Damascus University Journal for Sustainable Planning **مجلة جامعة دمشق للتخطيط المستدام**

Vol 1 (2): 35-51. **المجلد 1 (2): 35- 51**

The Role of Digital Technology in Promoting Sustainable Development

Rana Hussein Hotayt [1]

[1] Professional Doctorate in Teaching Arabic for Non-Native Speakers and Quranic Sciences, Master's in Law - General Law Master's in Quranic Sciences: Specialization in Quranic Exegesis Research-based
Master's in Applied Computational Linguistics - Lebanese University
Diploma in Graphic Design / Lebanon.
ranahotayt22@gmail.com

Received: 26/6/2024

Accepted: 8/7/2024

Abstract:

The role of digital technology in sustainable development involves utilizing various tools and innovations to address social, economic, and environmental challenges while ensuring the well-being of current and future generations. Key aspects of the interaction between digital technology and sustainable development include data-driven decision-making, where technology enables the collection, analysis, and interpretation of vast amounts of data. Smart city technologies optimize resource utilization, while digital solutions such as smart grids enhance the management of renewable energy. E-governance fosters transparent and efficient administration. Digital technology facilitates remote education and healthcare, promotes financial inclusion, and enhances precision agriculture. Additionally, climate monitoring tools support adaptation to environmental changes, while global communication fosters idea exchange. However, as digital technology advances, addressing cybersecurity concerns and ethical considerations becomes critical. Overall, integrating digital technology offers opportunities for innovation and efficiency in sustainable development, requiring careful attention to ensure equitable distribution of benefits and minimize existing disparities.

Key Words: Sustainable Development, Digital Technology, Smart Cities, Renewable Energy, E-Governance

دور التكنولوجيا الرقمية في تعزيز التنمية المستدامة

رنا حسين حطيط [1]

[1]الدكتوراه المهنية في تدريس اللغة العربية لغير الناطقين بها وعلوم القرآن، الماجستير في القانون – القانون العام الماجستير في علوم القرآن: تخصص في تفسير القرآن الكريم على أساس بحثي ماجستير في اللغويات الحاسوبية التطبيقية – الجامعة اللبنانية دبلوم في التصميم الجرافيكي / لبنان.

ranahotayt22@gmail.com

الملخص:

دور التكنولوجيا الرقمية في التنمية المستدامة يتضمن استغلال مجموعة من الأدوات والابتكارات لمعالجة التحديات الاجتماعية والاقتصادية والبيئية، مع ضمان رفاهية الأجيال الحالية والمستقبلية. عدّة جوانب رئيسية للتفاعل بين التكنولوجيا الرقمية والتنمية المستدامة منها، اتخاذ القرارات استنادًا إلى البيانات، إذ تمكن التكنولوجيا الرقمية من جمع وتحليل وتفسير كميات ضخمة من البيانات، وتقنيات المدن الذكية لتحسين استخدام الموارد، وإدارة الطاقة المتجددة باستخدام حلول رقمية مثل الشبكات الذكية، والحكومة الإلكترونية لتحقيق حوكمة شفافة وفعّالة. تمكين التكنولوجيا الرقمية للتعليم والرعاية الصحية عن بُعد، وتعزيز التمويل الشامل، وتعزيز الزراعة بدقة.

تساعد أدوات مراقبة المناخ في التكيف مع التغيرات البيئية. يعزز التواصل العالمي تبادل الأفكار، ولكن مع تقدم التكنولوجيا الرقمية، يصبح التصدي لقضايا الأمان السيبراني والاعتبارات الأخلاقية أمرًا حيويًا. في المجمل، يقدم دمج التكنولوجيا الرقمية فرصًا للابتكار والكفاءة في التنمية المستدامة، مما يتطلب انتباهًا دقيقًا لضمان توزيع الفوائد بشكل عادل والحد من تفاقم الفوارق القائمة.

كلمات مفتاحيّة: التنمية المستدامة، التكنولوجيا الرقمية ، المدن الذكية ، الطاقة المتجددة، الحكومة الإلكترونية.

تاريخ الايداع 2024/6/26

1- Introduction:

The world today is witnessing rapid technological advancements, with digital technology becoming indispensable across various facets of life. In this context, the utilization of digital technology emerges as a key driver for achieving sustainable development. This study focuses on the challenges and opportunities associated with this dynamic interplay. The objectives are to analyze the impact of digital technology on society, promote inclusivity, and advance digital learning within education. These goals emphasize the pivotal role of digital technology in shaping our future and its strategic interaction with sustainable development concepts, necessitating in-depth research.

A descriptive-analytical methodology is employed, gathering information from diverse sources such as books, studies, and research papers, followed by thorough analysis and discussion.

