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Global drivers of artificial intelligence development: An empirical study using the global AI index aross 62 countries

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Abstract

This research examines the key factors influencing the development and application of artificial intelligence (AI) across 62 countries, utilizing the Global AI Index as the principal evaluation tool. The study focuses on seven indicators that represent five main variables: talent, infrastructure, operational environment, innovation, and investment. Through the use of multivariate analysis, the research identifies that the presence of skilled talent, adequate technological infrastructure, and a supportive operational environment are essential for fostering innovation in AI. The findings reveal a strong and statistically significant correlation between talent and innovation, as well as between innovation and investment. These results underscore the critical role that national strategies, educational systems, and business ecosystems play in creating a fertile environment for AI advancement. Interestingly, the analysis also indicates that the operational environment does not have a significant direct relationship with innovation, suggesting the presence of underlying structural or policy-related factors that may be limiting its impact. This highlights the need for further investigation into the contextual elements that facilitate or hinder AI innovation. Overall, the study provides practical insights for policymakers and stakeholders seeking to enhance their countries' AI capacities through targeted investments in human capital, infrastructure, and innovation-supportive policies.

Keywords: artificial intelligence, infrastructure, innovation, investment, operational environment and talent.

Introduction

The Innovation Ecosystem Theory has emerged as a key approach for understanding how innovation arises and is sustained in complex and collaborative contexts. This theory conceptualizes innovation as the result of dynamic interactions among diverse actors, such as firms, universities, governments, and civil society, who operate within a shared environment that facilitates collaboration, knowledge exchange, and co-creation (Autio & Thomas, 2014). Unlike traditional linear models of innovation, the ecosystem approach highlights the interdependent and adaptive nature of these actors, recognizing that their joint participation enables the continuous evolution of the innovation environment (Ritala et al., 2013). In this context, each actor contributes unique resources, capabilities, and perspectives, generating collective value that exceeds individual contributions.

This model has been especially relevant in environments characterized by technological complexity and digital transformation, where the capacity to innovate depends not only on internal capabilities but also on the actor's position within broader collaborative networks. In this way, the innovation ecosystem becomes a platform that not only produces knowledge but also distributes, reconfigures, and strategically applies it to address social, economic, and environmental challenges.

Misra and Wilson (2023) highlight that stakeholders in innovation ecosystems are primarily motivated by the potential social impact of their contributions. While digital tools provide high-level information to support initial decision-making, stakeholders ultimately rely on contextual information from human networks to make final decisions. This underscores the pivotal role of people over digital tools in these ecosystems. Pham and Vu (2025) discuss the establishment of green innovation ecosystems through strategic business models in the public sector. They emphasize that effective governance and stakeholder collaboration are crucial for fostering sustainable innovation. This underscores the importance of social capital and governance competence in managing innovation ecosystems. Effective collaboration harnesses human and social capital, contributing to societal progress and value co-creation. Contemporary perspectives on Innovation Ecosystem Theory stress the importance of stakeholder interaction, governance, and social capital in driving innovation.

These elements collectively create an environment conducive to sustainable and impactful innovation outcomes (Neto et al., 2024). The Innovation Ecosystem Theory emphasizes that innovation emerges from dynamic interactions among multiple stakeholders, including firms, universities, governments, and other institutions. Key variables in this theory include stakeholder collaboration, knowledge flow, governance mechanisms, technological infrastructure, social capital, and institutional support. Effective collaboration fosters trust and mutual learning, while governance structures coordinate roles and reduce system complexity (Pham & Vu, 2025). Knowledge sharing, both formal and informal, is critical for co-creating value and accelerating innovation (Lin et al., 2025).

Technological infrastructure, such as digital platforms and data-sharing tools, enhances interoperability and communication, though innovation remains highly reliant on human networks (Misra & Wilson, 2023). Social capital, including trust and shared norms, underpins successful partnerships and long-term engagement (Zhang et al., 2021). Supportive public policies and institutional frameworks help legitimize and sustain ecosystem activities, especially in mission-driven contexts (Pham & Vu, 2025). Together, these variables form a complex but adaptive environment that enables sustainable and scalable innovation.

