



The Impact of Geopolitical Risk on the Assimilation of Frontier Technology as Measured by the Frontier Technology Readiness Index (FTRI)

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Abstract

The research explored the impact of geopolitical risk on the assimilation of frontier technology as measured by the frontier technology readiness index (FTRI). The study was based on a sample of 50 countries that were randomly selected covering the period from 2010 to 2024. The sampling procedure for the study was based on simple random sampling. The study was based on quantitative research involving testing the hypothesis through an application of the logistic regression model. The theoretical framework for the study was based on differentiated securitization theory, particularly the securitization theory. The study tested the hypothesis on whether geopolitical risk was significantly and positively correlated with uptake of frontier technologies. The findings of the research were that geopolitical risk is profoundly and negatively correlated with levels of skills, industry capacity and access to finance. Furthermore, the research displayed that level of ICT infrastructure, and the level of research and development were significantly and positively associated with geopolitical risk. It can be concluded that geopolitical risk has a mixed reaction to the diverse measures of frontier technologies readiness index. Policy makers are recommended to rethink of the impact of global risk in the formulation of frontier technology investment strategies.



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Keywords

Frontier Technology Readiness Index; Geopolitical Risk; Global Risks; Logistic Regression Model; Securitization Theory.

Introduction

Caldara *et al.* (2022) defined geopolitical risk as the possibility, occurrence, and intensification of unfavorable outcomes linked to war, terrorism, and any conflicts between states and political actors

that interfere with the peaceful development of international relations. According to Bondarenko *et al.* (2023), abrupt spikes in geopolitical risk have significant effects on macroeconomic and financial variables despite being of non-economic in origin.

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Coelho *et al.* (2024) asserted that frontier technology readiness index measures the extent to which countries are prepared to embrace use, adopt and adapt frontier technologies through consolidating of data on the availability of finance, industry capacity, research and development, labour skills and level of ICT infrastructure development.

Coursera (2024) proclaimed that frontier technology included any novel and developing technology with the potential to change how human beings communicate and solve global problems. It further reiterated that frontier technology included artificial intelligence (AI), blockchain technology, renewable energies technologies, internet of things (IoT) and big data.

Measuring Geopolitical Risk

High geopolitical risks cause capital flows to shift from emerging countries to advanced ones, according to Caldara *et al.* (2018). It is also emphasized that significant geopolitical dangers led to a drop in real activities and weaker stock returns. According to Caldara *et al.* (2018), the Gulf War, the September 11, 2001, terrorist attacks in the United States, the 2003 Iraq invasions, the 2014 Russia-Ukraine crisis, the 2015 Paris terrorist attacks, the

2022 Russian invasion of Ukraine, and the 2023 Israel-Hamas war are the main components of the geopolitical risk index. By using an algorithm that gauges the frequency of articles about geopolitical risk in major international newspapers, such as the Wall Street Journal, the Financial Times, and the New York Times published in the United Kingdom, Canada and United States of America. Caldara *et al.* (2018) assessed geopolitical risk using the methods used in Saiz *et al.* (2013) and Baker *et al.* (2016).

Impact of Geopolitical Risk on Frontier Technology Strategy

McCaffrey *et al.* (2024) asserted that in the assessment of technological strategy top management should incorporate four key geopolitical risks in their risk management approaches that include cybersecurity risks, industry policy risks, changing technology regulations and increasing geostrategic competition as shown in Figure 1 below. It was reinforced that cybersecurity is one of the clearest examples of the interconnection between technology and geopolitics. Furthermore, it is stressed that geopolitical induced cyberattacks have significant implications for digital transformational strategy, cybersecurity and risk management.