1.1 Research Questions:

How can digital technology improve its role in achieving sustainable development? What strategies can overcome the challenges of utilizing digital technology in sustainable development? What are the current digital technologies that can be effectively integrated into sustainable development efforts? What policies and measures can be adopted to strengthen digital technology as a tool for achieving sustainable goals? How can public-private sector collaboration enhance digital technology's contribution to sustainable development? What technical, economic, and social challenges may impede the improvement of digital technology's role? How can financial and technical support for developing and adopting digital technology in sustainable contexts be provided? What role can education and technical training play in enhancing understanding and usage of digital technology to achieve sustainable goals?

1.2 Research Hypotheses:

1. **Positive Impact Hypothesis:** Adopting digital technology in fields such as agriculture, infrastructure, and education can significantly enhance efficiency and improve outcomes in the context of sustainable development.
2. **Economic Impact Hypothesis:** Information and communication technologies (ICT) can act as a catalyst for economic growth in developing countries by fostering innovation and creating job opportunities, thereby promoting sustainable development.
3. **Environmental Impact Hypothesis:** Smart and sustainable use of digital technology can mitigate negative environmental impacts, such as energy consumption and electronic waste production.
4. **Social Impact Hypothesis:** Utilizing digital technology can enhance the quality of life in local communities and foster social participation, contributing to sustainable economic and social development.
5. **Government Integration Hypothesis:** Improved integration of governmental sectors through digital technology can enhance policy effectiveness and strengthen sustainable development.
6. **Cultural Interaction Hypothesis:** Information technology can serve as a source of positive cultural interaction and promote communication between communities, building bridges toward sustainable development.

2 Sustainable Development and Its Relationship with Digital Technology

Development is defined as the state's ability to increase and strengthen various human, economic, natural and social resources with the aim of achieving higher production results to meet the basic needs of the majority of its citizens and enable them to submit their demands and rights to governments. The concept of development is applied at the populist and societal levels, but it is also applied at the individual level in the sense of developing the individual himself, developing his cognitive, cultural and productive capacities, and enriching them in line with the requirements of modern civil life. Understanding issues such as sustainable development is important and essential in grasping a large part of the broad concept of development. (Nweke, 2010)

2.1 Sustainable Development: Concepts and Principles:

Sustainable Development According to the 1987 Brundtland Commission's Report entitled "Our Common Future", the concept of sustainable development has become known and used, the World Commission on Environment and Development (WCED) has defined it as development that meets the needs of the present (without compromising on the ability of future generations to meet their own needs), this report helped to understand that under sustainable development fall several pillars to achieve it, such as: Preserving the safety of the environment, satisfying basic human needs, achieving social justice, and providing multiple community solidarity. One of the outcomes of this definition was the realization that sustainable development encompasses a number of diverse areas, and these areas are of ecological, economic and social value. (Nweke, 2010)

- The concept of sustainable development began to emerge in international developmental literature during the mid-1980s, driven by growing concerns over environmental preservation and influenced by studies and reports from the Club of Rome (Club of Rome, n.d.)

in the 1970s[1]. These studies highlighted the need to conserve finite natural resources, maintain environmental balance, and address ecological disruptions. The term gained wider usage due to increasing environmental crises and the global rise in pollution levels.

Sustainable development is a multi-faceted concept with diverse interpretations, leading to the emergence of numerous and overlapping definitions. This overlap characterizes the current discourse on sustainable development. In 2015, the United Nations introduced 17 comprehensive Sustainable Development Goals (SDGs), setting a global agenda for sustainable growth (Huxley, 2019).

- The term "sustainable development" is composed of two parts (Ibn Manzur, 1993): "development" and "sustainable." Linguistically, "development" originates from the Arabic root word "namā," meaning to grow or increase. It signifies growth, progress, and enhancement. "Sustainable," on the other hand, derives from the notion of seeking continuity or permanence.

The United Nations defines sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs." This definition emerged in response to severe resource depletion (Jaafar & Al-Momani, 2013) and emphasizes the necessity of conserving natural resources whenever possible. Thus, sustainable development represents a relatively modern concept, reflecting the shift towards a balanced approach to resource utilization.

[1] The Club of Rome is a non-governmental, non-profit think tank in Zurich, Switzerland that brings together economists, scientists and politicians from different countries with common interests in global challenges such as overpopulation and global warming.
The Club of Rome was founded in April 1968 by Italian economist Orleo Pesci, Scottish scientist Alexander King and American billionaire David Rockefeller at the Accademia dei Lincei think tank in Rome.
His interest in global affairs began in 1972 with the Limits to Growth report LTG, which sold 30 million copies and has been translated into 30 languages, making it the best-selling environmental economics book in history, and warns of the lack of continued economic development due to the depletion of resources as a result of rapid population growth. The oil crisis of 1973 has confirmed the concerns of the Club of Rome.
On 1 July 2008 Established in Winterthur in Zurich, Switzerland
Currently, the German club is headed by Ernst von Weizsäcker, the Scottish Grimm Maxton, and the general secretary is the Swede Anders Wikman.

