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(Research/Review) Article

Tech for Good: Leveraging AI and IoT for Climate-Resilient Economic Development

Alif Fachrurrozi Septianto [1], Sherli Putri Febriani [2], Dora Febiola [3], Arum Sulistyowati [4], Muhammad Arif Rakhman [5]

[1] Universitas Darul Ulum Islamic Centre Sudirman GUPPI, Indonesia; e-mail: alifseptianto027@gmail.com
[2] Universitas Darul Ulum Islamic Centre Sudirman GUPPI, Indonesia; e-mail: sherliputrifebriani@gmail.com
[3] Universitas Darul Ulum Islamic Centre Sudirman GUPPI, Indonesia; e-mail: dorafebiola2@gmail.com
[4] Universitas Darul Ulum Islamic Centre Sudirman GUPPI, Indonesia; e-mail: arumsulistiyawati09@gmail.com
[5] Universitas Darul Ulum Islamic Centre Sudirman GUPPI, Indonesia; e-mail: arif@undaris.ac.id

Abstract: This study examines the role of smart technology, particularly Artificial Intelligence (AI) and the Internet of Things (IoT), in strengthening economic resilience in the face of climate change impacts. Using a qualitative descriptive approach with a literature stufy method, secondary data was obtained from scientific journals, books, proceedings, and relevant online articles. The analysis was conducted through reduction, categorization, and thematic analysis of the relevant literature. The results show that AI contributes significantly to improving economic efficiency and risk prediction compabilities. While IoT strengthens connectivity and automation that support supply chain stability, the intregration of AI and IoT in the agricultural sector significantly increases productivity and food security. In addition, smart technology is also an effective mitigation tool against exctreme climate variations that impact the economy and society. This study emphasizes the importance of cross-sector collaboration and digital infrastructure investment to build adaptive and sustainable economic resilience. The implication of this research provide a basis for policy strategies and digital innovation in an era of increasing dynamic climate change.

Keywords: AI for Risk Prediction; IoT Strengthens Connectivity; Smart Agriculture Innovation; Smart Technology for Resilience; Climate-Adaptive Economy

1. Introduction

Climate change is an environmental issue with a high level of complexity. Climate change itself is defined as a change in the average variation of climate conditions od a particular place (Madyar Dewi et al., 2023). Climate change is one of the biggest challenges facing the world today, with widespread and complec impacts on various sectors of life, especially the economy. Increasingly intense and unpredictable climate change can pose major risks and have global impacts that disrupt human life in terms of health, agriculture, forests, infrastructure, transportation, tourism, energy, and society (Ainurrohmah & Sudarti, 2022a). This situation highlights the need for innovative strategies that not only focus on mitigating the impacts but also on enhancing overall social and economic resilience.

Amidst this dynamic, digital technologies such as AI and IoT offer great potencial for delivering more adaptive and responsive solutions. The integration of IoT and AI is key to creating urban systems that are not only connected, butalso intelligent in responding to the dynamics of the city (Zakiansyah et al., 2025). Smart technologies such as artificial intelligence (AI) and the Internet of Things (IoT) offer great potential as innovative solutions to address the challenges of climate change. throught their capabilities for large scale, real time data analysis, these technologies enable more accurate risk prediction, more efficient recource management, and the design of responsive and proactive adaptation strategies. With the continuing growth of the global population, increasing demand for food and greater pressure on natural resources, smart technology is key to increasing agrivultural productivity while maintaining environmental sustainabillity (Ratna Nawangsari, 2024). The application of smart technology not only contribute to mitigating the impacts of climatr change, but also strengthen social and economic resilience amid growing climate encertainty. Therefore, analisys of the application of this technology is crucial to evaluate its effectiveness in strengthening economic resilience in the face of current global climate dynamics.

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2. Literature Riview

Intelligent Technology (AI)

(Tarumingkeng, n.d.) in his work entitled "AI - Its Impact on the Global Economy" examines the role of artificial intelligence in building global economic resilience. His research shows than AI has significant contribution to imptoving economic stability throught its ability to analyze data and predict crises quickly and accurately. AI is used to manage economic risks, accelerate responses ro disasters, and encourage economic disversification by creating new technology-based sectors. This is also reinfoeced by research conducted by (Lintang Rachmadana et al., 2022) n the FAIR: Financial & Accounting Indonesian Research journal entitled "The Impact of Artificial Intelligence on the Economy," which examines the influence of artificial intelligence implementation on global economic change. This study found that AI plays a significant role in strengthening economic efficiency and productivity, as well as assisting in complex decision-making under uncertainty. The results of research conducted by (Ayuningtyas & Rositawati, 2025) show that the integration of Artificial Intelligence (AI) and Internet of Things (IoT) technology in the agricultural sector can increase productivity, resource use efficiency, and support the four main pillars od foof security, namely availability, accessibility, utilization, and stablility. Thus, it can serve as an alternative in enhancing economic resilience in Indonesia.