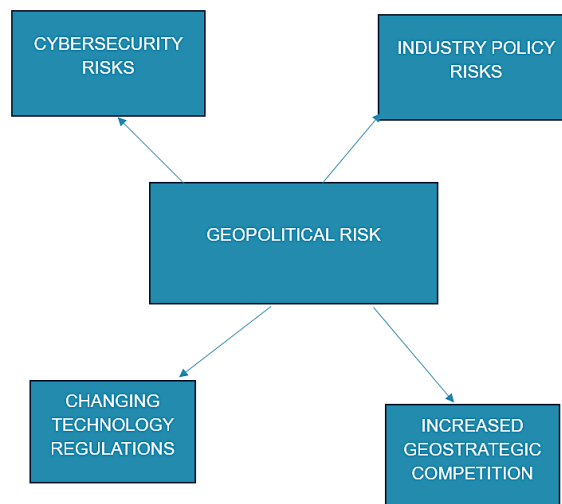


Fig. 1: Geopolitical risks

Problem Statement

The increased geopolitical risk actions and geopolitical threats all over the world notably the Russian Ukraine invasion of 2022, the recent

Ukraine Russian invasion of 2023, recent Israel Hamas war of 2023, Syrian conflicts of 2024, the Houthi missile attacks in the red sea, USA and China tension over Taiwan, all have devastated impact on

the flow of foreign direct investments particularly regarding frontier technology investments. Bremmer *et al.* (2024) affirmed that global inflation shock continued to exert a powerful economic and political drag that could result in a high probability of a persistent sub-par global GDP growth contributed by tighter monetary policies. Therefore, the present study purported to examine the impact of geopolitical risk on frontier technology.

Research Questions

- What is the impact of geopolitical risk on the assimilation of Frontier technology?
- What is the association between geopolitical risk and Frontier Technology Readiness Index (FTRI).

Research objectives

- Examine the impact of geopolitical risk on the assimilation of frontier technology.
- Analyse the association between geopolitical risk and the variables of the frontier readiness index.

Conceptual Hypothesis

- **H0:** Geopolitical risk is not significantly and positively associated with the assimilation of frontier technology
- **H1:** Geopolitical risk is significantly and positively associated with the assimilation of frontier technology

Operational Hypothesis

- **H1a:** Geopolitical risk is significantly and positively associated with the level of ICT infrastructure for using, adopting and adapting frontier technologies.
- **H1b:** Geopolitical risk is significantly and positively associated with the level of relevant skills for using, adopting and adapting frontier technologies.
- **H1c:** Geopolitical risk is significantly and positively associated with the level of R & D capacity for using, adopting and adapting frontier technologies.
- **H1d:** Geopolitical risk is significantly and positively associated with the level of relevant industry capacity for using, adopting and adapting frontier technologies.
- **H1e:** Geopolitical risk is significantly and positively associated with the level of availability

of finance to the private sector to enable usage, adoption and adaptation of frontier technologies.

Research Gap for the Study

Anecdotal literature covered mostly the impact of geopolitical risk on a few variables that comprised the frontier technology readiness index (FTRI) and hence this study aimed at rigorously examining the impact of geopolitical risk on the assimilation of the composite variables of the FTRI that include skills, research and development, access to finance, industry activity and information communication technology. The rigor of analysis of the present study would guide policymakers and business leaders to rethink and consider the effects of geopolitical risk during frontier technology strategic decision formulation and frontier technology strategic resource allocation.

Materials and Methods

Literature Review

Introduction

The literature review discusses the theoretical framework, conceptual framework including their rationale and the empirical review of the discourse.

Theoretical Framework for the Study

Liehr and Smith (2001) defined a theoretical framework as a conceptual structure that may be found in the literature and functions as a pre-made study map. Grant *et al.* (2014) described a theoretical framework as comprising concepts, theories, structures, and theoretical principles. The theoretical framework that was used for the study was differentiated securitization theory with a focus on securitization. Sergunin (2019) described securitization as a speech or act with distinct consequences in international politics. It is reiterated that an issue is securitized when the audience tolerates violation of rules that would otherwise be obeyed. The differentiated securitization theory postulated that any public issue can be located on a spectrum ranging from non-political through politicized to securitized as shown in Figure 2 below. Non-political issues are regarded as not part of public debate and does not involve the state. Politicized issues are regarded as part of public policy and require government to make decision and allocate resources. Finally, an issue is described as securitized when it is presented as an existential threat that requires emergency measures (*ibid*).

Hence, for this study the securitization theory is perceived as a relevant theoretical framework to the present study that explored the impact of geopolitical risk on the assimilation of frontier

technology readiness index. Buzan *et.al* (1998) alluded to securitization as a more extreme version of politicization and regarded it as a special kind of politics or as above politics.