A comprehensive survey of the primary definitions of sustainable development identifies four broad categories:

1. **Environmental Definitions:** These focus on the optimal use of agricultural lands and water resources, aiming to expand global green spaces.
2. **Social-Human Definitions:** These emphasize population growth stabilization and curbing rural-to-urban migration by improving education and healthcare services in rural areas.
3. **Economic Definitions:** These are divided into perspectives from industrialized nations and developing countries.

- For industrialized countries, sustainable development entails deep and sustained reductions in energy and resource consumption, along with radical transformations in current lifestyles. These countries advocate against exporting their industrial developmental models globally.
- For developing countries, sustainable development centers on resource utilization to uplift the living standards of the most impoverished populations.

4. **Technological Definitions:** These definitions view sustainable development as the progression toward cleaner industries and technologies that require minimal energy and resources while producing limited pollutants, thereby mitigating global warming and ozone layer damage.

The **World Commission on Environment and Development (WCED)**, established by the United Nations, offered a comprehensive definition of sustainable development in its 1987 report titled "Our Common Future." It describes sustainable development as "development that meets the needs of the present without compromising the ability of future generations to meet their own needs."

Ultimately, sustainable development reflects fairness toward future generations. It aims to ensure that the current generation leaves a resource legacy for future generations that is equal to or better than the one inherited.

2.1.1 Principles of Sustainable Development

1. **Systematic Approach in Planning and Implementing Sustainable Development Plans :**

The systematic or systemic approach is a fundamental requirement for preparing and implementing sustainable development plans. This is because the human environment is a subsystem within the broader global ecosystem. Sustainable development employs this approach to achieve harmony among subsystems, ensuring balance across Earth's environment.

2. **Public Participation:**

Achieving sustainable development necessitates suitable decentralization that allows official bodies, civil organizations, and the general population to participate in planning, executing, and monitoring development strategies. This is often referred to as "development from the bottom up." The role of local governments can be summarized as:

- Mitigating global warming.
- Managing and treating environmental, commercial, and industrial waste.
- Reducing emissions harmful to the ozone layer.
- Decreasing reliance on petroleum derivatives.

3. **Optimal Dynamic Utilization of Economic Resources:**

Ensuring resources are used efficiently and effectively to meet current and future needs.

4. **Prolonging the Lifespan of Economic Resources:**

Strategic planning is crucial to extend the usability and availability of resources over time.

5. **Environmental Balance and Biodiversity:**

Preserving ecological balance and maintaining biodiversity are key to sustainable ecosystems.

6. **Preserving Natural Characteristics:**
This principle emphasizes maintaining the attributes and essence of nature while adapting production, investment, and consumption structures to align with sustainability goals.

2.1.2 Goals of Sustainable Development and Integrating Modern Technology with Societal Objectives:

Sustainability aims to avoid harming future generations, whether through resource depletion, environmental pollution, public debt burdens, or neglecting human resource development. These issues could create challenging circumstances for future societies due to present-day decisions. Development involves empowering people as active agents, rather than merely serving them. It seeks to enable individuals to realize their potential, positioning them as both the means and the end of development. Sustainable development today focuses on creating new economic and agricultural practices that meet current needs while ensuring long-term viability (Al-Raeei, 2023).

- Sustainable Development Goals (SDGs) (United Nations Environment Programme, 2015)

The basic goals of sustainable development are numerous; its objectives include, but are not limited to:
Reduce the depletion of natural resources.
Creating development that can be protected and sustained without harming the environment.
Saving contemporary development methods and investing them in environmentally friendly projects.

In addition, international organizations such as the United Nations and non-governmental organizations (NGOS) manage efforts to ensure that the development goals of individuals are achieved in various fields, and the most important goals of permanent development set by these bodies are the following:

- Eradicate poverty globally.
- Promote good health and well-being.
- Saving quality education for all.
- Save clean water and sanitation.
- Build strong infrastructure, support industry, and embrace innovation.
- Enable affordable access to energy, without harming the environment.
- Empowering gender equality.

However, the contradictions of modern society—spending substantial resources on environmental protection while simultaneously funding projects that harm the environment−the urgent need for a sustainable model. This requires cultural shifts and agricultural and economic reforms.

3 The Role of Digital Technology in Achieving Sustainable Development:

Digital technology plays a crucial role in advancing sustainable development goals, such as eradicating poverty, improving health and education, and protecting the environment.

