Integration of AI and IoT Into Corporate Social Responsibility Strategies for Financial Risk Management and Sustainable Development

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Article

Integration of AI and IoT into Corporate Social Responsibility Strategies for Financial Risk Management and Sustainable Development

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Abstract: This research focuses on exploring the intricate relationships between Artificial Intelligence (AI) and the Internet of Things (IoT) and institutional frameworks within the realm of sustainable development. It investigates how these technologies influence economic and social growth, pinpointing both their prospective benefits and associated risks. Methodologically, the research relies on information gathering and case study analysis, assessing the impact of technology in various domains, from smart cities to the manufacturing sector. The findings emphasize the necessity of integrating technological innovations into broader social and environmental initiatives, highlighting the importance of institutional transformations for achieving environmental sustainability.

Keywords: corporate social responsibility; financial risk management; sustainable development; AI Integration; IoT application; innovative environmental strategies; Industry 5.0

1. Introduction

In the contemporary landscape, integrating sustainable development into the strategic frameworks of socioeconomic systems is increasingly recognized as a pivotal determinant of their success. This imperative is further accentuated in the context of economic growth and innovation, especially with the advent of cutting-edge technologies. Among these, Artificial Intelligence (AI) and the Internet of Things (IoT) stand out for their profound potential to redefine paradigms of sustainable development. However, utilizing these technologies to foster sustainable progress requires a comprehensive reassessment of strategic goals and the analytical methods used to understand the cyclical dynamics of economic systems.

Our investigation delves into the ramifications of AI and IoT across multiple domains, such as urban planning, logistics, and industrial operations, aiming to identify and address emerging challenges while exploring viable pathways toward sustainable growth. Specifically, this study focuses on the roles of AI and IoT within the framework of sustainable development management, emphasizing the critical aspects of risk assessment and the enhancement of corporate social responsibility. The significance of this research lies in its exploration of AI and IoT not only as catalysts for environmental innovation but also in their capacity to influence financial systems, all within the ambit of "Integration of AI and IoT into corporate social responsibility strategies for financial risk management and sustainable development.

The study is based on the hypothesis that the integration of Artificial Intelligence (AI) and the Internet of Things (IoT) into strategies for corporate social responsibility can markedly enhance the efficacy of managing sustainable development. Within this framework, the study assesses the current

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landscape of scholarly inquiry, addressing both supporting and disputing viewpoints on the effects of these technologies on the pursuit of sustainability.

The examination of recent advancements in this area has uncovered key developments. The investigation by Zakaria Boulouard and colleagues (2022) delves into the role of AI and IoT in fostering sustainable development within emerging economies, underscoring the opportunities and hurdles these innovations present. Furthermore, a thorough literature review by Bibri and associates (2023) zeroes in on the creation of eco-friendly smart cities through the fusion of AI, IoT, and extensive data utilization. Additionally, Dias et al. (2023) scrutinize AI and IoT implementations in smart urban environments, highlighting the crucial process of converting data into actionable insights. This collective body of work underpins the premise of our study, emphasizing the "Integration of AI and IoT into corporate social responsibility strategies for financial risk management and sustainable development," thereby offering a comprehensive view of the potential transformative impact of these technologies on sustainable development initiatives. An analysis conducted by McKinsey & Company (2023) on the proportion of organizations using artificial intelligence (AI) in their sustainability development efforts shows that the introduction of AI is an important and gaining momentum phenomenon, but its application varies greatly due to the region.