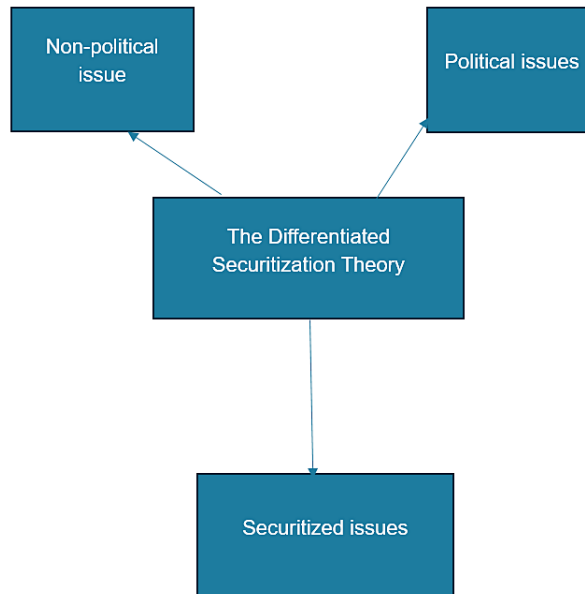


Fig. 2: The Differentiated securitization theory

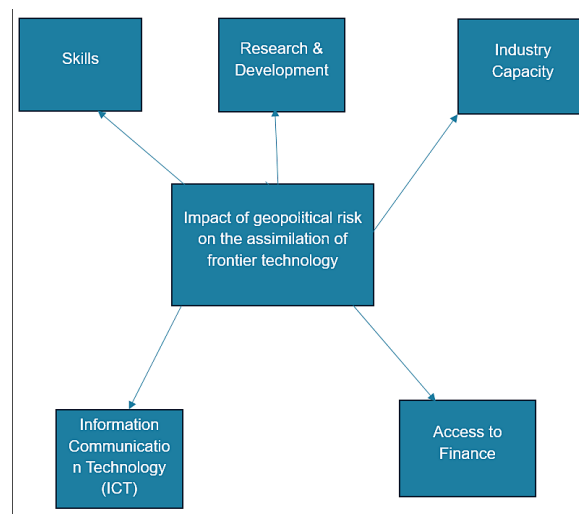


Fig. 3: Conceptual framework for the study

Conceptual Framework for the Study

The conceptual framework is an essential part of the research design. Robinson *et al.* (2011) reiterated a conceptual framework as comprising of presumptions, conceptions, expectations, and ideas guiding and supporting the research.

Figure 3 displays the conceptual framework used for the study. The Impact of geopolitical risk is represented as the dependent variable whilst skills, research and development, industry capacity, ICT and access to finance are independent variables for the research.

Rationale of the Conceptual Framework for the Study

The conceptual framework of the study is based on the variables of the frontier technology readiness index (FTRI). UNCTAD stat (2024) developed the frontier technology readiness index as comprising of data obtained around the world on information communication technology (ICT) deployment, skills, research and development activity, industry capacity and access to finance. The data from the UNCTADstat (2024) was perceived as robust, reliable and hence this study was anchored on this statistical data of the frontier technology readiness index.

Empirical Review of the Study

The empirical review of the research is based on the impact of frontier technology as explained in greater detail below.

Impact of Geopolitical Risk on Frontier Technology

According to Cheng *et al.* (2024), rising geopolitical risk significantly impedes the adoption of green technology. The study also showed that improvements in local green technology, marketization, and the protection of intellectual property rights lessen the disastrous effects of geopolitical risk. The study's sample was drawn from 30 Chinese provinces between 2003 and 2019. The methods used in Cheng *et al.* (2023) and De la Potterie *et al.* (1998) studies served as the foundation for this investigation. The study by Cheng *et al.* (2023) focused on the impact of geopolitical risk on the adoption of green technology focusing solely on industry activity of the frontier technology readiness index and hence the present study on the impact of geopolitical risk on the assimilation of frontier technology sought to examine comprehensively the impact of geopolitical risk on the use, adaption and adoption of skills, information communication technology, research and development activity, industry activity and access to finance.

