

اليوم الدراسي : البيئة الإقتصادية الرقمية لتفعيل التنمية المستدامة.

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مخبر الدراسات البيئية و التنمية المستدامة

عنوان المداخلة:

**Digital transformation: innovative solutions for achieving
sustainable development**

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الملخص:

في عالم اليوم سريع التطور، برز التحول الرقمي كقوة محورية تقود مبادرات التنمية المستدامة في جميع أنحاء العالم، يتجاوز هذا الانتقال التكنولوجي الثوري الحدود والقطاعات ليعيد تشكيل كيفية تعاملنا مع التحديات البيئية والاجتماعية والاقتصادية بشكل جذري، تستعرض هذه المقالة العلاقة متعددة الأوجه بين التحول الرقمي والتنمية المستدامة، مستكشفة الأبعاد المختلفة لهذا التفاعل بالإضافة إلى التقنيات والاستراتيجيات والتحديات والاتجاهات المستقبلية التي تشكل هذا المشهد الديناميكي، وذلك من خلال تحليل هذه العلاقة من زوايا مختلفة، يمكننا فهم كيفية الاستفادة المبتكرة من التقدم الرقمي لتعزيز مستقبل أكثر عدالة ومرونة واستدامة بيئيًا.

الكلمات المفتاحية: التحول الرقمي، التنمية المستدامة، التكنولوجيا، الابتكار.

Abstract:

In today's rapidly evolving world, digital transformation has emerged as a pivotal force driving sustainable development initiatives across the globe. This revolutionary technological transition transcends borders and sectors to fundamentally reshape how we address environmental, social, and economic challenges. This article delves into the multifaceted relationship between digital transformation and sustainable development, exploring the various dimensions of this interaction as well as the technologies, strategies, challenges, and future trends shaping this dynamic landscape. By analyzing this relationship from various perspectives, we can better understand how digital advancements can be innovatively utilized to promote a more equitable, resilient, and environmentally sustainable future.

Keywords : Digital transformation, Sustainable development, Technology, Innovation.

Résumé :

Dans le monde en constante évolution d'aujourd'hui, la transformation numérique s'est imposée comme une force essentielle qui stimule les initiatives de développement durable à l'échelle mondiale. Cette transition technologique révolutionnaire dépasse les frontières et les secteurs pour remodeler fondamentalement la manière dont nous abordons les défis environnementaux, sociaux et économiques. Cet article s'attarde sur la relation complexe entre la transformation numérique et le développement durable, explorant les différentes dimensions de cette interaction ainsi que les technologies, stratégies, défis et tendances futures qui influencent ce paysage dynamique. En analysant cette relation sous plusieurs angles, nous pouvons mieux comprendre comment les avancées numériques peuvent être utilisées de manière innovante pour promouvoir un avenir plus équitable, résilient et écologiquement durable.

Les mots clés : Transformation numérique, Développement durable, Technologie, Innovation.

1. Introduction :

In today's rapidly evolving technological landscape, digital transformation emerges as a pivotal force driving significant changes across various sectors. At its core, digital transformation involves the integration of digital technology into all areas of business and society, fundamentally changing how organizations operate and deliver value to customers. Moreover, it's also reshaping the public sector and governance, influencing everything from policy-making to citizen engagement.

The imperative for sustainable development underscores the urgent need to balance socio-economic growth with environmental stewardship to ensure a harmonious future for coming generations. As such, digital transformation presents a unique array of opportunities to advance sustainable development goals (SDGs) through innovative solutions that enhance efficiency, reduce waste, and improve service delivery.

This article explores how digital technologies are being leveraged to propel sustainable development, with a focus on the marginalized sectors of society. By integrating case studies

and theoretical insights, we aim to provide a comprehensive understanding of digital transformation's role in fostering an inclusive, sustainable future.

Research Problem: "How does digital transformation contribute to achieving sustainable development?"