Internet of Things (IoT)

In a study on the role of digital technology in economic resilience conducted by (Wibowo et al., 2023). The authors discuss how the aplication of IoT can strengthen the digital economy through the device connectivity, big data integration, and industrial process automation. The results show that the application of IoT in the digital economy and bussiness sector has a positive impact on economic resilience, particularly interms od efficiency, competitiveness, and adaptabillity to market changes. IoT helps companies optimize their supply chains, reduce production costs and create new product and service innovations that increase economic added value. In addition, wibowo emphasized that IoT plays an important role in maintaining the stability of the digital economy because it is capable of providing a fast and accurate data- based monitoring and decision-making system. In macro context, IoT is the main foundation for the development of a robust digital economy ecosystem, where the business sector, government, and society are interconnected through smart technology infrastructure.

In another study conducted by (Purba et al., n.d.) it was included that the development of the digital economu is a major driver of indonesia's economic growth and resilience especially in the facce off global challenges. The digital economy has proven to be capable if increasing efficiency, expanding finacial inclusion, and creating new jobs, especially for micro, small, and medium enterprises (MSMEs). Another study conducted by ZULMI (2024), developed a weather prediction system using Internet of Things (IoT) technology and the random forest classification method in machine learning. The system is capable of predicting weather conditions such as sunny, cloudy, light rain, and heavy rain with an accuracy of 88–89%. The data used comes from NASA's POWER, while the hardware involves BME280 sensors and anemometers to obtain parameters such as temperature, humidity, air pressure, and wind speed. The results of the study show that this system can provide fast, accurate, and easily accessible weather information through online and offline platforms. This research makes an important contribution to strengthening early warning system and economic decision-making that depends on weather conditions, such as in the agriculturen transportation, tourism, and renewable energy sectors.

Economic Resilience

Much researcch has ben conducted on economic resilience, both in regional and natonal contexts. One relevant study is the dissertation by Subkhan et al. (2024) entitled "Digital Economy Management Model for Economic Resilience and Competitiveness of Smart Cities in Indonesia." This study uses a mixed methods approach through Systematic Literature Review (SLR), Soft System Methodology (SSM), Fuzzy Analytical Hierarchy Process (FAHP), and scenario planning involving 30 experts from six smart cities in indonesia, namely Jakarta, Bandung, Semarang, Surabaya, Banyuwangi, and Makassar. The results of the study show that the economic resilience of a city is greatly influenced by the strength of its digital infrastructure, collaboration betweetn economic actors, and the community's ability to adapt to digital transformation.. Farid (2024) found that the development of smart cities contributes greatly to regional economic resilience because it strengthens responsiveness to ecternal shocks, promote incocme equality, and creates a sustainabke entreoreneurial ecosystem. Research conducted by (Savilia et al., 2025) shows that an open economy provides significant benefits in the form of increased investment,

international trade, and technology transfer, wich can strengthen national economic capacity. However, this study also emphasizes that high dependence on global markets can weaken economic resilience, especially during international crises or commodity price fluctuations. Therefore, counties need to implement economic diversification strategies, strengthen domestic sectors, and increase foreign exchange reserves in order to be able to cope with external pressure. Research conducted by Supriyadi et al., (2022) emphasizes that economic resilience cannot be achieved without food security, and that policy innovations based on environmental sustainability and institutional transparency are key to maintaining national economic stability in the future. The studies show that economic resilience is a multidimensional concept that includes the ability to survive, adapt, and transform in the face of crises. In the context of smart city development and the digital economy in indonesia, this concept is increaslingly relevant as it can serve as the bbasis for economic policies towards sustainability incusiveness, and technological innovation.

