Geopolitical Fragmentation in the World and Its Consequences on Developing Countries: A Game of Chess on a Fractured Board

Jonathan K. MUYA Faculty of Economics and Management University of Kinshasa¹, DR Congo https://orcid.org/0009-0001-2142-4430

Article's history:

Received 9th of January, 2025; Revised 29th of January, 2025; Accepted for publication 4th of February, 2024; Available online: 5th of February, 2025; Published as article in Volume II, Issue 2, 2025

© The Author(s) 2025. Published by RITHA Publishing under the CC-BY 4.0. license, allowing unrestricted distribution in any medium, provided the original work, author attribution, title, journal citation, and DOI are properly cited.

Cite this article:

Muya, J. K. (2025). Geopolitical fragmentation in the world and its consequences on developing countries: a game of chess on a fractured board. *Journal of Global Sustainability and Development,* Volume II, Issue 2, 7 – 26. https://doi.org/10.57017/jgsd.v2.i2.01

Abstract

This paper explores the impact of geopolitical fragmentation on developing countries amid rising tensions between major powers like the USA, Russia, and China. It examines how these dynamics compel developing nations to make difficult decisions regarding economic survival, sovereignty, and growth. The analysis focuses on the economic, political, security, and environmental consequences of this fragmentation, using examples such as sanctions and trade wars. The study also assesses the role of the USA and its allies in shaping global governance, highlighting the challenges brought by the increasing influence of emerging powers like China and India. It argues for the need to reform institutions such as the IMF to better reflect the complexities of this fractured global landscape. At the same time, the paper emphasises the potential of regional institutions to address these challenges and foster cooperative development. Ultimately, the paper underscores the importance of navigating these shifts to ensure sustainable development in a divided geopolitical environment.

Keywords: geopolitical fragmentation, developing countries, major powers, global governance, emerging economies.

JEL Classification: F02; F13; F54; F55; 019; Q56.

-

¹ BP 190 Kinshasa XI, Kinshasa, Democratic Republic of Congo

Journal of Global Sustainability and Development Introduction

The contemporary geopolitical landscape is increasingly characterized by division and competition, reminiscent of a fractured chessboard where global powers vie for influence and control. As articulated by Kissinger (1994), "The future of the world order will be determined by the interactions of major powers." On one side, the United States and its allies strive to maintain their dominance, while on the other, Russia rallies its bloc in opposition. Amidst this dynamic, China emerges as an ambiguous player, strategically maneuvering between these two camps to secure its interests.

The roots of this geopolitical struggle can be traced back to the Cold War, a period when developing countries were often pressured to choose between capitalism, championed by the USA and its allies, and communism, led by the USSR. Gaddis (2005) emphasizes that the Cold War was "not merely a struggle between two superpowers but a global conflict that engaged nearly every nation". This competition had profound consequences for developing nations, frequently treating them as pawns in a larger ideological battle. Many countries aligned with one bloc or another in pursuit of economic aid, military support, or political legitimacy, often at the cost of their sovereignty and independent development.

Today, developing countries find themselves caught in a similar struggle, facing new dilemmas in deciding whether to align with the stability and prosperity promised by the USA or to counterbalance western dominance by siding with Russia. Stiglitz (2002) asserts that globalization has often prioritized the interests of major powers over those of developing nations, exacerbating their vulnerabilities in the process. The complexities extend beyond mere political affiliations; they involve considerations of economic survival, sovereignty, and long-term growth.

As these nations navigate turbulent waters, they must weigh the benefits and risks of aligning with major powers, often finding themselves in precarious positions influenced by competing agendas. Key questions arise: How can developing nations protect their interests while navigating the geopolitical rivalry between the USA and Russia? What role does China play in either facilitating or complicating these nations' quests for independence and development? Moreover, how can developing economies leverage their positions to maximize benefits while minimizing potential losses in this competitive landscape?

This paper will explore these questions by examining the roles of major global powers and the implications of their competition on developing nations. Scholars such as Rodrik (2018), Piketty (2014), and Moyo (2009) contribute to our understanding of these challenges, while Acemoglu & Robinson (2012), Sachs (2005), and Sen (1999) provide insights into the dynamics of economic growth and political decisions that shape development pathways.

1. Literature Review

In the context of your research paper the literature review should be a critical synthesis of previous research in the subject field. The evaluation of the literature leads logically to the research question. Who is doing what? Who has done what? Who first did it or published it? Taken from published papers, research monographs, catalogues etc. based on primary sources. Offering a, probably new, structured view of the field of study.

The dynamics of geopolitical fragmentation and their impact on developing countries have garnered significant scholarly attention. Gaddis (2005) highlights the historical precedents of such fragmentation during the Cold War, where developing nations often served as battlegrounds for ideological conflicts between major powers. This period deeply influenced the sovereignty and developmental trajectories of these nations. Building on this, Stiglitz (2002) critiques globalization for exacerbating the vulnerabilities of developing economies, arguing that global systems often prioritize the interests of major powers over those of smaller nations.

The role of emerging powers like China and India in reshaping global governance is a recurring theme in recent literature. Mearsheimer (2014) and Rodrik (2018) explore the geopolitical and economic strategies employed by these powers, emphasizing their influence in challenging the USA-led global order. Meanwhile, Bräutigam (2020) delves into China's growing involvement in Africa, assessing whether its investments signal a "debt trap" or genuine developmental assistance.

Institutional reforms are another critical area of focus. Scholars such as Acemoglu and Robinson (2012) and Sachs (2005) argue for restructuring global institutions like the IMF to reflect the changing global landscape.

Weiss (2022) emphasize the importance of fairer representation within these institutions, particularly for developing nations. Additionally, Acharya (2017) and World Bank (2019) underscore the potential of regional institutions like the African Union and the African Continental Free Trade Area (AfCFTA) to address global fragmentation through collective regional action.

The environmental dimension of geopolitical fragmentation is also significant. Biermann (2022) explores the challenges posed to global climate governance, emphasizing the need for cooperative action amid rising tensions. Regional organizations, as argued by Ezeibe & Oguonu (2014) and Healy (2020), play a critical role in addressing security and environmental challenges.