2. Digital Transformation:

the transformation process of companies turning into the Industry 4.0 Connected Smart Enterprise from the industrial stage can not succeed easily, and digital transformation is considered a intergrade (Dalenogare, Benitez, & Ayala, 2018)

- Digital Transformation is a form of business transformation which is considered as a holistic form, supported by IS and accompanied by fundamental technological and economic changes at both industrial and organizational level. (Besson & Rowe, 2012)
- It Is defined as “the changes associated with the applications of digital technology in all aspects of human society.” (Stolterman & Fors, 2004)

Digital transformation refers to the integration of digital technology into all areas of a business, fundamentally changing how it operates and delivers value to its customers. It's not merely about upgrading existing technology systems or moving some services online; it involves a holistic rethinking of business strategies, operations, and customer interactions through the lens of digital technology. This transformative process leverages a wide array of digital tools and technologies, including cloud computing, big data analytics, artificial intelligence (AI), the Internet of Things (IoT), and more, to create new — or modify existing — business processes, culture, and customer experiences.

- Goals of digital transformation :

The essence of digital transformation lies in its capacity to foster agility, improve efficiency, and provide deeper data-driven insights. By harnessing these technological advancements, organizations can break down traditional barriers, streamline workflows, and engage with their customers and employees in more effective ways. The ultimate goal of

digital transformation is to enhance business performance and sustain competitiveness in an increasingly digital world.

3. sustainable development:

The concept of sustainable development originates from ecology and is subsequently applied in the fields of economics and sociology; these two aspects of sustainable development are more emphasized. Economic sustainability refers to making enterprises more efficient and effective, so that they can continue to remain competitive in the market (Baumgartner & Ebner, 2010). In other words, the sustainable growth strategy of the economy should allow companies to survive for a long time and bring positive effects to stakeholders, the country, and even the world.

Later, some scholars combine sustainable development with corporate governance and point that sustainable development of enterprises is an ecological concept with economic meaning, mainly including fairness, sustainability, and commonality. Edward Freeman and Evan (1990) state that the sustainable development of enterprises should not only cover the current operating goals and the realization of net profits but also include the long-term consolidation of market position and the sustainable growth of net profits (Edward Freeman & Evan, 1990). Argues that the sustainable development ability of enterprises includes three aspects: economic sustainability, environmental sustainability, and social sustainability (Ahmad, 2015).

Furthermore, some scholars explore the factors that influence the sustainable development ability of enterprises. Barney (1991) establishes four indexes, namely, advantage value, rareness, limit ability, and substitutability, and finds that strategic resources improve the corporate sustainable development ability (Barney, 1991). In addition, on the basis of the RBV (resource-based view), Mata et al. (1995) analyzes four information technology (IT) attributes that can strengthen an enterprise's sustainable development ability, namely, capital

requirements, proprietary technology, technical IT skills, and managerial IT skills (Mata, Fuerst, & Barney, 1995) .

Wang and Han (2016) find that CSR fulfillment can improve the level of sustainable development of enterprises. In addition, the better the quality of internal control, the higher the level of sustainable development. According to the survey of 214 executives and IT managers of China's auto industry suppliers (Wang & Han, 2016), Tao et al. (2017) find that IT capability has a positive effect on the corporate sustainable development ability, and active environmental management plays a partial mediation effect between the relationship of the IT ability and the corporate sustainable development ability (Tao, Liu, & Zhang, 2017). Su et al (2017) explore the relationship between social networks and the sustainable development of commercial banks' microfinance based on 316 questionnaires targeted at bank outlets and find that the network type and the nature of network relationships are conducive to promoting the sustainable development of microfinance (Su, Chen, Xu, & Li, 2017). The research of Wu and Zhang (2017) shows that public welfare donations can promote the sustainable development of enterprises, whereas accounting conservatism weakens the positive correlation between public welfare donations and the sustainable development of enterprises. Taking the Chinese A-share listed companies from 2012 to 2016 as samples (Wu & Zhang, 2017), Yang et al. (2018) find that the improvement of internal control quality can enhance the enterprise's sustainable development ability, whereas the management capacity can strengthen the role of internal control quality in enhancing the enterprise's sustainable development ability (Yang, Peng, & Yao, 2018). The research of Jin (2019) shows that heterogeneity of debts improves the sustainable development ability of enterprises. Further research results show that operating liabilities are more conducive to the sustainable development of enterprises than financial liabilities. On the basis of 400 questionnaires aimed at executives of the listed companies (Jin, 2019), Ren et al. (2020) find that the CEO's humble leadership behavior not only can improve the performance of start-up enterprises but also can enhance the long-term sustainable development ability of enterprises (Ren, Xu, & Zhou, 2020).