Background and Literature Review

The Global AI Index includes the Global AI Index itself and seven indicators that affect the index in 62 countries, as well as general information about the countries (region, cluster group, income group, and political regime). The Global AI Index is the first index that measures nations based on their level of investment, innovation, and implementation of artificial intelligence (Tortoise Media, 2024).

The indicators of AI implementation include Talent, Infrastructure, and Operational Environment, which represent the application of artificial intelligence by professionals across various sectors, such as businesses, governments, and communities (Tortoise Media, 2024). The Talent indicator focuses on the availability of skilled professionals for providing artificial intelligence solutions. The Infrastructure indicator emphasizes the reliability and scale of access infrastructure, from electricity and internet to supercomputing capabilities.

The Operational Environment indicator centers on the regulatory context and public opinion surrounding artificial intelligence. Innovation includes the Research and Development indicators, which reflect advancements in technology and methodology, indicating the potential for artificial intelligence to evolve and improve. The Research indicator focuses on the extent of specialized research and researchers, examining the number of publications and citations in credible academic journals. The Development indicator focuses on the development of foundational platforms and algorithms on which innovative artificial intelligence projects are based (Tortoise Media, 2024).

Investment includes the indicators of Governmental and Commercial Strategy, which reflect financial and procedural commitments to artificial intelligence. The Governmental Strategy indicator centers on the depth of the national government's commitment to artificial intelligence, investigating spending commitments and national strategies. The Commercial indicator focuses on the level of business activity, investment, and AI-based commercial initiatives (Tortoise Media, 2024). All seven of these indicators were calculated by Tortoise Media through the weighting and aggregation of 143 other indicators (Tortoise Media, 2024).

The research provides a comprehensive overview of the dataset of the Global AI Index, serving as a fundamental element for understanding the landscape of artificial intelligence (AI) development in different countries (Zang et al., 2021). It highlights the importance of the Global AI Index as the first benchmarking tool designed to evaluate nations based on their investments, innovations, and implementations of AI technologies (Maslej et al., 2023). By incorporating data from 62 countries, the study aims to create a nuanced understanding of how various factors contribute to the practical application of AI (Ozkaya & Demirhan, 2023). The study delineates the seven key indicators that affect the Global AI Index, categorized into three main groups: AI Implementation, Innovation, and Investment. The AI Implementation group comprises indicators related to Talent, Infrastructure, and Operational Environment, which together represent the capacity to apply artificial intelligence across different sectors, including business and government (Mariani et al., 2023).

The emphasis on the Talent indicator highlights the need for skilled professionals. On the other hand, the Infrastructure and Operational Environment indicators underscore the importance of reliable access to resources and the regulatory context surrounding AI (Alruwaili et al., 2024). The Innovation variable, which encompasses Research and Development indicators, focuses on advancements in technology and methodology that propel artificial intelligence forward (Soni et al., 2020). The Investment variable explores factors such as Governmental Strategy and business activity, reflecting the financial commitments needed to foster AI growth (Challoumis, 2024). The introduction sets the stage for an in-depth analysis by establishing the relevance of the dataset and the intricate relationships among the various indicators that inform national AI strategies (Albahri, 2023).

Research Contribution

This research contributes to the growing body of knowledge on artificial intelligence (AI) development by integrating the Innovation Ecosystem Theory with empirical data from the Global AI Index, covering 62 countries. The primary contribution lies in identifying and analyzing the key variables of talent, infrastructure, operational environment, innovation, and investment that shape national AI capabilities. By applying a multivariate analysis using PLS-SEM, the study uncovers the significant relationships between these variables, demonstrating that talent and infrastructure are strong predictors of AI innovation, and that innovation, in turn, drives investment.

A notable finding is the limited impact of the operational environment on innovation, which challenges existing assumptions and opens avenues for future research. Furthermore, the study validates the role of stakeholder interaction, social capital, and governance, central tenets of the Innovation Ecosystem Theory, as critical enablers of sustainable AI development. Through this integrated approach, the research offers both theoretical and practical insights, supporting policymakers and stakeholders in designing more effective AI strategies grounded in innovation ecosystem dynamics.