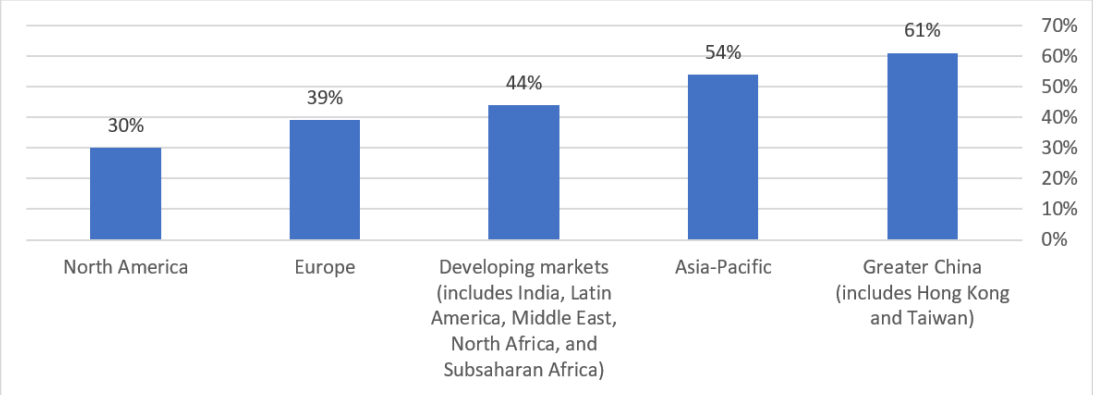

Figure 1. Global share of organizations using artificial intelligence (AI) in their sustainability efforts in 2022, by region. Source: comp. auth. based on: McKinsey & Company. (2023).

As per the findings of the study, it is noteworthy that the Greater China region exhibits the highest percentage of organizations (61%) utilizing AI for sustainable development. This may indicate a strong political backing, funding for innovation, and a significant level of adoption of novel technologies in this region. Second place is occupied by the Asia-Pacific region, where 54% of organizations are implementing AI. This may reflect the growing importance of the economic potential of sustainable innovations, including AI, to improve the environmental and social aspects of development. The growth rate of 44% of organizations involved in the use of artificial intelligence for sustainable development in emerging markets is also encouraging, despite possible limitations in infrastructure and tech availability. Europe (39%) and North America (30%) are behind Asian regions when it comes to applying AI for sustainable development. This phenomenon may be attributable to disparities in regulatory methodologies, the magnitude of investment in AI research and development, as well as varying levels of readiness to adopt novel technologies.

According to the findings of the Nutanix survey conducted in 2023, various initiatives have been identified as the primary factors contributing to the increased focus on sustainable development. These include initiatives related to corporate culture, social sphere, and management (ESG), as well as supply chain failures and prolonged cycles of equipment purchases, which occupy the top spot among the primary factors, with 63 and 59 percent of the total.

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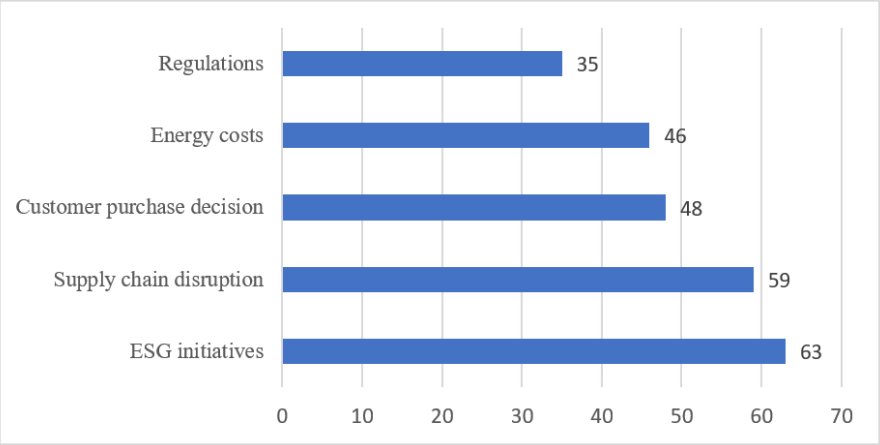

Figure 2. Reasons to improve sustainability worldwide in 2023. Source: comp. auth. based on: Nutanix. (2023).

These variations may be influenced by societal, societal, political, and infrastructure-related factors. Given the need to address the climate crisis and social issues, the data highlight the need to globalize sustainable practices and technologies, including AI, to achieve broader and more effective sustainable development.

There are also several controversial theories in this area. The limitations and obstacles associated with the introduction of these technologies are discussed in studies by Verdejo Espinosa et al. (2021) and Dias et al. (2023) Arsic (2021) and Lee (2020) talked about cybersecurity issues that are important because of the risks that come with using AI and IoT.