4. digital transformation and sustainable development:

Digital transformation significantly contributes to achieving sustainable development by integrating advanced technologies to improve efficiency, reduce waste, and enhance decision-

making across various sectors. Here are some keyways in which digital transformation aligns with and promotes sustainable development:

- **Enhanced Efficiency and Reduced Resource Use:** Digital technologies like IoT (Internet of Things), AI (Artificial Intelligence), and big data analytics enable more efficient resource management. They allow businesses and governments to monitor and reduce energy consumption, optimize logistics and manufacturing processes, and minimize waste through predictive maintenance and real-time data analysis.
- **Smart Infrastructure:** Smart cities harness digital technologies to optimize the use of resources such as water, electricity, and transportation. Smart grids can balance the demand and supply of electricity, reducing energy waste. Smart water management systems help in monitoring water quality and tracking consumption patterns, promoting water conservation.
- **Economic Inclusion:** Digital platforms can drive economic inclusion by providing remote access to financial services, healthcare, education, and employment opportunities, especially in underserved or rural areas. This fosters economic growth and reduces inequalities as outlined in the United Nations Sustainable Development Goals (SDGs).
- **Improved Environmental Monitoring and Protection:** Digital transformation aids in better environmental monitoring by using sensors and drones to collect data on air quality, deforestation, and wildlife populations. This real-time data is crucial for effective environmental protection and conservation efforts.
- **Sustainable Agriculture:** Digital technologies like precision agriculture use drones, sensors, and GPS technology to help farmers plant more efficiently, use water and fertilizers more judiciously, and increase crop yields while minimizing the environmental footprint.
- **Enhanced Disaster Response and Resilience:** Digital tools and platforms improve disaster preparedness and response. Satellite imagery, AI, and machine learning models can predict natural disasters and optimize response strategies, saving lives and reducing economic impacts.
- **Promoting Circular Economy:** Digital tools facilitate the transition to a circular economy by enabling the tracking and tracing of products throughout their lifecycle. This helps in maximizing resource efficiency, promoting recycling, and reducing reliance on finite resources.

- Remote Working and Learning: The shift to digital platforms for work and learning reduces the need for travel, which in turn lowers carbon emissions associated with commuting. This shift has been significantly accelerated by the global response to the COVID-19 pandemic.

Digital transformation, when strategically aligned with sustainability goals, offers a powerful means to address global challenges, promoting a more equitable, sustainable, and prosperous world.

5. Sustainability and digital transformation measurement:

Over the years, the concept of sustainable development has evolved to focus more on ecological, economic, political, and cultural objectives (James, 2014). The existing literature focuses on measuring sustainable development at the macro level, such as at the national level (Vachon & Mao, 2008), the provincial level (Yang & Ding , 2018), and the municipal level (Lam & Yap , 2019) . Studies on corporate sustainability mainly use ESG ratings as a proxy variable or divide corporate sustainability activities into sub-themes. For example, Branco and Rodrigues (2008) categorized corporate sustainability activities into 23 items and divided them into several categories such as environmental, human resources, products, customers, and community involvement. Considering that ESG ratings in China are new and imperfectly developed, this paper refers to the sustainability evaluation system proposed by Zaid et al. (2020) (Zaid , Wang , Adib , Sahyouni , & Abuhijleh , 2020), combined with corporate disclosure in China, categorizes it into categories including environmental management, environmental regulation, environmental governance, human resources, consumer and community involvement.