3.1Examples of how digital technology contributing to these goals

Below are examples of how digital technology contributing to these goals:

- **Eradicating Poverty:** Digital technology (United Nations, 2015). (International Telecommunication Union, 2019). (Organization for Economic Co-operation and Development, 2019). can provide employment opportunities, education, and training to impoverished communities. For instance, information and communication technologies (ICT) enable remote work and online education.
- **Improving Health:**

Digital innovations like artificial intelligence (AI) enhance disease diagnosis and treatment development, while virtual reality (VR) offers medical training for healthcare professionals.

- **Environmental Protection:**

Technologies like satellites monitor pollution, and AI optimizes energy efficiency, reducing environmental harm.

- **Enhancing Governance:**

Adopting e-government systems and digital solutions streamlines governance and improves service delivery.

- **Promoting Sustainable Agriculture:**

Smart farming technologies and data analytics boost crop production while conserving resources.

- **Monitoring Environmental Changes:**

Technologies aid in tracking environmental shifts and predicting climate change impacts.

- **Financial Empowerment:**

Digital financial services promote financial inclusion and offer sustainable funding opportunities.

- **Improving Cybersecurity:**

Robust security measures protect digital infrastructure and data from cyber threats.

3.2 Overall Contributions of Digital Technology to Sustainable Development

- **Boosting Productivity:** Digital tools enhance productivity across economic sectors, fostering growth and job creation.
- **Enhancing Efficiency:** Technology optimizes resource utilization, reducing waste and consumption.
- **Promoting Inclusivity:** Digital solutions expand access to essential services, education, and healthcare, fostering social equity.

By integrating digital technology with sustainability goals, societies can navigate challenges while leveraging innovation to build a more equitable and resilient future.

4 Technological Foresight: A Window into Understanding the Future of Technology

Technological foresight refers to the process of estimating the future by analyzing current trends and information related to technology. It aims to understand how technology will evolve over time and how these developments may impact various aspects of life. Technological foresight relies on research, analysis of current innovations, and monitoring of emerging technological trends.

This process helps organizations, governments, and businesses make sustainable decisions and prepare for future challenges. It includes monitoring emerging technologies, analyzing rising trends, and estimating how current technological innovations might evolve. Technological foresight helps identify potential opportunities and challenges, guiding investments and shaping strategies for future technologies.

In a rapidly evolving technological era, technological advancement plays a critical role in shaping our future. Understanding future trends and how technology will impact our lives requires the effective use of planning tools and decision-making strategies. This is where technological foresight comes in.

4.1 Technological foresight

Technological foresight is the process of analyzing and estimating the future using current information and technological trends. It aims to predict how technology will evolve and how these developments will influence various aspects of life. This process aids businesses and governments in developing future strategies, enabling them to adapt to anticipated technological transformations. Through thorough analysis of future trends, new opportunities and potential challenges can be identified, allowing organizations to prepare for them. Technological foresight directs investments towards emerging and innovative technologies that will play a pivotal role in the future.

Steps in Technological Foresight

1. **Monitoring Emerging Technologies:**
2. Analyzing new technologies that are appearing and understanding how they might evolve in the future.
3. **Trend Analysis:**

Examining current trends and estimating how they will impact the future.

4. **Engaging with Experts:**

Consulting with experts in various fields to gain valuable insights into future technologies.

4.2 Challenges of Technological Foresight

1. **Uncertainty:**

Predicting the future is challenging due to uncertainty and the multitude of factors at play.

2. **Pace of Change:**
3. The rapid pace of technological evolution makes foresight a continuous challenge, requiring constant monitoring of swift transformations.

In an era of accelerating technological development, **technological foresight** is a vital tool for understanding and analyzing the future of technology. It enables organizations to adapt to anticipated transformations and prepare for the challenges of adjusting to these changes.

Advanced technology is considered a crucial tool in achieving sustainable development goals. Technological foresight plays a central role in understanding future shifts and how technology can contribute to strengthening sustainable development.

4.3 Importance of Technological Foresight in Sustainable Development

Technological foresight can identify emerging technologies that will play a key role in achieving sustainable development. It helps direct investments towards technological fields that enhance economic, environmental, and social goals. Furthermore, advanced technology can improve resource use efficiency and reduce harmful environmental impacts.

- The future of sustainable development the threat posed by globalization, driven by economic insecurity and the consequences that this brings, is growing rapidly; therefore, it is necessary to work on managing natural resources, tracking the effects of change, and proposing flexible policies that consider the rights of individuals at risk in the future, that would reduce any future risks. (International Institute for Sustainable Development, n.d.)

Technological foresight emerges as a vital tool in achieving sustainable development objectives. By guiding innovation towards sustainability, technology can play an active role in creating a future that balances progress with environmental and social responsibility.

5 The Role of Digital Technology in Achieving Sustainable Development

Sustainable development can only be realized with the support of an economic system that rejects imposed development models that are disconnected from the community's identity and culture, alongside a policy of self-assessment. Community involvement in decisions related to development is one of the fundamental conditions for the success of an economic plan and for achieving self-sustaining sustainable development.

