Higher Education and Scientific Research or one of its universities with international organizations (such as UNESCO, WHO, or the World Bank) or with foreign

universities and government-funded programs. Such collaborations, including the establishment of joint research laboratories, reflect the growing international dimension of academic research under the dynamics of academic globalization.

4.2. Digital Transformation and Technology Enhancement in Education:

Information and communication technologies (ICTs) play a major role in developing and improving the quality of education, while contributing to sustainable societal development. Thus, policies in higher education must aim to:

- Strengthen digital transformation within higher education.
- Develop ICT infrastructure across universities.
- Integrate e-learning and blended learning into the university system.
- Invest in the development of distance and blended learning to expand accessibility, particularly in remote areas.
- Benefit from international experiences in digitization through knowledge exchange, academic missions, and training programs.

The use of technology in education not only enhances the learning experience and ensures access for all through online platforms, but also strengthens the knowledge economy, as countries investing in scientific research are better positioned to build innovation- and knowledge-based economies.

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4.3. Enhancing Quality and Academic Excellence:

The quality of higher education is understood as a comprehensive management system based on fundamental, positive, and transformative changes across all dimensions of the institution—encompassing values, organizational culture, management concepts, and leadership styles. Achieving this requires:

- Implementing international quality standards in higher education.
- Updating curricula and teaching methods to align with modern developments.
- Promoting excellence in teaching and scientific research.

4.4. Improving Scientific Research and Development:

Scientific research constitutes the backbone of progress in all fields, as it provides solutions to social, economic, and technological challenges. With the accelerating pace of global change, improving research is a pressing necessity for sustainable development and innovation. Policymakers must therefore focus on:

- Supporting research centers and encouraging applied research.
- Allocating larger budgets for scientific research and aligning it with national economic needs.
- Focusing on priority research fields such as energy, technology, health, and the environment.
- Encouraging innovation and research in strategic areas to meet the demands of the national economy.

4.5. Updating Administrative Structures and Governance

Administrative restructuring and good governance are essential for efficiency and transparency in managing institutions. With rapid economic and technological developments, modernizing these areas has become vital to ensuring adaptability and achieving strategic objectives. This can be accomplished through:

- Strengthening the administrative and financial autonomy of universities.
- Developing digital management systems to improve administrative efficiency.

4.6. Linking Universities with the Labor Market

Connecting universities with the labor market represents a cornerstone for achieving sustainable development and ensuring alignment between educational outcomes and national economic needs. With rapid labor market transformations driven by technological progress and globalization, universities must adapt by preparing graduates equipped with the skills and knowledge required by employers. This linkage requires innovative strategies, including:

- Updating academic programs to match market demands.
- Creating partnerships with enterprises to provide internships, training, and job opportunities.
- Establishing career guidance centers to support student employability.
- Encouraging entrepreneurship and innovation among graduates to promote self-employment and contribute to economic growth.

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- Updating curricula to align with labor market requirements.
- Strengthening partnerships with the public and private sectors to provide training and employment opportunities.
- Revising university specializations to meet labor market demands.
- Achieving this integration between universities and the labor market not only ensures graduates' employability but also contributes to strengthening the national economy and supporting innovation and development.

4.7. Promoting Equity in Higher Education:

Ensuring equity in higher education is a fundamental pillar in building fair and sustainable societies, as it provides everyone—regardless of social, economic, or gender background—with equal opportunities to access education and achieve personal development, through:

- Expanding access to higher education in remote areas.
- Guaranteeing equal opportunities between genders and social groups, while reducing social disparities.

4.8. Developing Human Resources:

- Investing in the training and skills development of university professors.
- Attracting Algerian talents abroad to work in local universities.

4.9. Promoting Sustainability and Local Development:

- Integrating sustainability concepts into curricula (renewable energy, environmental management, sustainable economy).
- Encouraging research in renewable energy and sustainable agriculture.
- Supporting research that addresses local development challenges, such as: developing technologies that serve local communities, food security, and natural resource management.
- Building community partnerships.

4.10. Encouraging Entrepreneurship within Universities:

Establishing business incubators within universities to support students and researchers in transforming their ideas into practical projects.

4.11. Increasing Funding:

Funding directly affects the quality of higher education and its effectiveness in achieving sustainable development. With the growing demand for higher education and its expanding role in developing the knowledge-based economy, it becomes essential to increase investment in this vital sector to ensure its sustainability and achieve its objectives. Governments and the private sector must therefore invest in higher education and scientific research to achieve sustainable development.

The importance of increased funding lies in:

- Improving the quality of education by providing qualified teaching staff and updated curricula.
- Supporting scientific research.

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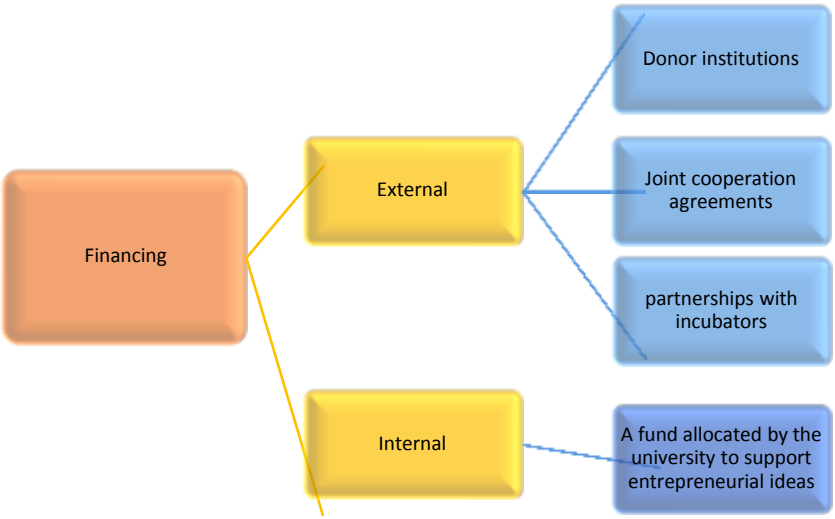
- Developing infrastructure.
- Enhancing innovation and technology.

Funding sources include:

- Internal funding, through allocating a university fund to support entrepreneurial ideas.
- External funding, through donor institutions, joint cooperation agreements, and incubator companies.

Figure (1): Financing Mechanisms



Source: Mohsen Thamer, Youssef Bahi, Mechanisms for the Adoption and Support of Universities for Entrepreneurship, Journal of Entrepreneurship for Business Economics, No. 02, 2021, p. 173.

Conclusion:

In conclusion, the development of higher education and scientific research in Algeria, within the context of digital transformation, requires a comprehensive vision that integrates technological modernization, pedagogical reform, and enhanced university governance. Digitalization has become a strategic necessity to improve the quality of education and to strengthen the university's connection with its economic and social environment. Despite the progress achieved, challenges remain, particularly in terms of limited funding, unequal opportunities among universities, and the shortage of qualified human resources. Therefore, the success of educational policies calls for the activation of national and international partnerships, increased investment in research and innovation, and ensuring equal access to higher education. Ultimately, the core challenge lies in building a modern Algerian university capable of competing globally and contributing effectively to sustainable development.

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