Overall, the literature emphasizes the multifaceted impact of geopolitical fragmentation on developing countries, ranging from economic and political pressures to security and environmental challenges. This review highlights the need for a nuanced understanding of these dynamics to inform policy and institutional reforms aimed at fostering sustainable development.

2. Research Methodology

This study adopts a qualitative approach, combining theoretical analysis with practical insights. The research is grounded in a comprehensive review of existing literature, including books, academic journals, and reports from global institutions. Key steps in the methodology include:

Foundational works such as Why Nations Fail (Acemoglu & Robinson, 2012), Dead Aid (Moyo, 2009), and Development as Freedom (Sen, 1999) were examined to understand the structural challenges faced by developing countries. Contemporary studies on global governance, such as Weiss (2022) and Rodrik (2018), provided insights into institutional dynamics and emerging power structures.

Central concepts such as geopolitical fragmentation, global governance, and regionalism were identified and summarized. These concepts were then contextualized within the framework of challenges faced by African countries, such as limited financial market access, political pressures, and climate vulnerabilities.

The theoretical frameworks and arguments from the literature were compared with real-world examples from African countries. For instance, China's Belt and Road Initiative (Bräutigam, 2020) and the African Continental Free Trade Area (World Bank, 2019) were examined to understand their impact on economic resilience and autonomy. Similarly, case studies on sanctions and trade wars (Fajgelbaum & Khandelwal, 2021) were analyzed to assess their consequences for African nations.

The study also explored the role of regional organizations, such as the African Union and AfCFTA, in fostering resilience and promoting cooperative development. The potential of these institutions to act as counterweights to global fragmentation was critically assessed. By integrating theoretical perspectives with real-world data, this methodology provides a comprehensive analysis of the challenges and opportunities presented by geopolitical fragmentation for developing countries, particularly in Africa.

3. Research Findings

3.1. Consequences of geopolitical fragmentation on developing countries

The fragmentation of global geopolitics presents significant consequences for developing countries, manifesting in economic, political, security, and environmental dimensions.

Geopolitical fragmentation complicates the political landscape for developing countries, often leading to issues of sovereignty and external interference. Nations may struggle to maintain independent foreign policies as they are pressured to align with the strategic interests of either the USA or Russia. For instance, many African nations have found themselves navigating the complexities of relations with both China and the USA, leading to internal divisions. The case of South Sudan, where the USA has considerable influence, demonstrates how a country can feel pressured to align with a major power while simultaneously contending with internal political strife and external expectations (Ahmed, 2009).

Furthermore, developing nations that choose to remain neutral may find themselves marginalized. The situation in Myanmar illustrates this well, as the military junta's refusal to align with either bloc has led to economic isolation and humanitarian crises. As a result, external funding and political support have dwindled, leaving the nation struggling to address its developmental challenges Narayana (2023).

The implications of arms races and military alliances are particularly pronounced for developing countries caught in the crossfire of major power competition. Regional instability often escalates as countries align themselves with competing blocs, leading to increased militarization. For example, nations in Africa and the Middle East have experienced heightened tensions and conflicts partly due to the influence of external powers seeking to extend their strategic reach. The ongoing conflict in Libya, exacerbated by foreign interventions and support from various powers, illustrates how such dynamics can destabilize entire regions.

The proliferation of arms and military support can further entrench conflicts, making it more challenging for these countries to achieve lasting peace. The USA's military aid to Egypt, despite concerns over human rights violations, reflects a strategic partnership that prioritizes stability over reform, perpetuating a cycle of dependency and unrest (Khalil, 2024).

Developing countries often find themselves in precarious economic situations due to the increasing frequency of trade wars and sanctions instigated by major powers. For instance, sanctions against Venezuela have severely limited its ability to borrow internationally, as the USA has imposed restrictions on transactions involving its state-owned oil company, PDVSA. These sanctions not only cripple the country's economy but also hinder its capacity to access vital financial markets (Rodríguez, n.d.). Additionally, countries like Iran face similar challenges, with US sanctions preventing them from trading oil effectively, leading to substantial losses in revenue and economic instability (Bahrami, 2019).

Moreover, countries heavily reliant on exports to the USA may experience downturns when trade barriers are erected. For example, Ethiopia faced substantial economic challenges due to the withdrawal of its eligibility for the African Growth and Opportunity Act (AGOA), which allowed duty-free access to the US market for certain exports. This decision was based on human rights concerns and highlights how geopolitical considerations can severely impact developing nations' economies.

Fragmented cooperation among global powers also hinders collective efforts to address pressing environmental issues. Developing countries, often at the forefront of climate change impacts, require international support for sustainable development initiatives. However, geopolitical tensions can impede collaborative efforts, as nations prioritize strategic interests over environmental considerations. The failure of the COP26 climate negotiations to secure binding commitments from major powers exemplifies this challenge, leaving many developing nations without the support they need to combat climate change effectively (Arora & Mishra, 2021).

Upon these evidences, it's clear that he consequences of geopolitical fragmentation are profound for developing countries, shaping their economic stability, political autonomy, security landscape, and environmental resilience. The complexities of navigating this fragmented landscape necessitate careful consideration of how these nations align themselves in a world defined by competition among major powers.

3.2. Strategic Interests in Developing Countries

The USA and its allies significantly influence global geopolitics, particularly concerning developing countries. This section discusses the strategic interests of the USA, its economic and military support mechanisms, and the broader implications of its dominance in international institutions like the IMF.

The USA's strategic interests in developing nations encompass various dimensions, including promoting democratic governance, ensuring stability in volatile regions, and securing access to essential resources. The United States has sought to counter China's growing influence, particularly in Africa and Latin America, through initiatives that enhance economic ties and political alliances. For instance, the African Growth and Opportunity Act (AGOA) exemplifies U.S. efforts to foster trade relationships with African nations while simultaneously promoting stability and democratic governance (US Department of State, 2018).