Hypothesis

1. H_1: Talent has a positive effect on Innovation.
2. H_2: Infrastructure has a positive effect on Innovation.
3. H_3: Operating Environment has a negative effect on Innovation.
4. H_4: Innovation has a positive effect on Investment.

Methodology

The research methodology involved the collection of data from the Global AI Index, which includes the global artificial intelligence index and seven indicators that influence this index in 62 countries. This dataset was complemented with general information about the countries, such as region, cluster, income group, and political regime, obtained from www.kaggle.com. A multivariate statistical technique was implemented to establish the impact of the variables in the research model through PLS-SEM software. This analysis aimed to demonstrate the inferential relationships between the studied variables, providing insights into how factors such as talent, infrastructure, operational environment, and innovation interrelate in the context of countries adopting artificial intelligence practices. By integrating structural equation modeling for the inferential analysis, the methodology effectively addresses the research objectives and enhances the robustness of the findings.

Findings

In Figure 1, it is evident that the found t-statistic value of 3.620 was greater than the critical t-value of 2.325 to establish a positive impact between talent and innovation at a 99% confidence level. The correlation coefficient found of 0.644 indicates a strong correlation between talent and innovation. This implies that as the talent variable increases, the innovation variable also tends to increase. Additionally, it shows that the found t-statistic value of 2.423 was greater than the critical t-value of 2.325 to establish a positive impact between infrastructure and innovation at a 99% confidence level. The correlation coefficient found of 0.310 indicates a moderate correlation between infrastructure and innovation. This implies that as the infrastructure variable increases, the innovation variable also tends to increase.

On the other hand, it illustrates that the found t-statistic value of 0.653 was not greater than the critical t-value of 1.285 to establish a positive impact between the operational environment and innovation at a 90% confidence level. The correlation coefficient found of -0.046 indicates that there is no correlation between the operational environment and innovation. This implies that as the operational environment variable increases, the innovation variable tends to decrease.

Finally, it is evident that the found t-statistic value of 14.187 was greater than the critical t-value of 2.325 to establish a positive impact between innovation and investment at a 99% confidence level. The correlation

coefficient found of 0.863 indicates that there is a correlation between innovation and investment. This implies that as the innovation variable increases, the investment variable also tends to increase.