Our research, therefore, aims to provide a thorough evaluation of the significance of artificial intelligence and the internet of things in favor of environmentally-conscious growth, as well as to identify both the advantages and the drawbacks associated with their use. We are committed to providing data-based recommendations for the formation of effective and sustainable economic models relevant to modern society.

2. Literature Review

The ongoing digital transformation offers profound opportunities for the development of competitive and innovative business models, the integration of circular supply chains, and the shaping of the institutional frameworks of economic systems. This shift holds considerable promise for sustainability, despite the environmental footprint associated with ICT. Pursuing the environmental goals outlined by the United Nations Agenda (Lee et al., 2016) and adopting the principles of a closed-loop economy underscore the imperative for enduring solutions.

Embracing a sustainable digital transition necessitates the harmonization of pivotal technologies, including the Internet of Things (IoT), edge computing, and Artificial Intelligence (AI). The expansion of IoT and IIoT technologies paves the way for a more sustainable future by enabling comprehensive management of the product lifecycle. However, this advance also introduces potential risks that may impede the fulfillment of the United Nations' sustainability objectives.The IoT Sustainable Development Guide from the World Economic Forum in 2018 suggested a way to measure how well IoT is working by using the UN Sustainable Development Goals. This approach emphasizes the importance of taking measures consistent with UN Goal 12 'Ensuring sustainable consumption and production' (Lee et al, 2016) However, the ICT industry, especially the Internet of Things, hasn't helped enough to make the world a better place. This means we need to come up with new plans and strategies.

The research by Fraga-Lamas and the co-authors (2021) highlights the significant contribution of the Internet of Things and artificial intelligence to the transition to a sustainable digital and smart circular economy. The key role of IoT in digitizing operations to promote sustainability is highlighted by the disparity between the potential of these technologies and their present contribution to the

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sustainability of the IoT sector. This study focuses on the need to develop integrated approaches within the framework of the Industry 5.0 concept, which considers not only technological capabilities, but also their environmental and social footprint. This will contribute to the formation of new models of sustainable development management (Paula Fraga-Lamas et al., 2021).

Our understanding of sustainable development in the context of the digital age is impacted by the findings and conclusions of the study by Leal Filho and his colleagues (W. Leal Filho et al., 2022). They identify the potential opportunities that AI presents for incorporating into sustainable development strategies, thereby enabling them to address intricate environmental and social issues. This research demonstrates the crucial significance of employing artificial intelligence to enhance the standard of living and safeguard the environment in diverse locales, presenting fresh strategies and strategies for achieving a more harmonious and balanced progression. The analysis by Leal Filho and co-authors (2022) demonstrates that AI has the potential not only as a tool for optimization and automation, but also as a catalyst for innovative, sustainable and socially responsible development. Artificial intelligence emerges as a pivotal element in the creation of new management frameworks capable of navigating the intricate and evolving circumstances of contemporary society, with a keen focus on environmental, economic, and social dimensions.

The deployment of Edge-AI and Green Internet of Things (G-IoT) necessitates robust safeguards against diverse cyber threats (Dong et al., 2019), alongside the establishment of infrastructure tailored for forthcoming 5G/6G networks, demanding extensive computational resources. Addressing the need for universal standards within the fragmented IoT market and the formation of decentralized data storage becomes imperative. Within the ambit of Industry 5.0, Edge-AI and G-IoT applications are mandated to fulfill stringent performance and reliability criteria, yet their alignment with sustainable development principles — encompassing social equity and the mitigation of environmental footprints, notably in carbon emission reduction — is paramount. This approach advocates for a comprehensive strategy in evaluating and managing energy use and carbon emissions, advocating for the broad adoption of these innovations.

The examination of Vinuesa et al.'s (2020) work unveils critical insights: artificial intelligence harbors the capacity to substantially bolster sustainability across various fields, such as environmental science, healthcare, and urban development. Nonetheless, this potential is accompanied by risks that demand judicious governance. The research underscores the imperative of a balanced utilization of AI, weighing its environmental benefits against potential detriments. The findings stress the importance of a cross-disciplinary, comprehensive methodology towards employing AI and IoT for environmental advancement, emphasizing the intertwined nature and complexity of technological and economic systems (Somantri and Surendro, 2024) These conclusions support a post-institutional perspective on the roles of AI and IoT in sustainable development, spotlighting the necessity for an amalgamated approach to the oversight and regulation of these technologies to ensure sustainable progress.According to the global security automation survey conducted by the SANS Institute, D3 Security (2021), 49 percent of respondents reported their concerns about dependence on other IT operations processes and tools that hinder key automation processes.