To begin enumerating the key aspects of the USA's strategic interests in developing countries, it is essential to consider economic assistance, military backing, and the pivotal role of international financial institutions.

Economic and military support

The USA employs economic aid and military support as pivotal instruments to exert its influence in developing countries. Financial assistance is often directed towards humanitarian efforts, infrastructure development, and fostering political reforms. For example, USAID provides substantial funding to countries facing crises, such as Yemen, where the US has committed millions to alleviate humanitarian needs amidst a prolonged conflict (Ofozoba, Okelue and Okeke, 2023).

In the Democratic Republic of the Congo (DRC), the situation is particularly dire. The eastern region has faced significant instability due to armed groups and external influences, notably from Rwanda. UN experts have highlighted Rwanda's involvement in the DRC's eastern conflicts, pointing to how geopolitical fragmentation allows Rwanda to benefit from external support while the DRC struggles with a long-standing ban on arms purchases (International Crisis Group, 2023). This imbalance hampers the DRC's ability to respond effectively to threats, perpetuating a cycle of violence and instability.

Military support serves to bolster the defense capabilities of allied nations. The US provides military assistance to countries like Egypt and Jordan to maintain regional stability and counter threats, particularly in the Middle East. However, this dependence on US support can restrict the autonomy of developing nations in foreign policy decisions, as seen in Egypt's adherence to US directives due to reliance on military aid (Khalil, 2024).

The role of the IMF in providing financial relief: the dominion of the USA

The International Monetary Fund (IMF) plays a crucial role in the global economy, particularly concerning developing countries. The USA holds significant voting power within the IMF, which allows it to influence critical decisions, including the allocation of resources during crises. This power was evident during the COVID-19 pandemic when the IMF sought to allocate Special Drawing Rights (SDRs) to bolster liquidity in global markets. However, the extension of SDRs faced delays largely due to opposition from the US under the Trump administration, which emphasized a narrow view of financial assistance despite the pressing needs of developing countries for liquidity and economic stability.

Moreover, the US decision to withhold support for expanding SDRs during times of crisis illustrates how the interests of a single nation can impede collective action needed by the international community. Developing countries, reliant on external financial assistance, found themselves at a disadvantage as the US leveraged its influence to block initiatives that could have provided much-needed relief.

3.3. Advantages and Disadvantages of Alignment: Finding the Sweet Spot

Aligning with major powers like the USA can bring both advantages and disadvantages for developing countries, making it a delicate balancing act. As advantages we can cite:

Alignment often leads to increased economic support, such as foreign aid, investment, and trade benefits. Programs like the African Growth and Opportunity Act (AGOA) offer preferential access to US markets, fostering growth and development.

- Military support from the US can help stabilize regions, addressing security threats and fostering peace. This support can also provide access to defense technology and training, strengthening national security.
- Aligning with the US can provide developing countries with a stronger voice in international organizations like the United Nations, the IMF, and the World Bank, where US influence plays a key role in shaping policies and decisions.

Those advantages come with some drawbacks:

- Over-reliance on US assistance can create dependency, making it difficult for developing countries to chart independent paths. This reliance may limit their ability to make autonomous decisions in global affairs.
- Aligning with a major power may lead to friction with rival nations, such as China, which could harm diplomatic relationships and trade opportunities. The geopolitical competition for influence can create instability.
- Internal opposition may arise, as alignment with foreign powers can be perceived as a threat to national sovereignty. Citizens and political leaders may resist perceived foreign interference in domestic affairs, particularly if economic policies favor external interests.

In summary, alignment with the US offers significant benefits, but it also presents risks. Developing countries must carefully evaluate the balance between leveraging external support and maintaining their sovereignty and independence in an increasingly interconnected world.

3.4. Geopolitical Fragmented World and Global Governance

Geopolitical fragmentation significantly impacts global governance, influencing international cooperation, multilateral institutions, and the ability to address global challenges effectively. A crucial aspect of this fragmentation is the role of the International Monetary Fund (IMF) and how the growing economic influence of countries like China reshapes its governance structure.

The growing rift between global powers, particularly the USA and China, has weakened international cooperation across trade, technology, military influence, and governance. The US - China trade war, for instance, has destabilized global markets, disrupted supply chains and hindering economic growth in developing nations that rely on stable trade dynamics. The technological rivalry in areas like 5G and cybersecurity further polarizes nations, forcing developing countries to choose sides and complicating their integration into global systems. Military tensions in strategic regions like the Indo-Pacific and Africa also undermine peace and security efforts. These divisions have paralyzed institutions like the UN and WTO, leaving critical global challenges such as climate change and poverty unaddressed. For developing countries, this fractured system reduces opportunities for collaboration and strains already limited resources. Renewed commitment to collective action is essential to ensure an inclusive and effective global system.

Multilateral institutions, such as the United Nations and the IMF, face significant challenges due to geopolitical fragmentation. The USA's withdrawal from various international agreements under the Trump administration weakened these institutions' effectiveness. Additionally, the IMF's decision-making process has been criticized for not adequately

reflecting the growing economic power of countries like China, which has emerged as a major player in global finance.

As of 2021, China is the second-largest economy in the world, yet its voting power in the IMF does not align with its economic standing. The IMF's quota system, which determines the voting rights of member countries, has remained largely unchanged for years, causing friction between established powers and emerging economies (Vasudevan, 2022).

Recent attempts to reform the IMF's quota system have faced resistance from traditional powers, particularly the USA, which holds significant sway over the institution. This stagnation in reform undermines the legitimacy of the IMF and its ability to address the needs of a changing global economy effectively.

Geopolitical fragmentation severely hampers efforts to address global challenges. Issues like climate change, public health crises, and terrorism require coordinated international responses; however, the current geopolitical landscape often leads to fragmented approaches that fail to produce meaningful results. The COVID-19 pandemic, for instance, highlighted the necessity of global cooperation in vaccine distribution, yet political tensions hampered collaborative efforts (Javed & Chattu, 2020). Moreover, the failure of major powers to commit to binding climate agreements has hindered progress on global climate action, leaving developing countries to face the brunt of climate impacts without sufficient support or resources (Biermann, 2022).