Climate Change

Calimate change has become an urgent global challenge, with impacts felt arounnd the world. Research conducted by Raihannur & Nadhira (2025) found that risisng global temperatures and climate uncertainty cause declines in agricultural yields and damage to infrastructure, witch ultimately reduce people's incomes and widen economic disparities. Developing countries' dependence on the agricultural sector makes their economies highly vulnerable to external shocks caused by climate change. Research conducted by Ainurrohmah et al,. (2022) found that climate change caused by rising global temperatures has a direct impact on economic stability, especially in sectors that depend on natural conditions such as agriculture, fisheries, and forestry. Rising temperatures, changes in rainfall, and extreme weather phenomena have led to a decline in agricultural productivity and reduced fish catches, which ultimately reduce people's incomes. This is reinforced by research conducted by Andarini (2023) wich concludes that global warming is the main couase of global climate change, triggering a significant increase in global temperatures due to the greenhouse effect of human activities, such as carbon dioxide, methane, and other industrial gas emissions. Climate change also causes global temperature increases and changes in rainfall, which in turn lead to decreased agricultural productivity, disrupted harvest cycles, and reduced farmer income. In addition, rising sea levels threaten coastal areas that serve as centers of economic activity, fishing, and tourism.

3. Research Methodology

Type of Research

This research uses a qualitative descriptive approach with a library research method. This approach was chosen because it was considered the most appropriate for analyzing the extent to wich the application of smart technologies, particulary Artificial Intelligence (AI) and Internet of Things (IoT), can strengthen economic resilience in the face of climate change impact.

Data Source

The data in this study is secondary, obtained from various scientific and reliable sources, such as:

a. National and International Journals,

b. Books, seminar proceedings, and research reports,

c. Articles from credible online sites relevant to the themes of smart technology the digital economy and climate change.

d. Some of the main references used are from studies by Tarumingkeng (n.d.), Lintang Rachmadana et al. (2022), Ayuningtyas & Rositawati (2025), Wibowo et al. (2023), Subkhan et al. (2024), dan Raihannur & Nadhira (2025).

Data Analysis Techniques

The analysis process was carried out through several main stages, namely:

1. Data reduction, wich involved selecting and filtering the literature most relevant to the research topic;
2. Categorization, wich involved grouping the information into three main focuses: smart technology (AI and IoT), economic resilience, and climate change;
3. Thematic analysis, which reviews the relationship between variables and draws conclusions about how the application of smart technology can support economic resilience in the face of climate change.

The results of the analysis are then presented descriptively and interpretively, linking varuous findings from existing sources to build a comprehensive understanding of the role of smart technology in strengthening economic resilience to climate change.

4. Result And Discussion

1. The role of Artificial Intelligence (AI) in Economic Reslilience

Based on research by Tarumingkeng (n.d.) and Lintang Rachmadana et al. (2022), the application of AI has been proven to contribute significantly to improving economic efficiency and strengthening rish prediction capabilities. This technology enables more accurate market data analysis, assists in rapid decision-making, and detects potential economic disruptions. In the context of climate change, AI can be used to analyze weather data, predict natural disasters, and optimize resource use in the agricultural and industrial sectors.

2. Aplication of the Internet of Things (IoT) foe Economic Resilience

According to Wibowo et al. (2023) and ZULMI (2024), the application of IoT can strengthen the digital economy structure through inter-device connectivity system and production procces automation. IoT provides real-time data that helps monito weather, raw material supplies, and supply chain stability

For example, the IoT-based weather prediction system developed by ZULMI (2024) has an accuracy rate of up to 89%, which greatly helps the agricultural and energy sectors in dealing with extreme climate risks.

3. Integration of Smart Technology for Resilient Economic Development

The resul of research by Ayuningtyas & Rositawati (2025) show that the integration of AI and IoT in the concept of smart farming increases resource efficiency and agricurtural productivity. This improvement directly strengthens food security, which is an important pillar of economic resilience

Meanwhile, Subkhan et al. (2024) mphasize that the readiness of digital infrastructure and the community's ability to adapt to technology are important factors in building resilient economic resilience in the digital era.

4. The Impact of Climate Change on the Economy

Findings from Ainurrohmah et al. (2022), Andarini (2023), and Raihannur & Nadhira (2025) reveal that climate change has a direct impact on declining agricultureal productivity, increasing economic enequality, and the risk of social instability.

In such conditions, smart technology acts as an effective mitigation tool through prediction systems, energy efficiency, and data-driven policy planning.

Overall, the literature synthesis show that the application of AI and IoT has a positive impact on economic efficiency, climate risk reduction, and increased competitiveness in the agricurtural and industrial sectors.

Research findings show that the application of smart technology plays a strategic role in strengthening economic resilience to climate chane. There are three main mechanism that stand out from the results of the analysis:

1. Risk Prediction and Management

   AI technology is capable of processing big data to predict extreme weather, price fluctuations, and potential economic disruptions. With this capability, goverments and industry sectors can create more adaptive and responsive policies to the threats of climate change.

2. Digital Economy Efficiency and Innovation

   The application of IoT drives automation and efficiency in the supply chain. This efficiency not only increases productivity but also reduces dependence on resources that are vulnerable to climate change.