Dieckelmann *et al.* (2024) affirmed that financial stability, and the global economy may be threatened by geopolitical risk. It is reiterated that the economy and financial markets may be negatively impacted, which will subsequently have an adverse effect on banks' and non-banks' funding, lending, solvency, asset quality, and profitability. In addition, It had

been noted that negative geopolitical events by themselves are unlikely to precipitate a systemic catastrophe, according to recent experience, but they may do so if they interact with pre-existing vulnerabilities (ibid).

Shrestha *et al.* (2024) acclaimed that the target debt ratio and geopolitical risk were significantly and negatively correlated. The study also found a negative correlation between geopolitical risk and the distance to default score, which lends credence to the idea that geopolitical risk is connected with a higher default probability. Heterogeneity analysis served as the study's foundation. The study by Shrestha *et al.* (2024) focused on the impact of geopolitical risk on the target debt ratio, which focused on one aspect of the frontier technology readiness index with regard to access to finance and the present research broadly explored the impact of geopolitical risk on the use, adoption and adaptation of the various components of the frontier technology readiness index that capture skills, industry activity, information communication technology, research and development as well as analyzing the impact of geopolitical risk on the access on finance as measured by the ratio of domestic credit to private sector as percentage of GDP.

Nguyen *et al.* (2022) uncovered a significant and robust negative impact of geopolitical risk on total factor productivity and foreign direct investment. The study recommended that geopolitical stability was a crucial requirement for emerging countries to consolidate their economic progress. The study was based on 18 emerging economies covering the period from 1985 to 2019. The study applied Granger causality panel data set. The present research is unique in that it evaluated intensively the impact of geopolitical risk on the frontier technology readiness index whilst the study by Nguyen *et al.* (2022) focused more on the impact of geopolitical risk on the total factor productivity and FDI and did not focus on the effect of geopolitical risk on the use adaptation and adoption of research and development activity of which was covered in the present research.

Special Eurasia (2024) observed a significant pivotal frontier for war dominance and economic prosperity afforded by advancement in artificial intelligence and other associated frontier technologies. It further noted ascendancy of artificial intelligence

as a geopolitical force in Russia, USA and China supported by significant levels of investment in research and development. It is further stressed that the increased use of artificial intelligence by governments and companies potentially increased geopolitical risks across the globe. It was concluded that artificial intelligence could significantly impact geopolitical dynamics (ibid). The present research broadly investigated the impact of geopolitical risk on the use, adoption and adaption of a variety of variables that compose frontier technology readiness index that included impact of geopolitical risk on the use, adaption and adoption of artificial intelligence, big data and a lot more.

Zheng *et al.* (2024) observed a significant influence of geopolitical risk on the allocation of budgets for renewable energy that caused a reduction in funding for renewable energy technology associated with geopolitical risk across various quartile levels in the countries that were studied. The study was based on the top 10 economies associated with substantial research and development expenditure in renewable energy technology. The study employed the quartile on quartile to explore the association between geopolitical risk and renewable energy technology. The study by Zheng *et al.* (2024) focused entirely on one aspect of the frontier technology readiness index that is on industry activity and yet the present study examined the impact of geopolitical risk on an array of factors that affected global economies that included impact of geopolitical risk on skills, industry activity, information communication technology, access to finance as well as research and development.

Wang *et al.* (2024) declared that there is a strong positive association between energy transition and geopolitical risk. It is also reaffirmed that the relationship between energy transition and geopolitical risk is amplified by improvements in green policies and green technologies. Multivariate linear and non-linear regression techniques were used in the study. The OECD nations served as the study's base. In the wake of geopolitical threats and actions, the study suggested integrated solutions that combine environmental and technology innovation to improve an effective and resilient energy transition approach. The study by Wang *et al.* (2024) focused on the impact of geopolitical risk on energy transition which is only one item out of

five variables that comprised the frontier technology readiness index and whilst the present study examined all the variables that compose the FTRI.