In nutshell, geopolitical fragmentation poses significant challenges for global governance, particularly regarding the role of institutions like the IMF. The failure to adjust the IMF's quota system in light of emerging economies undermines its effectiveness and reflects broader tensions in global governance. As countries grapple with pressing global challenges, the need for innovative approaches to enhance collaboration and inclusivity among nations has never been more urgent.

Emerging economies, particularly China and India, have been playing an increasingly important role in reshaping global geopolitics. Their economic growth, diplomatic influence, and strategic interests are challenging the traditional dominance of western powers, leading to new dynamics in global governance, trade, and security.

3.5. Growing Economic Influence of Emerging Markets

China's rapid economic growth has shifted the balance of power in global finance and trade. As the world's second-largest economy, China's influence on global markets is profound, particularly in the Asia-Pacific region and Africa. It has become the leading trading partner for many developing countries, offering them infrastructure investments through initiatives like the Belt and Road Initiative (BRI) (Schmidt, 2021). While this provides opportunities for economic development, it also creates dependency on Chinese capital and markets, which can put pressure on developing countries' economic sovereignty (Albert, 2020).

India, another rising power, is also expanding its geopolitical influence through trade agreements and diplomatic partnerships, particularly in South Asia and Africa. Indians' "Look East" and "Act East" policies are designed to deepen engagement with Southeast Asian countries, promoting economic ties and security partnerships (Dahiya, 2021).

Journal of Global Sustainability and Development Shaping global governance

The rise of emerging economies has implications for global governance, particularly in institutions like the World Bank and the IMF. These institutions have historically been dominated by western powers, with the USA holding significant influence. However, the growing economic power of China and India has led to calls for reform in these institutions to better reflect the realities of the global economy.

Chinas' increased financial contributions to international institutions like the IMF have given it greater influence over decision-making. However, despite its large economy, China's voting power in the IMF remains disproportionately low compared to its economic size. This misalignment has led to tensions, with emerging economies calling for more equitable representation in global financial governance.

The BRICS group (Brazil, Russia, India, China, and South Africa) has also emerged as a platform for emerging economies to advocate for reforms in global governance. Through BRICS, these countries have pushed for a more multipolar world order that challenges western dominance. They have advocated for increased representation in institutions like the UN Security Council and greater financial autonomy through the establishment of the New Development Bank (BRICS Bank) (Lissovolik, 2020).

Strategic and security concerns

The growing economic influence of China and India has significantly reshaped global security dynamics Campbell, 2021). China's rise, in particular, has been accompanied by an expanding military presence in the South China Sea, where it has constructed artificial islands and fortified them with military installations. Beyond its immediate region, China's strategic investments in ports and military facilities across Asia, Africa, and even the Middle East -commonly referred to as its "string of pearls" strategy - have drawn significant international attention. These moves are viewed by many as an effort to secure vital trade routes and expand its geopolitical footprint, raising concerns among Western powers and neighboring countries about potential security threats and challenges to the rules-based international order.

In response to China's growing influence, nations like the United States, Japan, and India have intensified their military and strategic cooperation. Joint naval exercises, intelligence-sharing agreements, and defense partnerships have become more frequent, as these countries seek to maintain a balance of power in the region. For instance, the United States has strengthened its alliances with traditional partners such as Japan and South Korea while fostering deeper ties with India, recognizing its pivotal role in the Indo-Pacific. These efforts aim to counterbalance China's assertiveness, ensuring freedom of navigation and the stability of critical maritime corridors.

India, meanwhile, has taken a proactive approach to enhancing its own strategic posture in the region. Through increased defense partnerships with countries in Southeast Asia and the Indian Ocean, India has signaled its commitment to regional security. Its active participation in the Quadrilateral Security Dialogue (Quad) (Grossman, 2020) - a strategic alliance with the USA, Japan, and Australia - underscores its intent to counter China's growing influence in the Indo-Pacific. By deepening ties with these countries and expanding its naval capabilities, India seeks not only to protect its own interests but also to contribute to a broader effort to ensure a free and open Indo-Pacific.

The costly bill on developing countries

While emerging economies like China and India offer opportunities for trade, investment, and development, they also pose challenges for other developing nations. Countries that align closely with China, for instance, may find themselves entangled in geopolitical rivalries, as seen in the case of Sri Lanka and its Hambantota Port project. Similarly, the influx of Chinese capital has led to concerns about debt sustainability in countries like Zambia and Sri Lanka, where heavy borrowing for infrastructure projects has led to mounting financial obligations.

Moreover, the competition between China and the USA for influence in Africa has created both opportunities and risks for African nations. While African countries benefit from increased investment and infrastructure development, they must carefully navigate the competing interests of these major powers to avoid being drawn into geopolitical conflicts.

The rise of emerging economies, particularly China and India, is reshaping the global geopolitical landscape. Their growing influence in global governance, trade, and security is challenging the traditional dominance of western powers and creating new dynamics that developing countries must navigate. As these emerging powers continue to expand their reach, they will play an increasingly pivotal role in shaping the future of global geopolitics. The role of the international monetary fund in a geopolitically fragmented world

3.6. The Role of the International Monetary Fund in a Geopolitically Fragmented World

The International Monetary Fund (IMF) continues to play a vital role in global financial stability, but its effectiveness is increasingly challenged by geopolitical fragmentation and the growing influence of emerging economies. Historically, the IMF has been shaped by the economic and political power of its largest shareholders, particularly the USA and European countries. However, as countries like China, India, and other emerging economies grow in global influence, there are increasing calls for reforms to IMF governance and financial resources.

IMF's quota system and voting power imbalance

As highlighted by some scholars (Subramanian, 2011; Woods, 2006) one of the central challenges within the International Monetary Fund (IMF) is its quota system, which determines the financial contributions of member countries and their corresponding voting power. The United States remains the largest single shareholder, granting it significant influence over the institution's decisions. However, this governance structure has been criticized for not adequately reflecting the shifting dynamics of the global economy. Emerging economic powers such as China and India have seen substantial growth in their contributions to global trade and finance, yet their quotas and voting shares remain disproportionately low.