Sustainable development, from an environmental perspective, relies on the responsible management of natural and human resources to meet the needs of present generations while ensuring the well-being of future generations. This poses a challenge for individuals and societies, requiring significant efforts to raise awareness about this issue. Sustainable development entails protecting natural resources from human pressures, avoiding overuse of fertilizers and pesticides that pollute surface and groundwater, and preventing the unsustainable exploitation of forests and fisheries. It also emphasizes the optimal use of agricultural land and water resources, protecting endangered species, reducing major shifts in climate stability, and preventing the destruction of the ozone layer.

It is concluded that sustainable development, especially in industrialized nations, involves transitioning to cleaner, more efficient technologies and using cleaner technologies in industrial facilities. Industrial facilities often contribute to pollution of the surrounding air, water, and soil. In developed countries, waste flows are reduced, and pollution is cleaned up at significant expense. In developing nations, however, waste often goes unregulated. Despite this, pollution is not an inevitable consequence of industrial activity.

5.1 Key Areas Where Digital Technology Can Contribute to Achieving Sustainable Development

Digital technology plays a crucial role in achieving sustainable development by supporting several of its core goals, such as eradicating poverty, improving health and education, and protecting the environment. The following are key areas where digital technology can contribute to sustainable development:

1. **Education:**

Digital technology can help improve education worldwide by providing access to education for people living

in remote or disadvantaged areas, as well as for those with disabilities. It can also enhance the quality of education by offering personalized and interactive curricula.

2. **Examples of digital technology in education:**
   - E-learning platforms can provide educational opportunities for people in remote or underserved areas.
   - Virtual reality (VR) and augmented reality (AR) can offer interactive and engaging learning experiences.
   - Artificial intelligence (AI) can provide customized assessments and learning recommendations.
3. **Health:**

Digital technology can improve health by providing healthcare services to people in remote or underserved areas or those with chronic diseases. It can also enhance healthcare quality by offering new diagnostic and treatment methods.

Examples of digital technology in health:
- Satellites and AI can monitor and predict disease outbreaks.
- Robots and virtual reality can deliver healthcare in underserved areas.
- Health apps can provide access to health information and support.

4. **Environment:**

Digital technology can aid in environmental protection by providing new ways to reduce pollution and resource consumption. It can also improve our understanding of the environment and how to preserve it.

Examples of digital technology in the environment:
- Satellites can monitor environmental pollution and climate change.
- AI can develop new solutions for reducing emissions and energy consumption.
- Digital technology can enhance public participation in environmental protection.

In addition to these areas, digital technology can also contribute to sustainable development in other sectors, such as:
- **Economy:** Digital technology can boost economic growth and create job opportunities.
- **Governance:** Digital technology can enhance transparency and accountability in government.
- **Society:** Digital technology can foster communication and participation among people.

By advancing these areas, digital technology plays a pivotal role in realizing the goals of sustainable development, fostering an interconnected and prosperous future.

5.2 Challenges Facing the Use of Digital Technology in Achieving Sustainable Development

Digital technology plays a significant role in achieving sustainable development by supporting many of its core goals, such as eradicating poverty, improving health and education, and protecting the environment. However, there are several challenges that hinder the effective use of digital technology in sustainable development:

1. **Digital Divide:**

The digital divide refers to the inequality in access to digital technology among different social and economic groups. This divide can worsen inequality and poverty, as people without access to digital technologies are deprived of the opportunities they can offer.

2. **Examples of the digital divide:**

- The percentage of people using the internet in developing countries (International Telecommunication Union, 2019), (General Secretariat of the Supreme Council for Planning and Development, 2015), (The African Academy of Sciences, 2018), (United Arab Emirates, 2019), (United Nations Economic and Social Commission for Western Asia, 2019), (Vision 2021, n.d.), (Friedenspreis des Deutschen Buchhandels, n.d.), (United Nations Publications, n.d.)
  - Is much lower than in developed countries?
  - Women and girls are more likely to experience the digital divide compared to men.
  - People living in remote or underserved areas are more likely to face the digital divide.

3. **Lack of Skills:**

Digital technology requires specific skills and knowledge. A lack of skills can hinder the use of digital technology for sustainable development, as individuals may not be able to effectively utilize it.

Examples of skill gaps:

- The percentage of people with digital skills is much lower in developing countries compared to developed nations.
- Women and girls are more likely to lack digital skills compared to men.
- People in remote or underserved areas are more likely to lack the necessary digital skills.

4. **Security Risks:**

Irresponsible use of digital technology can lead to security risks, such as the spread of misinformation or cyberattacks. These risks can obstruct the achievement of sustainable development by undermining trust and social stability.