Nguyen *et al.* (2023) asserted that elevated geopolitical tensions can hinder the progress towards achieving sustainable development goals of climate action (SDG 13) and decent work and economic growth (SDG 8) in countries highly dependent on natural resources. The research was based on 41 countries covering the period from 2015 to 2021. Improvement to institutional quality was recommended as a remedy to offset the adverse effect of geopolitical risk on the achievement of sustainability development goals. The study by Nguyen *et al.* (2023) focused on the impact of geopolitical risk on the achievement sustainability development goals of climate action and decent and economic growth in countries. However, the present study analysed the impact of geopolitical risk five variables that make up the FTRI.

Guo (2024) affirmed that geopolitical risk significantly and negatively impacts how well businesses succeed when it comes to internationalization. Additionally, it was shown that geopolitical risk significantly hindered the internationalization of businesses in poor nations. China A share manufacturing listed businesses from 2008 to 2019 served as the study's basis. The present study examined the impact of geopolitical risk on the assimilation of skills, information communication technology, access to finance, research and development as well as on industry activity. The study by Guo (2024) focused on geopolitical risk on internationalization which one aspect of the FTRI that belong to industry activity.

Fossung *et al.* (2024) proclaimed that geopolitical risk had a profound and negative impact on information technology sector and the consumer staples sector. The study also observed that geopolitical risk as having a significant and positive impact with communication services. The study was based on the event study methodology and investigated the effect of geopolitical risk on the returns of firms in the communication services, consumer staples sector and information technology sector. The study by Fossung *et al.* (2024) evaluated the impact of geopolitical risk on information technology sector and consumer staples sector whilst the present study focused comprehensively on all the variables that

included impact geopolitical risk on use, adoption and adaptation of skills, research and development, access to finance and as well as the impact of geopolitical risk on the assimilation of information communication technology and industry capacity.

Jawadi *et al.* (2024) affirmed that geopolitical uncertainties have the potential to slow economic growth and cause the euro to depreciate. Additionally, it was noted that geopolitical concerns have the potential to raise inflation and exert pressure on the prices of gas and Brent oil in Europe. The study, which covered the years 2003–2024, was based on the ARDL model using bound tests to evaluate the short- and long-term effects of geopolitical hazards.

Trinh (2024) observed that geopolitical risk has a detrimental effect on energy technologies and research & development expenditures for renewable energy. It added that governments may manage geopolitical risk while ensuring a sustainable energy transition by increasing their investments in energy technology innovation. To address endogeneity concerns, the study employed dynamic panel data estimation with GMM-type tools and a newspaper-based geopolitical risk index. The study by Trinh (2024) examined the impact of geopolitical risk on energy technologies and research and development expenditures for renewable energy. The present study looked at the impact of geopolitical risk on the entire basket of FTRI variables including impact of geopolitical risk on the industry activity and research and development as examined by Trinh (2024).

Sweidan (2024) deduced that the USA information technology sector profoundly and positively influences China's geopolitical risk. It was reiterated that geostrategic competition to become the market leader in the global IT sector emerged as the primary source of economic and political stability. The study was based on monthly data from January 1993 to November 2023 of USA and China technological war and applied the bounds testing approach for cointegration to estimate the parameters of the autoregressive distributed lag model. The study by Sweidan (2024) focused on the examination of the impact of USA information technology sector on geopolitical risk whilst the present study was centred on the impact of geopolitical risk on sub-set of variables that make up the FTRI comprising of skills, research and development, industry capacity,

access to finance as well as impact of geopolitical risk on information communication technology.

High levels of geopolitical risk have a profoundly inhibiting effect on private sector innovation, especially for enterprises that have a lot of exposure to overseas markets, according to Astvansh *et al.* (2022). The negative effects can last for three to five years after the conflict has finished. In order to reduce international tensions and promote a more creative and peaceful sustainable future, the study suggested that political and corporate leaders work together. The study examined the relationship between geopolitical risk and innovation using cross-referenced data for 4625 US corporations spanning more than 32 years using the geopolitical global risk index. The study by Astvansh *et al.* (2022) focused on the examination of geopolitical risk on private sector innovation, which belongs to the industry activity item of the FTRI and yet the present study explored the impact of geopolitical risk on all the items that comprise the FTRI including impact of geopolitical risk on the assimilation of skills, research and development, access to finance, information communication technology including effect of geopolitical risk on industrial capacity.