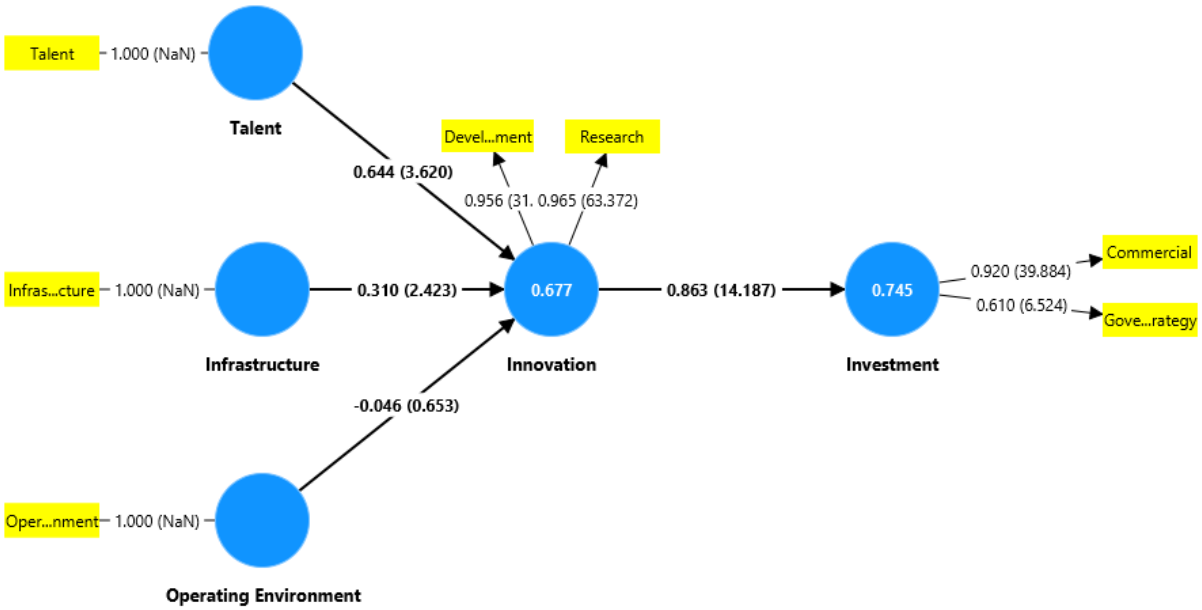

Figure 1. Results of Equation Modeling

Table 1. Correlation Results and t-Values of the Hypotheses

Hypothesis	Path	Correlation Coefficient	t-value
H_1: Talent has a positive effect on Innovation.	Talent → Innovation	0.644	3.620
H_2: Infrastructure has a positive effect on Innovation	Infrastructure → Innovation	0.310	2.423
H_3: Operating Environment has a negative effect on Innovation	Operating Environment → Innovation	-0.046	0.653
H_4: Innovation has a positive effect on Investment.	Innovation → Investment.	0.863	14.187

In Figure 2 and Table 2, The results reveal significant differences across countries in terms of talent, infrastructure, and operating environment. The United States scores the highest in talent, with a perfect score of 100, and also demonstrates strong infrastructure (94.02) and a solid operating environment (64.56). Countries like Canada, Ireland, and New Zealand also show high levels of talent and infrastructure, indicating a favorable business environment.

In contrast, nations such as Nigeria, Pakistan, and Vietnam have lower scores in talent and infrastructure, reflecting more challenges in these areas. Notably, some countries like Saudi Arabia and South Korea excel in the operating environment, with scores of 100 and 68.86 respectively, despite variations in talent and infrastructure. Overall, the data highlights the disparities in resources and conditions that influence each country's capacity to support economic activities.

Figure 2. Sum of Talent, Sum of Infrastructure, and Sum of Operating Environment by Country

Table 2. Sum of Talent, Sum of Infrastructure, and Sum of Operating Environment by Country

Country	Sum of Talent	Sum of Infrastructure	Sum of Operating Environment
Argentina	8.4	56.15	75.95
Armenia	6.69	37.84	58.4
Australia	25.43	63.43	61.23
Brazil	13.46	62.61	72.82
Bahrain	4.99	60.39	60.9
Austria	16.97	64.49	76.3
Belgium	15.17	65.1	64.08
Canada	31.28	77.05	93.94
Chile	10.56	61.97	56.73
China	16.51	100	91.57
Colombia	4.97	54.8	62.37
Czech Republic	11.11	64.26	76.97
Denmark	27.07	74.08	85.39
Egypt	1.11	38.84	0
Estonia	18.74	63.65	88.67
Finland	24.99	71.6	78.76
France	28.32	77.15	80.02
Germany	27.63	77.22	70.22
Greece	7.62	55.44	83.58
Hong Kong	17.56	96.11	59.5
Hungary	10.34	69.17	58.01
Iceland	18.45	72.45	41.19
India	45.27	33.91	77.3
Indonesia	5.51	47.52	51.18
Ireland	29.93	89.5	70.15
Israel	35.76	67.58	82.44
Italy	11.09	64.76	83.25
Japan	15.18	84.58	57.53
Kenya	0.75	14.11	29.84
Lithuania	14.3	63.19	80.67

Country	Sum of Talent	Sum of Infrastructure	Sum of Operating Environment
Luxembourg	21.66	94.88	66.96
Malaysia	10.44	62.04	73.24
Malta	15.87	67.12	70.96
Mexico	1.72	41.85	97.03
Morocco	3.36	44.88	60.17
New Zealand	23.3	69.78	90.35
Nigeria	2.74	0	50.1
Norway	27.61	76.2	36.65
Pakistan	8	2.43	12.48
Poland	14.21	70.96	99.56
Portugal	13.43	64.2	80.66
Qatar	0	67.97	62.58
Russia	12.46	62.59	52.85
Saudi Arabia	4.49	70.8	100
Singapore	39.38	84.3	43.15
Slovakia	8.55	65.36	88.71
Slovenia	13.02	72.06	94.55
South Africa	4.61	45.73	58.43
South Korea	14.54	85.23	68.86
Spain	17.61	73.32	75.36
Sri Lanka	6.27	34.64	35.79
Sweden	28.21	75.19	66.77
Switzerland	25.63	78.43	44.14
Taiwan	12.34	77.86	56.67
The Netherlands	33.83	81.99	88.05
Tunisia	8.94	38.59	62.32
Turkey	8.49	40.74	64.34
United Arab Emirates	2.65	79.16	72.12
United Kingdom	39.65	71.43	74.65
United States of America	100	94.02	64.56
Uruguay	7.28	58.77	70.75
Vietnam	6.34	55.76	37.61