For instance, China's voting share in the IMF is significantly smaller than that of the United States, despite its position as the world's second-largest economy and a major driver of global growth. This disparity has fueled dissatisfaction among emerging economies, which argue that the current system is outdated and fails to acknowledge their growing importance in the global economic order. Countries like China have increasingly called for a more equitable redistribution of quotas to align the IMF's governance with the realities of the 21st century. Without these reforms, the institution risks losing legitimacy among key stakeholders in the global south.

Journal of Global Sustainability and Development Impact of US influence on the SDRs controversy

The United States has frequently leveraged its dominant position within the International Monetary Fund (IMF) to advance its strategic geopolitical interests. One prominent example occurred during the Trump administration when the US blocked a significant allocation of Special Drawing Rights (SDRs). These SDRs, which could have provided crucial liquidity to developing countries grappling with economic challenges, were particularly vital during the COVID-19 pandemic. At a time when many nations were burdened with escalating debt and severe economic downturns, this decision was widely criticized as prioritizing US domestic and geopolitical considerations over the broader goal of global economic recovery (ECA-ECLAC, 2021).

This action underscored the far-reaching implications of US influence within the IMF, particularly for developing countries that heavily rely on the institution for financial assistance. The blockage of SDR allocations left many struggling nations without adequate resources to address their economic crises, exacerbating inequalities within the global financial system. It also highlighted the growing tension between the immediate strategic interests of the United States and the pressing economic needs of vulnerable economies, further eroding trust in the IMF's ability to serve all its members equitably Kevin P. (2021).

The incident reignited debates over the IMF's governance structure, with critics emphasizing the need for reforms that would limit the disproportionate power of major shareholders like the United States. Many argue that a more inclusive and balanced governance framework is essential to ensure that the IMF can respond effectively to global challenges, especially those disproportionately affecting developing countries. Without such reforms, the institution risks perpetuating systemic imbalances that undermine its legitimacy and capacity to foster international economic stability.

Conditionality and the changing global landscape

The issue of conditionality has long been a contentious aspect of the International Monetary Fund (IMF)'s lending practices. Borrowing countries are often required to implement strict fiscal and policy reforms as a condition for receiving financial assistance, which has led to criticism about the social and economic impact of these measures. In today's increasingly fragmented global landscape, this debate has gained new urgency. Emerging economies, particularly China, have positioned themselves as alternative sources of financing for developing countries, offering loans that come with fewer political and economic strings attached. Through initiatives like the Belt and Road Initiative (BRI), China has provided infrastructure and development funding to countries across Asia, Africa, and Latin America, challenging the traditional dominance of the IMF (Dreher et al., 2018).

This shift has placed many developing nations in a complex position. Countries like Zambia and Sri Lanka, which have become heavily indebted to Chinese lenders, now navigate a dual dynamic: balancing between the traditional financial assistance offered by institutions like the IMF and the newer, more flexible financing options provided by China. While Chinese loans often lack the stringent conditions associated with IMF programs, they have been criticized for creating risks of debt dependency and opaque lending practices. For these countries, the choice between IMF conditionality and Chinese-led development initiatives underscores the complexities of securing external financing in a multipolar world (Bräutigam, 2020).

As a result, the IMF faces growing competition in its ability to influence the policies of borrowing nations. The increasing prominence of alternative lenders has weakened the institution's traditional leverage in some regions, prompting calls for the IMF to adapt its approach to remain relevant. This may involve reevaluating the scope and nature of its conditionality to better meet the needs of borrowing countries while ensuring sustainable economic outcomes. In a world marked by diverse financial options, the IMF's future role will depend on its ability to navigate these shifting dynamics and foster more inclusive and flexible engagement with member states.

Looking forward: the need for reform

In a world increasingly shaped by multipolar power structures, the IMF's relevance will depend on its ability to adapt to new geopolitical realities. This includes addressing the growing demands for quota reform, as well as rethinking its approach to conditionality in an environment where alternative sources of funding are available. Moreover, the IMF must find ways to engage more effectively with emerging powers like China and India, whose economic influence will continue to shape the global financial system in the coming decades.

Reforming the IMF's governance structure to give greater voice to emerging economies would not only reflect the current global economic landscape but also ensure that the institution remains effective in promoting global financial stability. As geopolitical fragmentation deepens, the IMF's ability to bridge the interests of traditional and emerging powers will be crucial in maintaining its central role in the international financial architecture.

The fragmented global geopolitical environment presents developing nations with difficult choices, forcing them to navigate between alignment with major powers or neutrality. These decisions shape their economic growth, political autonomy, and long-term stability. Various authors have explored these dilemmas, offering diverse perspectives on the challenges faced by developing nations.

Aligning with major powers to circumvent IMF requirements

Several scholars have examined the economic and political implications of aligning with major global powers, particularly in contexts where countries seek alternatives to IMF conditionality. Hirschman (1945) argued that economic dependency on major powers creates vulnerabilities for developing nations. While economic aid and military support from countries like the USA can strengthen local economies, they often come with political and policy constraints. However, this alignment can also provide access to alternative funding sources, enabling nations to bypass the stringent fiscal and structural reforms typically required by the IMF. For instance, financial or military support from a major power can offer immediate economic relief, reducing the need to rely on IMF programs.

Mearsheimer (2014), from a realist perspective, highlighted the geopolitical motivations behind such alignments. He explained that aligning with major powers like China or the USA often involves becoming part of their broader strategic agendas. For developing nations, this alignment can offer an opportunity to secure loans or grants with fewer or no conditions, allowing them to sidestep the IMF's stringent requirements. China, in particular, has emerged as a significant alternative lender through initiatives like the Belt and Road Initiative (BRI), providing infrastructure funding without requiring adherence to the same economic and governance reforms that the IMF mandates. However, Mearsheimer cautioned that these

alignments can limit sovereignty, as nations often find themselves tied to the strategic interests of the major power providing the assistance.