According to Goes *et al.* (2023), the estimated welfare losses for the global economy in the event of a decoupling scenario can be severe, reaching up to 12% in some areas. It is also emphasized that because lower-income areas would gain less from technology spillovers from wealthier places, the estimated losses would be greatest there. According to the study, the welfare impacts' size and pattern are unique to the model involving the diffusion of ideas. A multi-sector multi-region general equilibrium model with dynamic sector-specific information diffusion, which amplifies the welfare losses of trade conflicts, served as the foundation for the study.

Alnafrah (2024) found that, in contrast to their ESG-committed competitors, non-ESG enterprises were significantly impacted negatively by geopolitical concerns. Furthermore, it has been noted that the presence of ESG firms in green markets lessens the detrimental effects of geopolitical risks, highlighting the essential role that ESG commitment plays in influencing investor behavior toward sustainable investments. The study used a strong methodological framework to examine daily financial

data from 2021 to 2024, which included causal effect modeling and the dynamic time-varying parameters vector autoregression (TVP-VAR) model.

Khan *et al.* (2022) deduced that geopolitical risk significantly affects technology in a variety of subsamples. It is also emphasized that technological rivalry drives geopolitical risk and that the interplay between technology and geopolitical risk is intertwined. The rolling window technique served as the foundation for the investigation. Since the private sector is a significant determinant, the report advised the international community to foster interoperability and improve collaboration with it. The study by Khan *et al.* (2022) focused on the impact of geopolitical risk on technology whilst the present research looked at the impact of geopolitical risk on a basket of variables that are aggregated in the FTRI including the impact of geopolitical risk on the use, adoption and adaptation of information communication technology.

Deng *et al.* (2021) observed that the real economy is significantly impacted by geopolitical risk. It was also noted that as geopolitical risk rises, company innovation output falls. It is emphasized that threats have a greater influence on innovation than actions. The instrument variable technique, which addresses endogeneity difficulties, served as the foundation for the investigation. The study by Deng *et al.* (2021) focused on the impact geopolitical risk on innovation output whilst the present study comprehensively looked at the impact of geopolitical risk on a set of the FTRI variables that included skills, research and development, access to finance, information communication technology as well as on industry activities including innovation.

Balteanu *et al.* (2024) observed that companies' exposure to vital inputs made in China continued to be high, particularly in Germany. Businesses are encouraged to use de-risking techniques to lessen this reliance, mostly by replacing Chinese suppliers with EU-based ones. Recent surveys carried out by Eurosystem central banks served as the basis for the study (ibid).

Uddin *et al.* (2023) noted that carbon dioxide emissions are positively impacted by geopolitical risk. The study, which focused on the BRICS nations, was conducted between 1990 and 2018.

The study employed fully modified least squares, cross-sectional autoregressive distributed lag, and dynamic ordinary least squares. The study by Uddin *et al.* (2023) focused on aspect of the frontier technology readiness index in particular industry activity whilst the present research explored further the other variables of the FTRI that included impact of geopolitical risk on use, adaptation and adoption of skills, industry activity, information communication technology, access to finance and research and development.

Research Methodology

The present study applied the quantitative research methodology involving testing the hypothesis through the application of logistic regression model. Guleria *et al.* (2022) proclaimed that logistic regression model models a binary dependent variable with an outcome variable of 0 or 1 by applying a logistic function. In order to forecast geopolitical risk acts based on the characteristics of the frontier technological readiness index, as indicated in equation 1 below, this study employed the logistic regression equation. A sample of 50 randomly selected nations from around the world served as the basis for the study. Using simple random sampling, the countries included in the study were chosen. Noor *et al.* (2022) pronounced that all units have an equal probability of taking part in the study based on using simple random sampling. Furthermore, it is emphasized that simple random sampling is advantageous in populations that are homogeneous and uniformly selected. Thus, simple random sampling was used in this study on the homogenous measures of frontier technological readiness index of various nations worldwide. Simple random sampling's main drawback is that it can be difficult in situations when population units are heterogeneous and widely distributed (ibid).

Cross sectional data from 2010 to 2024 sourced from the United Nation Conference on Trade and Development (UNCTD) was used in the study. The following regression equation was applied for the research.