In Figure 3 and Table 3, the visualizations present a comparative overview of countries based on the sum of their commercial strategies and government strategies related to development and research. The United States leads with the highest commercial score (100), indicating a dominant role in private-sector-led innovation and development. China follows with a strong performance in both commercial (44.02) and government strategies (94.87), reflecting a balanced national approach. Countries like Spain, Germany, and Finland also exhibit high government strategy scores, indicating strong public investment in development.

In contrast, countries such as Morocco, Bahrain, and Tunisia show low scores in both areas, suggesting limited engagement or capacity in strategic development initiatives. Notably, Canada and the United Kingdom demonstrate relatively high scores in both dimensions, highlighting well-rounded national strategies. Overall, the data reveal significant variation across countries, with some emphasizing government-led initiatives, others relying more on commercial strategies, and a few achieving balanced approaches. This underscores the diverse paths nations take in fostering research and development.

Figure 3. Sum of Development and Sum of Research by Country

Table 3. Sum of Development and Sum of Research by Country

Country	Sum of Development	Sum of Research
Argentina	3.19	1.25
Armenia	0.33	0.28
Australia	41.15	32.63
Austria	17.81	23.56
Bahrain	0	2.53
Belgium	19.81	22.15
Brazil	5.07	4.83
Canada	25.78	30.67
Chile	0.67	1.49
China	79.97	71.42
Colombia	0.89	0
Czech Republic	2.7	11.26
Denmark	8.92	26.01
Egypt	1.54	2.08
Estonia	9.31	11.75
Finland	18.32	25.21
France	21.44	25.48
Germany	24.79	35.84
Greece	2.21	15.12
Hong Kong	8.63	31.51
Hungary	5.4	4.31
Iceland	0.19	18.29
India	30.86	18.92
Indonesia	3.52	0.98
Ireland	30.85	16.79
Israel	27.96	32.63
Italy	14.66	20.3
Japan	34.47	22.51
Kenya	12.15	0.07
Lithuania	6.18	3.22

Country	Sum of Development	Sum of Research
Luxembourg	19.95	19.39
Malaysia	0.88	5.57
Malta	11.72	5.96
Mexico	4.46	8.11
Morocco	0.05	1.46
New Zealand	5.96	12.23
Nigeria	2.06	0.45
Norway	13.56	21.18
Pakistan	1.09	2.17
Poland	9.09	10.6
Portugal	3.92	8.96
Qatar	0	11.94
Russia	19.48	14.21
Saudi Arabia	14.38	13.63
Singapore	22.55	37.67
Slovakia	0.34	2.97
Slovenia	1.06	19.1
South Africa	7.52	0.83
South Korea	77.25	26.66
Spain	10.87	18.6
Sri Lanka	0.95	0.12
Sweden	17.81	27.61
Switzerland	23.11	38.24
The Netherlands	30.17	25.54
Taiwan	19.99	25.71
Tunisia	0	3.9
Turkey	1.02	9.53
United Arab Emirates	15.53	5.13
United Kingdom	25.03	36.5
United States of America	100	100
Uruguay	0.26	0.73
Vietnam	0.3	2.03

In Figure 4 and Table 4, the results show a wide variation in the sum of government strategy across different countries. Countries like the United States, Sweden, and Qatar have high scores, indicating a strong or comprehensive government strategy, with the US at 77.39, Sweden at 40.35, and Qatar at 33.49. Conversely, countries such as Nigeria, Pakistan, and Vietnam have much lower scores, reflecting less developed or less active government strategies, with Nigeria at 7.75, Pakistan at 13.92, and Vietnam at 30.92.