3. Materials and methods

An innovative post-institutional methodology is the basis for this study, as described by Frolov (2021) An interdisciplinary synthesis is required for this approach to overcome the mono-aspect, dichotomy, and dogmatism of traditional neo-institutional approaches. Thus, the research aims to provide a deep understanding of how AI and IoT affect sustainable development in different geo-economic situations.

The methodological approach incorporates an interdisciplinary analysis combining economic, technological, and social perspectives. The selected case studies reflect the variety of AI and IoT applications in the context of smart cities, transportation and business, revealing valuable hints into the actual-life scenarios of their implementation and impact.

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The analysis of data encompasses both quantitative and qualitative techniques. The purpose of quantitative analysis is to collect and process statistical data on the current state and trends in the development of AI and IoT. The qualitative investigation involves interpreting the outcomes of the case study, revealing key occurrences, obstacles, and chances.

The research involves a thorough examination of existing tactics and approaches for implementing AI and IoT, as well as a thorough examination of their effects on environmentally-friendly growth. This analysis assists to identify the key factors determining success or failure in the application of these technologies in various economic and social contexts. Ultimately, the amalgamation of the gathered data and derived insights aims to formulate sound recommendations for the practical application of AI and IoT in sustainable development strategies. Databases such as JSTOR, Google Scholar, and Scopus were utilized to gather pertinent research pertaining to the impact of AI and IoT on sustainable development. The criteria of relevance and citation were applied. The resources encompassed theoretical aspects, case studies, as well as critical reviews in this particular field. This study adopts an integrative framework to explore the impact of Artificial Intelligence (AI) and Internet of Things (IoT) technologies on sustainable development with an environmental focus. The framework enables an analysis of how the establishment and growth of new businesses utilizing AI and IoT can drive economic advancement and regional growth. Special focus is placed on the ability of this methodology to bridge the technological divide between developed and developing economies, a factor vital for achieving global sustainability. Throughout the research process, stringent adherence to ethical standards regarding confidentiality and data management was maintained.

Consequently, this integrative approach facilitates a comprehensive examination of AI and IoT's contributions to eco-friendly development. It allows for the identification and assessment of significant progress and challenges, and the formulation of effective strategies and practices to enhance the deployment of these technologies across various geographic and economic settings.

4. Results

Following the institutional analysis, the ensuing insights can be summarized as follows:

First, dependency on additional IT processes and systems is viable. This reliance mirrors the intricate web of connectivity and mutual dependency among various organizational segments and frameworks. Recognizing and leveraging these connections to foster optimization and cohesion can significantly enhance the efficacy of integration and the management of change.

Second, the hazard posed by insufficient internal competencies for managing and automating IT systems highlights the critical role of organizational learning and advancement. It's imperative for institutions to adopt strategies for learning and development that prepare their staff for emerging technologies and methodologies, fostering an ethos of perpetual education.

Third, the issue of opaque practices or restricted data access from vendors or alternate sources ties back to the policies governing institutional data and the exchange of information. Establishing a milieu characterized by openness, transparency, and collaboration, which ensures data availability for informed decision-making, is fundamental for fostering innovation and adaptability within an organization. Fourth, the general direction of the market and its impact on IT systems and automation management strategies reflect the need for institutional adaptation to changing external conditions. Organizations must exhibit flexibility and be receptive to modifications in order to maintain competitiveness and efficacy.

Finally, the limited capabilities of current tools for integration and automation from an institutional perspective highlight the importance of investing in technology and innovation. Organizations should constantly look for and implement innovative tech advancements to enhance their operations and boost effectiveness. Digital transformation in various industries will be accelerated by spending on various IT segments. Digital transformation includes, for instance, the use of artificial intelligence, the automation of procedures, and the transfer of data to cloud storage. Spending wisely on and implementing diverse info techs enhances these processes. As per the findings of the study, the cumulative number of corporate investments in artificial intelligence (AI)

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worldwide from 2015 to 2022 is estimated to be in the range of billions of US dollars. These findings are supported by a study conducted by Stanford University (2023).