Equation 1: Impact of Geopolitical Risk Acts Regression Equation

$$\text{GPRit} = \alpha_i + \beta_1 \text{ICTit} + \beta_2 \text{Skills it} + \beta_3 \text{R\&Dit} + \beta_4 \text{Industry capacityit} + \beta_5 \text{Access to Financeit} + \epsilon \dots(1)$$

The subscript for the country frontier technology readiness index measure i in year t of the UNCTAD statistics annual report (2010–2024) is it; the GPRit for the country geopolitical risk i in year t is equal to zero unless there was a geopolitical risk act or threat in the world that year; the coefficient of β_1 signifies the level of sufficient ICT infrastructure in relation to using, adopting and adapting frontier technologies especially since Artificial Intelligence (AI), Internet of Things, big data and blockchain are internet based technologies; β_2 symbolizes the level of relevant skills in terms of using, adopting and adapting frontier technologies, may be advanced skills but

general lower than those required to originate the technologies; β_3 relates to the level of Research & Development activity needed for the production, adoption and adapting of frontier technology; β_4 relates to the level of industry activity with regard to use, adoption and adaption of frontier technologies; and β_5 relates to the assessment of the availability of finance to the private sector to accelerate the use, adoption and adaptation of frontier technologies and domestic credit to the private sector as a percentage of GDP was selected as part of the index (UNCTAD, 2024).

Table1: Descriptive statistics

| Item | Mean | Median | SD (σ) | Max | Min |
|------------------------------|----------|----------|-----------------|--------|--------|
| Skills | 0.410811 | 0.40000 | 0.225691 | 1.0000 | 0.0000 |
| Research & Development (R&D) | 0.298899 | 0.20000 | 0.262209 | 1.0000 | 0.0000 |
| Industry Capacity (IC) | 0.555176 | 0.555176 | 0.194542 | 1.0000 | 0.0000 |
| ICT Infrastructure | 0.425288 | 0.425288 | 0.253013 | 1.0000 | 0.0000 |
| Access to Finance (ATF) | 0.648704 | 0.648704 | 0.171725 | 1.0000 | 0.1000 |

Source: Author, 2024

Table 2: Detailed extracts of the results for geopolitical technology readiness index for the year 2024

| Country/Index | Log Odds of GPRA | ICT | Skills | R&D | IC | ATF |
|---------------|------------------|-----|--------|------|-----|-----|
| USA | 1 | 0.9 | 0.8 | 0.9 | 0.8 | 1.0 |
| China | 1 | 0.4 | 0.4 | 1.0 | 1.0 | 0.9 |
| Singapore | 1 | 1.0 | 0.9 | 0.6 | 0.9 | 0.9 |
| Afghanistan | 1 | 0.1 | 0.2 | 0.10 | 0.4 | 0.1 |
| Israel | 1 | 0.7 | 0.8 | 0.6 | 0.9 | 0.8 |
| Benin | 1 | 0.5 | 0.5 | 0.1 | 0.4 | 0.7 |
| Belize | 1 | 0.5 | 0.5 | 0.1 | 0.4 | 0.7 |
| Myanmar | 1 | 0.3 | 0.2 | 0.2 | 0.5 | 0.5 |
| Philippines | 1 | 0.5 | 0.4 | 0.4 | 0.9 | 0.7 |
| Ukraine | 1 | 0.7 | 0.6 | 0.4 | 0.6 | 0.5 |
| Russia | 1 | 0.7 | 0.7 | 0.6 | 0.7 | 0.7 |

Source: Author, 2024

Results

The study observed that Singapore had a robust ICT infrastructure scoring a maximum index of 1.0 and Afghanistan scoring a minimum index of 0.1. Israel scored a maximum index of 1.0 for having abundant skills availability whilst Afghanistan had an index of 0.1. For research and development China and USA

scored a maximum index of 1.0 whilst Afghanistan, Benin, Belize and Myanmar scored a minimum index of zero. Philippines scored a maximum index of 1.0 for industry capacity whilst Afghanistan had an index of 0.2. USA scored a maximum index of 1.0 for access to finance and Afghanistan had an index of 0.1 as shown in Table 1 below. The detailed extract

of the GPTRI results for the year 2024 are shown in Table 2 below for some of the 11 countries that were included in the study.