5. **Examples of security risks:**

- The spread of misinformation through social media can exacerbate social conflicts.
- Cyberattacks on digital infrastructure can disrupt essential services.

- **Environmental Impact:**
- Digital technology can have a negative environmental impact, such as increasing energy consumption and generating electronic waste (United Nations, 2015) (United Nations, 2016) (United Nations, 2019).

6. These **impacts** can obstruct sustainable development by contributing to climate change and other environmental problems.

7. **Examples of environmental impact:**

- Data centers that use information and communication technologies consume large amounts of energy.
- Electronic devices, such as smartphones and tablets, contribute to electronic waste.

8. **Social and Cultural Impacts:**

Digital technology can have both positive and negative social and cultural effects, such as increasing social isolation or spreading racism. These effects can hinder sustainable development by exacerbating inequality and poverty.

Examples of social and cultural impacts:

- Social media usage can increase social isolation.
- Digital technology can lead to the spread of racism and other forms of discrimination.

It is important to address these challenges to ensure that digital technology is used in a sustainable and equitable manner. The role of digital technology in achieving sustainable development is vital, as technological innovations and digital solutions contribute effectively to economic, social, and environmental sustainability.

5.3 Promoting the Use of Digital Technology in Achieving Sustainable Development

To promote the use of digital technology in achieving sustainable development, several challenges must be addressed through specific actions. These actions include narrowing the digital divide by providing wider access to technology, building digital capacities through education, enhancing cybersecurity, reducing the environmental impact of technology, and encouraging innovation and partnerships across various sectors. Additionally, encouraging private investment and activating local capabilities to use technology in a way that balances technological development with core ethical values is essential. Achieving these goals requires the integration of efforts and collaboration among various stakeholders to effectively and sustainably adopt digital technologies.

Examples of actions to enhance the use of digital technology in sustainable development:

- **In Education:** Governments can provide internet access in schools and universities, develop digital curricula, and offer teacher training programs.
- **In Health:** Governments can use digital technology to provide healthcare in remote or underserved areas, **and** develop new diagnostic and treatment technologies.

- **In Environment:** Governments can use digital technologies to monitor environmental pollution and climate change, and develop new solutions to reduce emissions and energy consumption. (Abad-Segura, Batlles de la Fuente, González-Zamar, & Belmonte-Ureña, 2020, Damascus University)

Water Resource Management: Using smart irrigation systems supported by remote sensing technologies, optical analysis, and machine learning can improve water efficiency in agriculture. For example, sensors can measure soil moisture levels and automatically adjust irrigation systems to provide water only when needed.

Renewable Energy: Digital technology is crucial for developing smart grids, which allow greater integration of renewable energy sources like solar and wind into the power grid. For example, remote control systems can adjust the operation of household appliances based on available renewable energy.

Distance Learning: In light of the pandemic, distance learning has become a necessity, and digital technology is the ideal solution for delivering effective remote education. Online learning platforms, such as Coursera and YouTube, offer a diverse range of educational content accessible from anywhere and anytime.

E-Government: Digital technology enhances transparency and effectiveness in delivering government services, and fosters civic engagement. For example, electronic payment systems for taxes and government transactions provide a secure and efficient means for citizens to access services and pay taxes without needing to attend in person.

These examples highlight how digital technology can be an effective tool in achieving sustainable development goals across various sectors.

- **Some Measurable** (Sustainable Measures, n.d.) **Indicators to Assess the Role of Digital Technology in Achieving Sustainable Development:**

1. **Resource Efficiency:**
   - The rate of reduction in water or energy consumption in production or agricultural processes through the use of digital technology.
2. **Increased Access to Basic Services:**
   - The percentage of the population that can access healthcare or education remotely thanks to digital technology.
3. **Reduction in Environmental Emissions:**
   - A decrease in carbon emissions or electronic waste due to the adoption of digital technology.

5.4 Enhancing the Use of Digital Technology in Achieving Sustainable Development

To enhance the use of digital technology in achieving sustainable development, several challenges must be addressed through specific actions. These actions include narrowing the digital divide by providing wider access to technology, building digital capacities through education, improving cybersecurity, reducing the environmental impact of technology, and encouraging innovation and partnerships among various stakeholders. Additionally, stimulating private investment and activating local capacities are essential to ensuring the use of technology in a way that balances technological advancement with core ethical values. Achieving these objectives requires the integration of efforts and collaboration between various parties to promote the effective and sustainable adoption of technology.

Examples of actions that can enhance the use of digital technology in achieving sustainable development:

- **In Education:**

Governments can provide internet access in schools and universities, develop digital educational curricula, and offer teacher training programs.

- **In Health:**

Governments can use digital technology to provide healthcare services in remote or underserved areas and develop new diagnostic and treatment technologies.