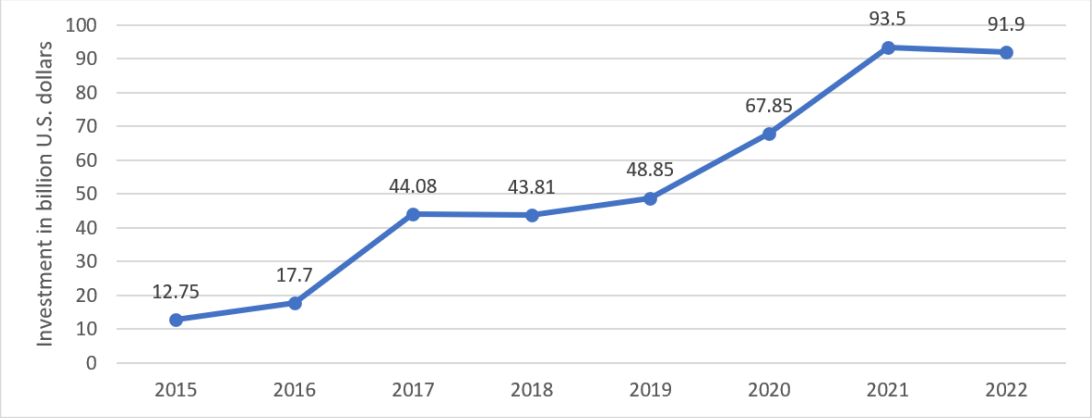

Figure 2015. to 2022 (in billion U.S. dollars). Source: Stanford University. (2023).

The theory of technological structures was developed by S.Yu. Glazyev, D.S. Lvov and G.G. Fetisov to explain the dynamics of technical and economic development. To accomplish this, the researchers suggested identifying a component of technical and financial advancement, which could be viewed as a conduit for technological advancements. They proposed to consider the technological framework as such a unit. A technological framework is conceived as a resilient, self-replicating system, comprising a collection of technologically linked sectors linked by the same type of technological links. Techno-economic development is seen as "a process of development and a consistent change of technological patterns" (Glazyev et al., 1992) Within the technological framework, all stages of macro-production processes are performed, starting with the extraction of resources, through their processing at different stages, and ending with final products. Since the technological framework is based on a complex of similar technologies, we can say that the framework is a homogeneous economic system. The term 'uniformity' refers to the synchronization of technological advancements, resources, skills and abilities of workers, organizational structures, management principles, scientific investigation and development, etc. According to the theory of TSHP, TSHP is only its "core" when it comes to technological framework. In this context, artificial intelligence and the internet of things can be considered components of a fresh technological framework that defines contemporary methods of production, management, and interaction. The advancement of novel economic and social structures is influenced by these technologies, which corresponds to the transition to a novel mode of existence within the framework of this theory.