Some countries, like the United Arab Emirates and Australia, also score relatively high, suggesting effective government strategies, while others like Angola or South Africa have lower scores, indicating room for improvement. Overall, these differences highlight the varying levels of government strategy development worldwide.

Figure 4. Sum of Commercial and Sum of Government Strategy by Country

Table 4. Sum of Commercial and Sum of Government Strategy by Country

Country	Sum of Government Strategy	Sum of Commercial
Argentina	54.94	0.34
Armenia	14.4	1.37
Australia	82.11	6.72
Austria	72.14	3.08
Bahrain	17.72	0.24
Belgium	63.58	5.31
Brazil	67.72	1.36
Canada	100	14.88
Chile	60.5	2.95
China	94.87	44.02
Colombia	85.29	0.5
Czech Republic	70.29	1.75
Denmark	74.23	3.46
Egypt	68.72	0.31
Estonia	72.08	12.51
Finland	85.99	4.64
France	91.2	7.65
Germany	84.65	8.29
Greece	22.15	0.92
Hong Kong	33.29	5.3
Hungary	55.01	1.08
Iceland	22.15	5.74
India	58.83	7.39
Indonesia	59.99	0.91
Ireland	69.44	3.94
Israel	43.91	27.33
Italy	61.43	2.64
Japan	71.96	7.31

Country	Sum of Government Strategy	Sum of Commercial
Kenya	7.75	0.31
Lithuania	64.28	1.77
Luxembourg	66.69	4.68
Malaysia	47.6	0.63
Malta	70.49	4.3
Mexico	54.21	0.78
Morocco	15.9	0.1
New Zealand	47.62	2.49
Nigeria	7.75	0.33
Norway	59.05	3.95
Pakistan	13.92	0.27
Poland	78.14	2.25
Portugal	70.69	2.05
Qatar	33.49	0
Russia	90.4	1.38
Saudi Arabia	91.63	4.73
Singapore	79.82	15.07
Slovakia	43.07	0.67
Slovenia	80.38	0.61
South Africa	0	2.03
South Korea	87.5	5.41
Spain	91.28	3.08
Sri Lanka	35.57	0.09
Sweden	40.35	4.51
Switzerland	12.18	7.76
The Netherlands	62.35	4.97
Taiwan	55.97	2.53
Tunisia	12.18	0.15
Turkey	67.45	0.95
United Arab Emirates	81.38	3.22
United Kingdom	82.82	18.91
United States of America	77.39	100
Uruguay	30.92	0.43
Vietnam	68.86	0.31

Discussion of Findings

1. **How do talent, infrastructure, and the operational environment contribute to the innovation capabilities of countries adopting artificial intelligence practices?**

   Talent and infrastructure play significant roles in enhancing innovation capabilities in countries adopting artificial intelligence (AI). Talent has a strong positive effect (coefficient: 0.644, t-value: 3.620), suggesting that skilled professionals, researchers, and human capital are critical drivers of innovation in AI. Infrastructure also contributes positively (coefficient: 0.310, t-value: 2.423), indicating that reliable technological, digital, and physical systems support innovation development. However, the operational environment shows a negative and statistically insignificant effect (coefficient: -0.046, t-value: 0.653), implying that it does not play a meaningful role in fostering AI-related innovation in the observed context.

2. **What is the nature of the relationship between innovation and investment in the context of artificial intelligence development**?

   There is a very strong and statistically significant positive relationship between innovation and investment (coefficient: 0.863, t-value: 14.187). This suggests that countries or organizations that advance in innovation—through research, development, and technological breakthroughs—are more likely to attract or increase investment in AI. Innovation acts as a key driver of financial commitment and strategic investment in AI-related initiatives.