- **In the Environment:**

Governments can use digital technology to monitor environmental pollution and climate change and develop new solutions to reduce emissions and energy consumption.

Water Resource Management:
The use of smart irrigation systems supported by remote sensing technologies, optical analysis, and machine learning can contribute to improving water use efficiency in agriculture. For example, sensors can measure soil moisture levels and automatically adjust irrigation systems to provide water only when necessary.

Renewable Energy:
Digital technology plays a crucial role in developing smart grids, which allow for greater integration of renewable energy sources like solar and wind into the power grid. For instance, remote control systems can adjust the operation of household appliances based on the availability of renewable energy.

Distance Learning:
During the pandemic, distance learning became a necessity, and digital technology emerged as the ideal solution for delivering effective remote education. Online learning platforms such as Coursera and YouTube provide diverse educational content accessible to everyone anytime, anywhere.

E-Government:
Digital technology enhances transparency and effectiveness in government service delivery and fosters civic participation. For example, electronic tax payment systems and government transactions provide citizens with a secure and efficient means of accessing services and paying taxes without the need for in-person visits.

These examples highlight how digital technology can be an effective tool in achieving sustainable development goals across different sectors.

6 Measurable Indicators to Assess the Role of Digital Technology in Achieving Sustainable Development

1. **Resource Efficiency:**
   - The rate of reduction in water or energy consumption in production or agricultural processes through digital technology.
2. **Increased Access to Basic Services:**
   - The percentage of the population who can access healthcare or education remotely thanks to digital technology.
3. **Reduction in Environmental Emissions:**
   - A decrease in carbon emissions or electronic waste resulting from the adoption of digital technology.
4. **Transparency and Civic Participation:**
   - Measuring improvements in levels of transparency and civic engagement in e-government and public services due to digital technology.
5. **Job Opportunities and Digital Economy:**
   - Tracking the growth rate of jobs in digital sectors and analyzing their contribution to GDP.
6. **Economic Empowerment of Developing Communities:**
   - Evaluating the extent to which digital technology projects empower economically and socially disadvantaged communities.
7. **Share of Renewable Energy:**
   - Analyzing the percentage of renewable energy used in smart grids compared to total energy consumption.
8. **Access to Digital Technology:**
   - Estimating the number of individuals or areas that have access to digital infrastructure such as high-speed internet.

These indicators can provide a better understanding of how digital technology is impacting sustainable development and track progress in this field.

7 Conclusion:

It is evident that the use of digital technology plays a vital role in achieving sustainable development. By enabling innovation, enhancing transparency, and improving public services, digital technology can play a pivotal role in achieving environmental, economic, and social goals.

On the other hand, we must address the challenges that include technological inequality, safeguarding individual rights and privacy, and addressing environmental impacts. Collaborative efforts to balance innovation with ethics, and the benefits with the challenges, will play a crucial role in determining how successful future technologies will be in supporting sustainable development.

The essence of sustainable development If we invest in it and develop it from the social, cognitive and economic side, we will have created a cohesive society, and it also takes another essential dimension, sustainable development is an appeal to achieve maximum human well-being and this can be achieved if property rights are available because it is the framework that encourages development, innovation, economic growth; it is the essence of development and not its opposite(Anderson & Huggins, 2004).

If carefully planned and effectively implemented, digital technology can be the driving force behind a transition toward a more sustainable and inclusive future. Therefore, these efforts must be continuous, supported by international cooperation and a commitment to sustainable development principles, to ensure that technological innovation contributes effectively to building a better world for both current and future generations.

8 Findings:

1. **Impact of Big Data:** The results showed that the use of digital technology to collect and analyze big data contributes to a better understanding of environmental and economic challenges and provides strong signals for making effective decisions.
2. **Integration of Technology in Sectors:** The study revealed that integrating technology into vital sectors such as education and health can enhance the quality of services and promote sustainable development.
3. **Advancements in Global Communication:** The results highlighted that digital technology has contributed to enhancing global communication and the exchange of ideas and solutions for sustainable development challenges.
4. **Social Challenges:** The research identified social challenges related to the digital divide and the necessity of focusing on achieving a balance in access opportunities to ensure inclusive participation.
5. **Shift Toward Clean Technology:** The research emphasizes the importance of adopting clean and sustainable technology to maintain a balance between technological advancement and environmental protection.
6. **Importance of Networking and Collaboration:** The study concludes that international cooperation and networking between sectors enhance the effectiveness of efforts to utilize technology in achieving sustainable development goals. It also highlights the need to explore new and sustainable financing mechanisms for digital technology projects.
7. **Cybersecurity Necessity:** The findings stress the importance of strengthening cybersecurity as a fundamental element to ensure data safety and maintain trust in the use of technology.