Nye (2011) introduced the concept of soft power to explain why some countries align with powers that offer not only economic incentives but also cultural and ideological appeal. This dynamic is especially evident in Africa, where Chinese investments have become an attractive alternative to IMF programs. Unlike IMF loans, which are often conditioned on fiscal austerity or liberalization measures, Chinese loans typically focus on tangible development projects, such as infrastructure, with fewer policy constraints. This has allowed many nations to avoid politically sensitive reforms tied to IMF conditionality, such as reducing public spending or privatizing state enterprises. However, while alignment with major powers like China may provide immediate financial flexibility, it can create long-term dependencies and expose nations to geopolitical risks.

In essence, aligning with major powers offers developing countries an alternative pathway to circumvent IMF requirements. By leveraging economic, strategic, or cultural ties, these nations can secure resources that allow them to maintain economic stability without adhering to the often unpopular and stringent conditions imposed by the IMF. However, this strategy comes with trade-offs, including potential erosion of sovereignty and increased vulnerability to the strategic interests of the allied power.

The neutrality stand: myth or reality?

Neutrality offers an alternative but challenging path for developing nations. Nkrumah (1965) championed a neutral stance during African independence movements to avoid entanglement in Cold War dynamics. However, he warned that neutrality without strong regional cooperation could lead to global marginalization.

Cohen (2019), in his analysis of India's foreign policy, demonstrated how efforts to balance relations with both Washington and Beijing have exposed India to external pressures, particularly in trade and security. Neutrality, he argued, often leads to underdevelopment as nations risk losing access to investment and technological advancements.

Acharya (2020) proposed regionalism as a solution, arguing that stronger regional organizations like ASEAN or the African Union enable countries to navigate great power competition collectively, avoiding isolation while securing long-term development and political independence.

Case studies: navigating the dilemma of alignment vs neutrality

A number of scholars have provided insightful case studies that highlight the complexities and challenges faced by developing countries in navigating their alignment or neutrality in the context of major powers and international financial institutions. Kilcullen (2010) explored the difficulties faced by African nations, particularly those in conflict-prone regions, in maintaining neutrality. His analysis focused on countries like Sudan and Somalia, where international interventions often manifest through proxy conflicts. These countries find themselves in a precarious situation, where avoiding alignment with major powers becomes increasingly difficult while also trying to secure their own economic stability and security. Kilcullen's research emphasizes the internal and external pressures these nations face in seeking to remain neutral while simultaneously addressing the demands of both regional conflicts and global geopolitical shifts. For these nations, neutrality becomes less of an ideal

and more of a strategic necessity, often undermined by external economic and security interventions.

Birdsall (2009) took a closer look at the role of international financial institutions, such as the IMF, in perpetuating dependency among developing nations. She argued that many countries reliant on IMF loans and assistance programs often have little room to resist the pressure from powerful countries like the USA. This pressure, Birdsall suggests, forces these nations into political and economic alignment with major powers, even when it might not align with their broader national interests. The dependency created by IMF programs, she argues, limits the ability of these countries to chart independent paths, often pushing them into accepting policies and conditions that may not be conducive to their long-term development. Birdsall's study sheds light on the tension between seeking financial assistance from institutions like the IMF and maintaining autonomy in decision-making, illustrating how the IMF's conditions can inadvertently entrench political dependencies.

Both Kilcullen and Birdsall offer compelling examples of the challenges developing nations face when trying to navigate the delicate balance between alignment and neutrality. Kilcullen's analysis underscores the geopolitical pressures on African nations caught between conflicting global powers, while Birdsall highlights the internal economic constraints imposed by international financial institutions. Together, these case studies demonstrate how the intersection of global power dynamics, security concerns, and financial assistance can severely limit the autonomy of developing countries, making it exceedingly difficult to maintain neutrality or independent governance.

The role of China and changing quotas in the IMF

The rise of China has added another layer of complexity. China's growing economic and geopolitical influence has reshaped global power dynamics, and this is reflected in the debate over the restructuring of IMF quotas.

Eichengreen (2011) argues that the IMF's failure to adequately reflect Chinas' increasing economic clout has undermined the institution's legitimacy in the eyes of developing countries. He notes that China's outsized economic role should be better represented in global governance structures, including a greater share of voting rights at the IMF.

Subramanian (2011) supports this view, advocating for a reassessment of global power structures to include growing economies like China and India. He warns that the continued marginalization of these economies in institutions like the IMF could lead to the creation of parallel financial structures, further fragmenting global governance.

It's obvious that the geopolitical fragmentation of the world places developing countries at the center of a strategic dilemma. Authors such as Hirschman (1945), Mearsheimer (2014), and Nkrumah (1965) have all highlighted how aligning with major powers offers immediate economic and security benefits but often comes at the cost of sovereignty.

Meanwhile, neutrality, as explored by Acharya (2020) and Cohen (2021), presents its own set of risks, leaving countries vulnerable to external pressures. As global institutions like the IMF face calls for reform, particularly in accommodating the rise of China, developing nations must navigate this complex landscape by strengthening regional ties and advocating for greater representation in global governance.

3.7. Regional Institutions and their Role in Mitigating Geopolitical Fragmentation

As geopolitical fragmentation deepens, regional institutions have increasingly become crucial in supporting developing countries. These institutions provide a platform for collective decision-making and a means of mitigating the adverse effects of geopolitical competition between major powers. Their role encompasses several key areas such as economic resilience, political stability, security cooperation, and environmental sustainability.

Economic cooperation and resilience

One of the key advantages of regional institutions is their ability to enhance economic resilience in a fragmented global environment. Acharya (2017) argues that regionalism allows smaller economies to unite and shield themselves from the adverse effects of trade wars and sanctions imposed by larger powers. The African Continental Free Trade Area (AfCFTA), which became operational in 2021, exemplifies this. By fostering intra-African trade, the AfCFTA reduces dependency on external markets and strengthens economic ties among African nations, enabling them to withstand global economic pressures.