Digital transformation is a complex process, and one variable is difficult to proxy for it (Matt , Hess , & Benlian , 2015). Some scholars have analyzed only single technology, for example, robotics, the Internet of Things (IoT), blockchain, and big data (Ballestar , Camina , Díaz-Chao, & Torrent-Sellens , 2021) . For example, (Chin, Wang, Yang, Duan, & Chen, 2021)explored the impact of blockchain on innovation. Other scholars decomposed digitalization into multiple technologies (Ballestar , Camina , Díaz-Chao, & Torrent-Sellens ,

2021) or used the proportion of R&D investment and innovation output as a proxy variable for digital transformation (Jafari-Sadeghi, Garcia-Perez , Candelo , & Couturier, 2021) This paper uses textual analysis to measure digital transformation for firms disclose more information in the form of text.

6. Digital transformation and corporate sustainability :

Digital transformation is seen as a keyway to achieve sustainable development (Andriushchenko, Buriachenko, Rozhko, Skok , & Hlushchenko, 2020). Digital technology achieves sustainable development by reducing costs, improving management efficiency and improving labor productivity. Existing research on digital transformation has focused on employment, labor (Ballestar , Camina , Díaz-Chao, & Torrent-Sellens , 2021), productivity, and innovation, while has rarely explored corporate sustainability. In a recent study, they used urban data and found that the digital economy can improve economic development and employment to achieve sustainable urban development. they found that digital transformation had a significant increase in the sustainable efficiency of technology investment in the banking sector. It is worth noting that all these studies focus on the macro level, so it is meaningful to explore the impact of digital transformation on sustainability at the firm level to fill the gaps in existing literature.

7. Digital transformation disrupts perceptions:

Digital transformation is disrupting perceptions (Rasiwala & Kohli, 2021). Digital transformation may disrupt existing organisational rules and structures, changing traditional competitive patterns and business models.

Some studies have found that digital transformation can strengthen the market position of monopolies (Soto Setzke, Riasanow, Böhm, & Krcmar, 2021) and weaken the differences brought about by firm scale.

Based on organizational capability theory, strategic organizational activities require external environmental resources and the ability to deal with the external environment. Digital transformation can accelerate the flow of information, knowledge (Hao & Zhang, 2021) . On one hand, senior digital technologies can convert data into digital resources in symbolic formats for communication; on the other hand, digital technologies can reduce the cost of storing knowledge. Technical staff are one of the key factors influencing innovation in firms, which is rarely considered in existing research on digital transformation. The digital

construction of a company brings more than just efficiency, it also requires a high level of technical skills among employees.

Does this give rise to a talent monopoly in companies? It is worth thinking about. Board diversity is one of the most important factors influencing corporate sustainability (Zaid , Wang , Adib , Sahyouni , & Abuhijleh , 2020), and in the same way, digital transformation is changing the organisational structure and board diversity of firms.

On one hand, emerging technologies promote a culture of gender equality, and digital technologies can increase ‘information centralisation’ and public access to information . On the other hand, digital technologies can exacerbate gender dichotomies and widen perceptions between men and women, such as health issues and risk awareness (Kohlrausch & Weber, 2021).

8. Conclusion :

Digital transformation presents a strategic opportunity to enhance business sustainability. By integrating innovative digital solutions, companies can not only achieve greater operational efficiencies but also contribute positively to environmental conservation and social welfare. Moving forward, it is imperative for organizations to invest in digital capabilities that align with sustainability goals to ensure long-term success and compliance with global sustainability standards.

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