In summary, the research demonstrates that digital technology can be a driving force for sustainable development, but this requires addressing challenges effectively and taking sustainable and inclusive actions.

9 Recommendations

1. **Enhancing Digital Integration:** Governments and international bodies should be encouraged to enhance digital integration in communities and reduce the digital divide by improving internet infrastructure and providing public access to technology. Governments should also promote the integration of technology into vital sectors such as health, education, and agriculture to improve service efficiency and achieve sustainable development.
2. **Encouraging Sustainable Innovation:** Support for research and innovation in digital technologies that promote sustainable development, such as clean energy technology and sustainable agricultural technology,

should be **prioritized**. This includes fostering the adoption of clean and sustainable technology to maintain a balance between technological progress and environmental protection.

3. **Raising Awareness and Training:** It is essential to raise awareness of the benefits of digital technology and provide training opportunities for communities, with a focus on utilizing technology in education and healthcare. Efforts to enhance cybersecurity should also be strengthened to ensure the safety of vital data and information and improve countries' ability to address cybersecurity challenges.

These are some proposed recommendations to achieve the desired goals. By studying the role of digital technology in this context, the research can help identify potential opportunities and challenges and direct efforts toward implementing effective strategies to enhance sustainable development. Additionally, it can provide a framework for applying digital technology in various fields such as agriculture, energy, and water, thereby promoting environmental, economic, and social sustainability in the relevant communities.

9 References:

- Al-Raeei, M. (2023). Analysing of the sustainable development goals in Damascus University during Syrian crisis using the strategy in the university and the bibliometrics data from SciVal. Discover Sustainability, 4(24). Damascus University. https://doi.org/10.1007/s43621-023-00140-y
- Abad-Segura, E., Batlles de la Fuente, A., González-Zamar, M.-D., & Belmonte-Ureña, L. J. (2020). Effects of circular economy policies on the environment and sustainable growth: Worldwide research. Sustainability, 12(14), 5792. Damascus University. https://doi.org/10.3390/su12145792
- Anderson, T., & Huggins, L. E. (2004, November 17). Economic growth—the essence of sustainable development. Hoover Institution. Retrieved April 12, 2019, from https://www.hoover.org
- General Secretariat of the Supreme Council for Planning and Development. (2015). The medium-term development plan for the State of Kuwait 2015-2019: Kuwait Vision 2035: New Kuwait. http://www.newkuwait.gov.kw/home.aspx
- Huxley, A. (2019). Means and ends. Hindawi Foundation.
- International Telecommunication Union. (2019). Information and communication technology for sustainable development. International Telecommunication Union.
- Ibn Manzur, A. F. J. M. (1993). Lisan al-Arab (Vol. 15). Dar Sader.
- Jaafar, S. A., & Al-Momani, F. N. (2013). Environment and environmental education (1st ed.). Al-Rushd Library Publishers.
- Nweke, O. I. (2010, October 29). Theories of social development (SOCI 403) (p. 8, Part 2.2).
- Organization for Economic Co-operation and Development. (2019). Digital technology and sustainable development. Organization for Economic Co-operation and Development.
- The African Academy of Sciences. (2018). Africa beyond 2030: Leveraging knowledge and innovation to secure sustainable development goals. African Academy of Sciences.
- United Arab Emirates. (2019). UAE Vision 2021. Retrieved from https://www.vision2021.ae
- United Nations. (2015). 2030 sustainable development agenda. United Nations.
- United Nations Economic and Social Commission for Western Asia. (2019). Sustainable development goals: Towards a transformative agenda. United Nations.
- Vision 2021. (n.d.). The UAE's vision for 2021. Retrieved from https://www.vision2021.ae
- Club of Rome. (n.d.). About the Club of Rome. Retrieved from http://www.clubofrome.org
- Friedenspreis des Deutschen Buchhandels. (n.d.). The Club of Rome: All laureates since 1950. Retrieved from https://www.friedenspreis-des-deutschen-buchhandels.de
- United Nations Environment Programme. (2015, January 1). About the sustainable development goals. Retrieved April 24, 2019, from https://www.unenvironment.org

- United Nations. (2016, January 1). The sustainable development agenda. Retrieved April 12, 2019, from https://www.un.org
- United Nations. (2019, May 7). 17 goals to transform our world. Retrieved from https://www.un.org
- The future of sustainable development: Rethinking sustainable development after Rio+20 and implications for UNEP. (n.d.). International Institute for Sustainable Development. Retrieved April 12, 2019, from https://www.iisd.org
- Innovation and technology for sustainable development: Promising prospects in the Arab region for 2030. (n.d.). United Nations Publications. Retrieved from https://www.unescwa.org
- Introduction to sustainable development. (n.d.). Sustainable Measures. Retrieved April 24, 2019, from https://www.sustainablemeasures.com