World Bank (2019) highlights that the AfCFTA also encourages industrialization and economic diversification, reducing African economies' reliance on volatile commodity markets. This approach not only strengthens economic resilience but also creates opportunities for sustainable growth. Similarly, in Southeast Asia, ASEAN has successfully deepened regional integration, promoting shared economic progress and lessening dependence on external powers like China and the USA (Cooper, 2010).

These regional efforts demonstrate the critical role institutions play in fostering economic cooperation. By prioritizing trade among member nations and building resilient economic frameworks, developing countries can better navigate global challenges. However, to fully capitalize on these opportunities, regional organizations must work towards strengthening their influence and autonomy, particularly when faced with external funding pressures.

Political autonomy and sovereignty

Regional institutions play a vital role in enabling developing nations to maintain political autonomy and sovereignty. Buzan and Wæver (2003) note that regional security complexes allow countries to address internal and regional conflicts without excessive reliance on global powers. For instance, the Intergovernmental Authority on Development (IGAD) has mediated peace processes in Somalia and South Sudan, ensuring these nations achieve political stability with minimal external interference.

Healy (2020) further emphasizes the significance of regional collaboration in tackling complex issues like governance and conflict resolution. Organizations like IGAD provide platforms for collective problem-solving, empowering member states to assert their sovereignty and resist aligning with competing global power blocs. This fosters a sense of independence that is crucial for long-term political stability and self-reliance.

By taking ownership of their political challenges, developing countries are better positioned to determine their own paths. Regional institutions act as critical intermediaries, helping nations manage conflicts and governance issues without succumbing to external pressures. However, sustained progress requires these organizations to continuously strengthen their mechanisms for conflict resolution and governance support.

Journal of Global Sustainability and Development Security cooperation

Security cooperation is another critical area where regional institutions excel, providing collective defense mechanisms that protect member states from external pressures. NATO's Partnership for Peace, for instance, has inspired organizations like ECOWAS, which has intervened in regional conflicts such as the civil wars in Liberia and Sierra Leone. These interventions promote stability and protect developing nations from being drawn into the geopolitical contests of larger powers (Jenkins 2007).

Kabia (2009) highlights that regional security organizations possess the added advantage of being culturally and politically closer to the nations they assist. This proximity ensures that their interventions are contextually appropriate and effective, reducing the likelihood of long-term dependency on external actors. Regional organizations like ECOWAS not only address immediate security concerns but also lay the groundwork for sustainable peace and stability in their regions.

However, despite their successes, these organizations face challenges, particularly when external powers attempt to influence their security priorities. To maintain their effectiveness, regional institutions must focus on strengthening internal collaboration and securing independent funding sources, ensuring that their strategies remain aligned with the needs of member states.

Environmental sustainability

Regional institutions are also instrumental in addressing environmental challenges, particularly as global geopolitical fragmentation undermines collective climate action. The Southern African Development Community (SADC) has led initiatives on water management and climate change adaptation in countries like Mozambique and Malawi. These efforts help mitigate the impact of climate-related issues, such as drought and flooding, which exacerbate poverty and instability in vulnerable regions (Nhamo, 2019).

Similarly, ASEAN has advanced environmental cooperation by tackling issues such as deforestation and pollution. These regional frameworks provide developing countries with a platform to jointly address environmental degradation, compensating for the lack of coordinated global climate leadership (Maritime Southeast Asia Forum, 2020). Through collaboration, member states can pool resources and expertise to implement sustainable solutions that benefit the entire region.

Nevertheless, regional institutions face limitations, particularly when balancing internal priorities with the influence of external powers. Strengthening their capacity for independent environmental action will enable these organizations to further reduce vulnerability and foster long-term sustainability in their regions.

Case study: The African Union's role in conflict resolution

The African Union (AU) serves as a critical example of a regional institution addressing geopolitical fragmentation. Its peace and security architecture have been instrumental in mediating conflicts in regions like the Sahel, where external powers often worsen instability. Francis (2017) highlights that the AU's efforts in Sudan and Mali have reduced the need for foreign intervention, empowering African nations to manage their conflicts independently. By leading these efforts, the AU has created a framework for regional diplomacy that prioritizes African solutions to African problems. This approach minimizes dependence on external

powers and fosters a sense of ownership among member states. The AU's proactive role in conflict resolution has also contributed to building trust among member nations, further strengthening its capacity to address future challenges.

While the AU has made significant strides, its efforts are often hampered by funding constraints and external influence. To enhance its impact, the AU must work towards securing sustainable funding and deepening its collaboration with member states. This will ensure that its peacekeeping and conflict resolution initiatives remain effective and aligned with the interests of the African continent.

The promise and challenges of regionalism

Regionalism presents a powerful framework for addressing the challenges of a fragmented global order, offering developing nations opportunities to foster economic resilience, political autonomy, security cooperation, and environmental sustainability. By acting collectively, these countries can navigate external pressures while safeguarding their interests and sovereignty. Institutions like the AfCFTA, IGAD, ECOWAS, and the AU demonstrate the significant strides that can be made when nations unite to solve regional issues.

However, regional institutions often face significant challenges, including dependency on external funding and the influence of global powers. These limitations can undermine their autonomy and ability to address the unique needs of member states effectively. Strengthening internal collaboration, securing sustainable financing, and enhancing the capacity of these organizations are critical steps to overcoming these hurdles.

Despite these challenges, regionalism remains a powerful tool for maintaining sovereignty and resilience. As Acharya (2020) and Cooper (2010) argue, these institutions enable developing nations to safeguard their interests while adapting to a rapidly changing geopolitical landscape. Strengthening their independence and collaboration will ensure their continued relevance and effectiveness in the future.

Conclusion

Geopolitical fragmentation poses complex challenges for developing countries, deeply affecting their economic, political, security, and environmental stability. As these nations navigate a world where global cooperation is increasingly fractured, the consequences manifest through limited access to financial markets, political pressures to align with major powers, intensified regional conflicts, and weakened global climate action. The restructuring of institutions like the IMF and the UN remains critical in ensuring fairer representation and consideration of the needs of developing nations, especially as they contend with outdated systems that fail to account for the economic rise of countries like China.