3. **How can understanding these relationships inform national strategies and policies to enhance the adoption of artificial intelligence and its effective implementation?**

   Understanding these relationships allows policymakers to prioritize investment in talent development and infrastructure as foundational elements of AI innovation. By focusing on educational systems, training programs, and research funding, governments can foster the human capital necessary for innovation. Simultaneously, developing robust infrastructure (e.g., data centers, internet connectivity, cloud computing) supports technological advancements. Since innovation leads directly to increased investment, enhancing innovation ecosystems can stimulate private and public sector funding, accelerating the adoption and scaling of AI. These insights support evidence-based policymaking for sustainable and competitive AI strategies.

4. **What role do governmental strategies and commercial activities play in promoting a conducive environment for innovation and investment in artificial intelligence?**

   Governmental strategies and commercial activities are crucial outcomes of investment driven by innovation. In the model, investment strongly influences both commercial strategies (coefficient: 0.920, t-value: 39.884) and governmental strategies (coefficient: 0.610, t-value: 6.524). This means that as innovation attracts more investment, it enables the development of targeted policies and business initiatives that foster a supportive ecosystem for AI. Governmental actions, such as funding, regulation, and infrastructure planning, and commercial activities, including product development and market expansion, both reinforce the AI innovation-investment cycle, creating a dynamic environment conducive to growth and implementation.

This research establishes a positive relationship between talent, infrastructure, and innovation, suggesting that a skilled workforce and strong infrastructure support are critical drivers of innovative outcomes. The strong correlation between talent and innovation highlights the importance of having qualified professionals and experts in the field to foster creativity and technological advancement.

The study revealed that the operational environment does not present a significant relationship with innovation, which may imply that factors such as regulatory frameworks or public sentiment towards artificial intelligence do not directly influence the innovation capacity in the analyzed countries. This observation requires further investigation into the specific elements of the operational environment that may need to promote the importance of reliable access to resources and the regulatory context surrounding artificial intelligence to effectively reach innovation. Additionally, the positive correlation between innovation and investment underscores the critical role of financial support in advancing technological initiatives. The strong correlation between innovation and investment suggests that countries prioritizing innovative strategies through resource access and governmental regulation in the implementation of artificial intelligence are more likely to attract further investment, thereby reinforcing their innovation capabilities. These findings emphasize the interconnectedness of talent, infrastructure, innovation, and

investment, providing valuable insights for policymakers seeking to enhance their countries' artificial intelligence capacities.

The analysis underscores the fundamental role of governmental strategies and commercial activities in creating a conducive environment for artificial intelligence innovation and attracting sustained investments. Proactive government policies, such as specific incentives, comprehensive education and training programs, and strategic public-private partnerships, can significantly enhance innovation capabilities and investor confidence. Similarly, a robust commercial activity driven by companies actively engaged in research, development, and application of artificial intelligence creates a dynamic market that stimulates innovation through competition and collaboration.

Understanding the intricate dynamics between talent, infrastructure, innovation, and investment also provides a strategic roadmap for policymakers. Countries that recognize and integrate these links into coherent national strategies are better positioned to leverage artificial intelligence effectively. In practice, this means formulating policies focused on fostering technical expertise and infrastructure while establishing clear frameworks to incentivize innovation and investment. By identifying and addressing gaps in their operational environment, primarily through specific regulatory adjustments, nations can create ecosystems where artificial intelligence technologies thrive, generating broader economic and social benefits.

Implications for Research

The academic and practical implications of this research are significant for scholars and professionals in artificial intelligence and policy development. Academically, the study contributes to the literature on artificial intelligence by thoroughly analyzing the relationships between key determinants such as talent, infrastructure, and innovation, thereby enriching our understanding of the factors influencing the development of artificial intelligence in different countries. The results from the study's analysis can serve as a foundation for future research, encouraging further exploration of how these indicators vary in different contexts and their subsequent effects on the implementation of artificial intelligence. It may also prompt discussions on adapting educational and training programs to align with the identified talent needs within the artificial intelligence sector.

Practically, the findings of this research have crucial implications for policymakers and industry leaders seeking to enhance the artificial intelligence capabilities of their countries. By illustrating the importance of talent and infrastructure as drivers of innovation, the study underscores the need for investments in education, training, and technological resources. Additionally, understanding the strong connection between innovation and investment could guide governments and businesses in developing financial strategies and commitments to support artificial intelligence initiatives, fostering a conducive environment for growth and competitiveness. As countries adopt the implementation of evolving artificial intelligence, this research provides practical insights that help shape effective strategies and policies, ultimately promoting equitable access and successful integration of artificial intelligence across various business sectors.