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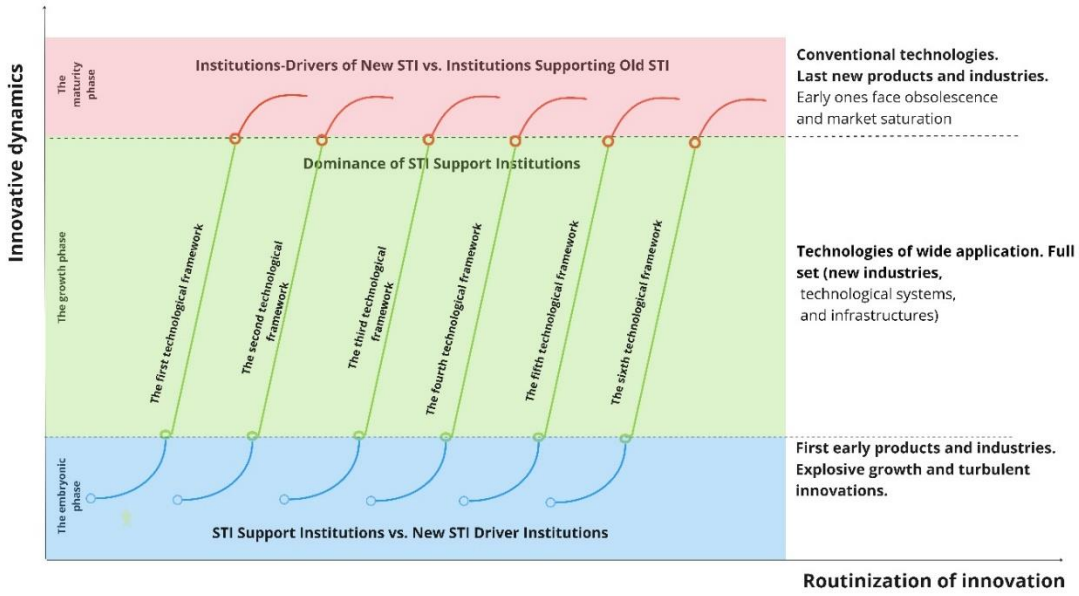

Figure 4. Coevolutionary multi-paradigm approach to technological development. Source: comp. auth.

From the perspective of constructive criticism, we observe the shortcomings of the theoretical approaches employed in the study of the technological evolution of economic systems:

1. The focus on the change of widely used technologies or technological structures leads to an underestimate of the role of complexity and co-evolution of technologies. We agree with the claim that "the key thesis of evolutionary economics – the uneven continuity of economic evolution – contradicts the very idea of innovative "pauses" and "gaps" in technological advancement and, furthermore, the idea of technological cycles (waves) of approximately the same duration" (Frolov, 2011). Indeed, technologies do not only compete, but they also adapt to each other, and often radical innovations in one technological area cause waves of innovation in other areas of technological activity. Therefore, in our opinion, the coevolutionary multi-layered approach is more appropriate to the task of studying complex technological systems, in particular, digital technologies and the digital economy in general. From this perspective, adaptation of the entire technological structure of the economy and the economic system, as well as expansion of their use. The development of new activities and jobs based on new technologies, including AI and IoT, is much more important than the change of technological structures and TSHP.

2. Institutions are assigned a secondary and inertial role in technical and economic development. The theory of TSHP considers institutions from the standpoint of their inertia and the effect of path dependence (the influence of the history of past development). In the theory of technology patterns and techno-economic paradigms, organizations react to technological changes that happen late and slowly. This slows down the replacement of patterns and causes a turning point during a paradigm shift. From the point of view of technological co–evolution, routine plays a bigger role than innovation. Here routine represents the process of mass perception, introduction and use of new technologies in various fields of economic activity. The routine process involves the dissemination of knowledge about the latest technological advancement among economic entities, and various technologies, as well as related technological standards, technological procedures, and commercial procedures, are adapted to it. As formulated by P.O. Luksha, starting from the ideas of O.V. Inshakov and Stepochkina (2003), "routine is an evolutionarily non–random practice that arises and is maintained at different levels of economic reproduction" (Luksha, 2009), i.e. at the levels of individual workers, enterprises and organizations, regions and municipalities, industries and spheres of the economy, the economic system of society, international economic systems relationships. Institutions are the mechanism for technological change.

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3. The ambiguity of the conceptual framework of diverse theories of technological and economic progress prevents their application in empirical investigation. To be applied to the preparation of scholarly works and tactics for societal advancement at various levels, conceptual advancements should provide opportunities for evaluating and comparing. However, there is a problem with determining the breadth of application in the case of TSHP. As critics point out, felt-tip pens are used almost everywhere, as is polyethylene. It is unclear what distinguishes them from TSHP (Field, 2011). Electricity is used extremely widely, and Internet technologies, nanotechnology, and biotechnology are based on this TSHP (Bekar et. al., 2018). It is impossible to imagine modern advanced technologies that could exist without electricity. The theory of techno-economic paradigms, similar to the theory of patterns, can be utilized in the qualitative analysis of economic changes. However, establishing precise boundaries and quantitative assessments of patterns and paradigms in practice can prove to be challenging, as they always exhibit an approximate appearance.