50 nations were chosen at random to participate in the study. Table 3 above displays the logit regression model's results. The coefficients β_1 , β_2 , β_3 , β_4 and

β_5 of the panel logistic regression equation (1) that were run through e Views are displayed in the table above. The dependent variable, geopolitical risk, had a value of 1 if there were geopolitical risk acts or threats occurring globally in that given year, and vice versa.

Table 3: Estimation of Logistic Regression Model on the Impact of Geopolitical risk and related measures

| Model/Variable | June 2010-July 2024 results | June 2010-July 2024 results | June 2010-July 2024 results | June 2010-July 2024 results |
|--------------------------------------|-----------------------------|-----------------------------|-----------------------------|-----------------------------|
| Variable/ Constant | Coefficient | Std. Error | z-Statistic | Probability |
| Constant | 1.016139 | | | |
| Skills (β_2) | -2.458375 | 0.651634 | -3.772632 | 0.0002 |
| Research & Development (β_3) | 1.080996 | 0.499112 | 2.165841 | 0.0303 |
| Industry Capacity (β_4) | -0.315030 | 0.632855 | -0.497792 | 0.6186 |
| ICT Infrastructure (β_1) | 3.866148 | 0.585829 | 6.598443 | 0.0000 |
| Access to Finance (β_5) | -3.864636 | 0.660590 | -5.850276 | 0.0000 |
| Cross-section | 50 | | | |
| Number of observations | 750 | | | |

Source: Author, 2024

The research revealed that geopolitical risk is significantly and negatively correlated with level of skills, industry capacity and access to finance. The present study further uncovered that geopolitical risk is profoundly and positively associated with level of ICT infrastructure and research and development.

Discussion

The present study uncovered that geopolitical risk is profoundly and positively correlated with the level of ICT infrastructure and research and development. This result is in agreement with the findings of Fossung *et al.* (2024), Special Eurasia (2024) and Sweidan (2024). However, the result of the study contrast the findings of Fossung *et al.* (2024). Moreso, the study observed that geopolitical risk is significantly and negatively associated with industry capacity, levels of skills and access to finance. The result concurs with the findings of Nguyen *et al.* (2023), Zheng *et al.* (2024).

Conclusion

It can be concluded that geopolitical is significantly and positively correlated with the level of ICT

infrastructure and level of research and development. This partly concurs with Sweidan (2024) and contrasted with Trinh (2024). Furthermore, it can be affirmed that the level of access to finance, level of industry capacity and level of skills are profoundly and negatively correlated with geopolitical acts and threats. This is partly consistent with Deng *et al.* (2021). Guo (2024), Astvansh *et al.* (2022), conclusions. Geopolitical risk has diverse impact on the measures of frontier technology readiness index.

It is recommended that policy makers should rethink, factor out the impact of political and geopolitical risks in the formulation of technology strategies and risk management strategies for their organization. Further assessment of the resilience of the current technologies in the wake of geopolitical acts and threats should be undertaken in coming up with effective risk management strategies for the country or organization (McCaffrey *et al.* 2024). Firms are urged to diversify investments into the green markets especially with a commitment on ESG investments in order to be resilient to the devastating effects of geopolitical risks (Alnafrh, 2024).

It can be summed up that countries benefit more from research and development activities during elevated periods of geopolitical risk as new ICT solutions and other alternative means are invented that offer resilience to the devastating effects of geopolitical tensions, threats and acts. Effective unbiased collaborative partnerships between unions, nations, non-governmental organisations and the private sector are an inevitable necessity in resolving elevated threats, tensions and escalated wars (De Nederlandsche Bank (DNB), 2024 and Buck, 2024).

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Conflicts of Interest

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Data Availability Statement

The data used in this work is obtained upon request from the corresponding author. The data are not publicly available due to constraints.

Ethics Statement

This research did not involve human participants, animal subjects, or any material that requires ethical approval.

Informed Consent Statement

This study did not involve human participants, and therefore, informed consent was not required.

Clinical Trial Registration

This research does not involve any clinical trials.

Author Contributions

The sole author was responsible for the conceptualization, methodology, data collection, analysis, writing, and final approval of the manuscript.

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