Moreover, the insights gained about the roles of governmental strategies and commercial activities expand the practical utility of this research for decision-makers. Governments can leverage these findings to design specific regulatory frameworks, incentives, and collaboration mechanisms that stimulate the adoption and investment in artificial intelligence. Industry leaders, informed by the identified relationships, can strategically align their business efforts with national priorities, thereby optimizing their contributions to

innovative ecosystems. Consequently, this integrated approach can accelerate sustainable advancements in artificial intelligence, enhancing economic resilience and global competitiveness.

Limitations

A limitation of this research is its reliance on the dataset from the Global AI Index, which, although comprehensive, may not reflect the full complexity of the factors influencing the development of artificial intelligence in different contexts. This dataset encompasses 62 countries, but the cultural, economic, and political particularities of each nation may not be fully represented, potentially leading to oversimplified conclusions. Additionally, the indicators used to assess talent, infrastructure, and the operational environment may differ in their definitions and measurement methods across countries, affecting the consistency and comparability of the data. Although the study utilizes structural equation modeling to infer relationships between variables, it may not account for all confounding factors or emerging trends in AI that could influence the results, highlighting the need for continued exploration and refinement of metrics to evaluate AI capabilities in diverse national contexts.

Conclusions

Talent is established as the most influential factor in innovation capabilities, followed by infrastructure, while the operational environment does not seem to have a significant direct impact on innovation. These findings highlight the importance of investing in the training and education of human capital and improving infrastructure, while suggesting that the operational environment should be reviewed and optimized to truly facilitate progress in artificial intelligence-related innovation. Government policies that prioritize these aspects could significantly enhance the adoption and development of artificial intelligence in various contexts. A highly skilled and specialized workforce fosters creativity and the development of new technologies. The presence of professionals with appropriate skills in artificial intelligence is fundamental for creating innovative solutions and advancing technology in the field. Adequate infrastructure, which includes both technological resources and proper facilities, can facilitate the development of artificial intelligence by providing the necessary environment for experimentation, prototyping, and implementation of new solutions. However, it is important to note that this correlation is weaker than that of talent, suggesting that while infrastructure is important, it is not the sole determinant of success in innovation.

Factors such as regulatory frameworks and the supportive climate towards artificial intelligence may not be directly impacting the innovation capacity of the analyzed countries. This lack of correlation indicates that further research is needed to better understand how the operational environment could be adjusted to foster greater momentum towards innovation. Countries that promote an innovative environment not only develop new technologies and solutions but also become more attractive to investors, creating a virtuous cycle where innovation drives investment and vice versa. The findings emphasize the importance of financial support as a critical driver for technological advancement, underscoring that a solid investment strategy can further enhance innovation capabilities in artificial intelligence, highlighting the need for policies that integrate these two variables to maximize growth and competitiveness in the sector.

Future Research

Future research should further explore the dynamics of the operational environment and its potential influence on innovation. Given that the study has indicated no significant correlation between the

operational environment and innovation, it becomes crucial to identify which specific elements within this environment may be affecting innovative capacity. Additional research could address areas such as the effectiveness of different regulatory frameworks, public perception of artificial intelligence, and the barriers companies face when attempting to innovate. This would not only contribute to a better understanding of the context in which artificial intelligence operates but also help formulate policies that more effectively adjust the operational environment to stimulate innovation.

Furthermore, future research should focus on the development and implementation of effective strategies that link investment and innovation in artificial intelligence. As a strong correlation between these two variables is demonstrated, research could investigate how to optimize investment policies, including economic incentives and collaborations between the public and private sectors. The implementation of case studies in different countries may provide valuable insights into best practices for creating ecosystems that not only attract investment but also support innovative initiatives in artificial intelligence. Such research can provide a solid foundation for the adoption of more integrated and effective policies, thus promoting significant advancements in the development of artificial intelligence on a global scale.

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