The analysis indicates that the current model of the Industry 4.0 concept, which is a vector of development for the formation of economic systems, is focused on improving business models and economic thinking. It is obvious that the model does not adequately respond to environmental, climatic and social threats. This model creates technological monopolies and contributes to an increase in property inequality. The research demonstrates the significance of reconsidering man's contribution to the manufacturing process. Instead of considering technology as a substitute for human labor, it is proposed to focus on unique human qualities such as creativity and innovation.

The results suggest the need to integrate environmental goals into an industrial strategy. This includes the effective use of resources, the reduction of waste, the introduction of sustainable power sources, and the shift from anthropocentric to ecological thinking. The establishment of equitable and inclusive workplaces, the promotion of diversity and equality, and the consideration of employee welfare are emphasized as crucial elements of the new model. In today's world, we need to be able to change with the economy, technology, and society. This is what postinstitutionalism means. The research advocates for the development of frameworks that leverage technology to improve quality of life instead of replacing human work, specifically focusing on the integration of AI and IoT to augment human capabilities.

According to the findings, a strategy that melds regenerative characteristics, societal inclusion, and ecological accountability is essential for realizing comprehensive change and achieving sustainable growth. This strategy involves making choices that acknowledge the interconnectedness of ecological systems and striving to forge new paths to prosperity that honor such interconnectedness.

5. Conclusions and Their Discussion and Significance

Artificial Intelligence (AI) and the Internet of Things (IoT) emerge as pivotal in formulating new paradigms for the management of sustainable development. By harnessing the capacity to collect and analyze extensive datasets, these technologies enable enhanced comprehension and stewardship of environmental, social, and economic dimensions across diverse regions.

Particularly in the realms of energy, water supply, and waste management, the application of AI and IoT markedly augments resource management efficiency. Such advancements lead to more judicious resource utilization, diminished pollution, and an elevated standard of living.

Moreover, AI and IoT foster greater community engagement in the pursuits of sustainable development. The dissemination of environmental condition data through these technologies elevates public consciousness and propels collective responsibility.

However, the integration of AI and IoT within sustainable development frameworks is not devoid of challenges. Issues spanning data privacy and security, the imperative for skilled workforce adept in these technologies, and substantial financial commitments pose as notable barriers.

The efficacious integration of AI and IoT alongside other technological and societal innovations is crucial for optimizing benefits. This necessitates the cultivation of cross-disciplinary methodologies that amalgamate technological, economic, and social considerations.

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Overall, the incorporation of AI and IoT into sustainable development heralds novel avenues for enhancing operational efficiency, mitigating environmental degradation, and uplifting quality of life. This underscores the significant role of integrating AI and IoT into corporate social responsibility strategies for financial risk management and sustainable development. Nonetheless, the successful implementation of these technologies necessitates an integrated approach that encompasses technical, social, and economic facets.

Industry 5.0 is a concept that follows Industry 4.0 and focuses on the return of the human dimension to industrialization and technological development. Unlike Industry 4.0, which emphasized automation, data utilization, and intelligent systems to enhance production and operational efficiency, Industry 5.0 emphasizes the significance of human engagement and collaboration with technology. Postinstitutionalism emphasizes the complexity, dynamism, and diversity of modern social processes, which go beyond traditional institutional structures. In this context, the transition from Industry 4.0 to Industry 5.0 has several key aspects:

First, Industry 5.0 puts more emphasis on people and their creativity, intuition, and emotional intelligence, along with new technology. This transformation is perceived as a response to the dehumanization entailed in Industry 4.0, where the emphasis was on automation and efficiency.

Second, in the era of global environmental challenges, Industry 5.0 focuses on sustainable development, considering environmental responsibility and green technologies as a part of the industrial process. This shows a growing awareness of the need for a balance between industrialization and environmental conservation.

Third, the transition to Industry 5.0 implies enhancing civic responsibility and aiming for a more just and inclusive community. This includes ensuring equality, diversity, and consideration of all segments of the population.