   The smart technology-based digital economy is also an important foundation for creating inclusive and sustainable economic growth.

3. Socio-Economic Resilience and food Security

   The integration of smart technology in the agricultural sector helps farmers remain productive even in uncertain climatic conditions. This not only strengthens national food security but also improves the welfare of rural community.

Overall, this study shows that digital transformation through the application of AI and IoT is not merely a technological development, but also part of sustainable economic development strategy.

Effective implementation requires close collaboration between the government, the private sector, and the community in order to create an innovation ecosystem that is adaptive to climate change.

Reflecting on this, the results of this study emphaisize the importace of cross-sector collaboration and investment in digital infrastructure to accelerate adaptation to climate

change. Going forward, further research can focus on empirical analysis to measure the extent to which the implementation of smart technology can directly improve economic resilience indicators in various regions affected by climate change.

5. COMPARISON

Peran AI dan IoT

Table 1. Peran AI dan IoT

Aspect	AI	IoT
Contributions	Ai boost efficiency, helps predict risk, and supports data- driven decision making (Tarumingkeng, Lintang Rachmadana, Ayuningtyas & Rositawati)	Improves connectivity, automates processes, and enhances efficiency in industrial and agricurtural sectors (Wibowo, ZULMI, Purba)
Aplication Sectors	Agriculture, digital economy, disaster mitigation	Supply chain, earl warning systems, smart farming
Advantages	Big data analysis and long-term predictions.	Big data analysis and long-term predictions.
Challenges	Reliance on solid data infrastructure and precise algorithm.	Need for realiable internet connectivity and accurate sensors.

Impact on Economic Resilience

Table 2. Impact on Economic Resilience

Researcher	Main Findings
Subkhan et al. (2024)	Economic strength gets a big biist from digitizing cities and rolling out smart infrastructure.
Savilia et al. (2025)	Our national economic stability is pretty shacky if we're too reliant on global markets.
Supriyadi et al. (2022)	Economic resilience ties in closely with food security and keeping the environment sustainable.
Raihannur & Nadhira (2025)	Climate change cuts down on productivity and makes economic divides eveb wider.

The Impact of Climate Change on the Economy

Research by Ainurrohmah et al. (2022), Andarini (2023), and Raihannur & Nadhira (2025) highlights the following impacts of climate change:

- Decline in agricultural yields
- Rise in global temperatures and intensity of extreme weather
- Distruotion of economic and social cycles
- Threats to coastal areas and vital infrastructure

AI-IoT Integration in Smart Farming

Research by Ayuningtyas & Rositawati (2025) reinforces the argument that AI and IoT integration plays a significant role in:

- Improving resource use efficiency
- Ensuring food security
- Supporting SDG targets (Zero Hunger)

6. CONCLUSION AND RECOMMENDATIONS

Conclusion

From the synthesis of various literature, it can be concluded that:

1. Smart Technologies, particularly AI and IoT, have a real contribution to strengthening economic resilience, especially in the agricultural, industrial, and early warning systems for climate change sectors.
2. AI excels in risk analysis and prediction capabilities, which supports data-driven and proactive policy-making in response to the climate crisis.
3. IoT strengthens monitoring and automation system, leading to increased supply chain efficiency and connectivity between economic sectors.
4. The integration of AI dan IoT has been proven to increase productivity and efficiency in smart farming, which plays an important role in maintaining national food security as a key pillar of economic resilience.
5. Climate change has a broad impact on various economic sectors, and smart technology is a strategic solution for sustainable mitigation and adaptation.
6. Economic resilience is multidimensional, depending on the synergy between technology, policy, community capacity, and digital infrastructure.

Recommendation

Based on the results of the research and analysis, here are some recommendations for further development:

1. For the Goverment
   - Increase invbestment in digital infrastructure, especially in rural areas and the agriculture sector.
   - Encourage cross-sector collaboration (government, academia, industy, and economic policies.
   - Develop incentive policies for the adoption of smart technologies in sectors that are vulnerable to climate change.
2. For Business and Industry
   - Integrate IoT and AI into business process for greater efficiency and competitiveness
   - Invest in research and development of technology-based risk prediction and supplu chain management system.
3. For Researchers and Academics
   - Conduct further empirical research to measure the direct impact of smart technology on echonomic resilience in various regions of indonesia.
   - Focus on developing AI and IoT models that are economical, accessible, and environmentally friendly.
4. For the Community
   - Improve digital literacy and adaptation to new technologies, especially in the agriculture, fisheries, and MSME sectors.
   - Actively participate in digital training programs that support the inclusive use of smart technology.

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