Fourth, Industry 5.0 emphasizes the importance of flexibility and adaptability in a rapidly changing world. This includes the capacity to swiftly adapt to technological advancements, economic conditions, and social expectations.

Fifthly, unlike the full automation characteristic of Industry 4.0, Industry 5.0 strives to create harmonious cooperation between man and machine, where technology complements and expands human capabilities.

The analysis has led us to draw the following conclusions: 1) Companies and societies are increasingly focusing on long-term sustainability and social responsibility, moving beyond traditional financial indicators. 2) The implementation of sustainable IT practices necessitates the integration of knowledge from diverse domains, including but not limited to technology, ecology, social sciences, and management practices. This reflects the complexity of contemporary challenges that cannot be addressed solely through highly specialized approaches. 3) The increased focus on ESG initiatives in IT also shows that companies and societies must be prepared for rapid and sometimes unpredictable changes caused by both external factors (for example, climate change) and internal ones. This is especially true for changes in corporate culture (for example, changes in corporate culture). 4) Success in the IT sector requires the collaboration of many stakeholders, from governments and corporations to public organizations and individuals. This highlights the importance of integrating efforts and cooperation between different sectors of society. 5) Awareness of the limitations of the Industry 4.0 model, which focuses on technological automation and efficiency, but does not adequately consider social and environmental aspects. Postinstitutionalism emphasizes the importance of understanding the social and environmental consequences of technological development.

The current digital transformation and the growth of IoT/IIoT technologies provide significant opportunities for revising sustainable development management models, but also pose certain challenges. It is necessary to develop and implement effective mechanisms and policies to ensure security, standardization, sustainability and efficient use of resources in the field of Edge-AI G-IoT. A closed-loop economy and Industry 5.0 require an integrated approach that considers social, environmental, and technological aspects.

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The research conducted by Leal Filho and colleagues (2022) provides a significant foundation for further investigation and development of strategies for sustainable development through AI. It unveils novel avenues for incorporating artificial intelligence into sustainable management and development systems, emphasizing its significance as a crucial component in achieving sustainability objectives on a global scale.

Worldwide statistics suggest the adoption of artificial intelligence in environmentally sustainable initiatives as a notable and expanding movement, albeit with considerable geographic variability. Such disparities may stem from a mix of societal, political, and infrastructural influences. In light of the urgent need to tackle environmental and societal challenges, these findings underscore the imperative to disseminate sustainable methodologies and technologies, including AI, more universally to enhance the effectiveness of sustainable development efforts.

Exploring the role of digital technologies within sustainable development frameworks, it becomes evident that AI and IoT stand as instrumental in refining territorial management. Yet, their efficacy is heavily reliant on the underlying institutional context. These contexts are shaped by an amalgam of social conventions, legal frameworks, cultural norms, and economic paradigms, which together steer technological progress toward sustainability and societal welfare. Achieving a seamless integration of AI and IoT into sustainable practices demands a concerted effort to build and fortify institutional frameworks that facilitate a confluence of technological innovation with sustainable development objectives (Frolov, 2020). It is crucial to perceive digital technologies such as AI and IoT not as standalone solutions but as components deeply entwined with institutional settings that dictate their application. Institutions melding technological and societal elements are pivotal in ensuring that technological breakthroughs serve the cause of sustainable development and equity. Hence, to nurture the present and safeguard the future, attention must be given to both technological advancements and the evolution of operational modalities. This collective evolution ushers in what is termed as techno-economic institutions, necessitating the formulation of a financial architecture conducive to the deployment of novel technologies within a network of techno-economic institutions, viewed through the lens of techno-institutional dynamics.In conclusion, the transition from Industry 4.0 to Industry 5.0 from the point of view of postinstitutionalism is not just a technological upgrade, but a profound socio-cultural and environmental rethink aimed at creating a more sustainable, just, and humane future. This approach recognizes the complexity and interdependence of the modern world and strives for the harmonious integration of technological progress with human values and needs.

Author Contributions: Formal analysis, Resources A.V.N; Methodology, Assessment of AI's impact on economic and social development; identification of potential advantages and risks, Coevolutionary multi-paradigm approach to technological development, Writing—review and editing, A.V.S.; All authors have read and agreed to the published version of the manuscript.

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