The role of regional institutions, however, provides a beacon of hope in mitigating some of these challenges. Organizations such as the African Union, ASEAN, and the African Continental Free Trade Area (AfCFTA) demonstrate the potential for regional cooperation in fostering economic resilience, preserving political autonomy, ensuring collective security, and addressing environmental challenges. These institutions empower developing nations to form alliances that transcend the competition between global powers, enabling them to act more independently and focus on long-term development goals.

Moving forward, the global order must recognize the importance of accommodating the evolving dynamics within developing countries. This requires reforms in global governance, greater emphasis on regional collaboration, and a conscious effort to promote equitable economic and political systems that reflect the growing influence of emerging economies.

Credit Authorship Contribution Statement

The author was solely responsible for all aspects of the research, including conceptualization, methodology, analysis, and writing.

Acknowledgments

I would like to express my heartfelt gratitude to Master Alain Malata, who has been my thesis advisor, mentor, and guide. Working with you as your mentee and assistant has been a truly enriching experience. Your support and invaluable guidance have been essential to the completion of this work. Thank you for your constant encouragement and for helping me grow academically and professionally.

Conflict of Interest Statement

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

References

- Acemoglu, D., & Robinson, J. A. (2012). Why nations fail: The origins of power, prosperity, and poverty. Crown Business. https://ia800606.us.archive.org/15/items/WhyNationsFailTheOriginsODaron Acemoglu/Why-Nations-Fail_-The-Origins-o-Daron-Acemoglu.pdf
- Acharya, A. (2017). Regionalism and the politics of global governance: The role of regional institutions in shaping order. *Cambridge University Press.* ISBN: 978-1108416173
- Acharya, A. (2020). Regionalism and the politics of neutrality: Rethinking the role of regional organizations in global governance. *Global Governance*, 26(3), 357-377. https://doi.org/10.1163/19426720-02603004
- Ahmed, E. (2009). The Comprehensive Peace Agreement and the dynamics of post-conflict political partnership in Sudan. *Africa Spectrum*, 44(3), 133-147. https://doi.org/10.1177/000203970904400307
- Arora, N. K., & Mishra, I. (2021). COP26: More challenges than achievements. Environmental Sustainability, 4(6), 585–588. https://doi.org/10.1007/s42398-021-00212-7
- Biermann, F (ed) (2022). The Political Impact of the Sustainable Development Goals: Transforming Governance through Global Goals. Cambridge University Press. ISBN: 9781316514290
- Bräutigam, D. (2020). *The Dragon's gift: The real story of China in Africa*. Oxford University Press. ISBN: 978-0-1976-0640-4
- Cohen, S. P. (2019). *India's Foreign Policy: A Balancing Act Between the United States and China*. Brookings Institution Press. ISBN: 978-0-8157-3350-0.
- Muhammad, B. (2024). Regional Organizations and Global Governance: The Case of ASEAN. *Journal of Student Collaboration Research*, 1(2), 1-15. https://myjournal.or.id/index.php/ JSCR/article/view/256
- Eichengreen, B. (2004). Global imbalances and the lessons of Bretton Woods (NBER Working Paper No. 10497). *National Bureau of Economic Research*. https://www.nber.org/papers/w10497

- Fajgelbaum, P., & Khandelwal, A. (2021). The economic impacts of the US-China trade war, NBER Working Paper No. 29315, *National Bureau of Economic Research*. Https://www.nber.org/papers/w29315
- Ezeibe, C., & Oguonu, C. (2014). African Union and conflict resolution in Africa. *Mediterranean Journal of Social Sciences*, 5(27), 325-332. https://doi.org/10.5901/mjss.2014.v5n27p325
- ECA-ECLAC. (2021). Special Drawing Rights (SDRs) and the COVID-19 crisis. United Nations Economic Commission for Africa & Economic Commission for Latin America and the Caribbean. Https://repositorio.cepal.org/bitstream/handle/11362/47856/1/S2200199_en.pdf
- Gaddis, J. L. (2005). The Cold War: A new history. Penguin Press. ISBN: 978-0143038276
- Javed, S., & Chattu, V. K. (2020). Strengthening COVID-19 pandemic response, global leadership and international cooperation through global health diplomacy. *Health Promotion Perspectives*, 10(4), 300-305. https://doi.org/10.34172/hpp.2020.48
- Healy, C. (2020). Regional cooperation and conflict resolution: The case of IGAD. *Journal of East African Studies*, 14(1), 20-35. https://doi.org/10.1080/17531055.2019.1708283
- Hirschman, A. O. (1945). National power and the structure of foreign trade. *University of California Press*. https://doi.org/10.1525/9780520378179
- Jenkins, P. A. (2007). The Economic Community of West African States and the regional use of force. Denver Journal of International Law & Policy, 35(3), 333-355. https://digitalcommons.du.edu/cgi/viewcontent.cgi?article=1299&context=djilp
- Kabia, J. M. (2009). Humanitarian intervention and conflict resolution in West Africa: From ECOMOG to ECOMIL. *African Studies Review*, 52(3), 180-181. https://doi.org/10.1353/arw.0.0228
- Khalil, H. M. (2024). This country has laws: Legalism as a tool of entrenching autocracy in Egypt. *American Sociological Review*, 68(12), 1-22. https://doi.org/10.1177/00027642241267936
- Kilcullen, D. (2010). Counter insurgency: A global history. *Oxford University Press*. https://books.google.com/books/about/Counterinsurgency.html?hl=fr&id=A8amtX_z1WkC#v=onepage&q&f=false
- Kevin P. (2021) 2021: Time for US Leadership on Multilateralism and a Sustainable Recovery. https://www.globalpolicyjournal.com/blog/27/01/2021/2021-time-us-leadership-multilateralism-and-sustainable-recovery?utm_source=chatgpt.com
- Mearsheimer, J. J. (2014). *The tragedy of great power politics*. W.W. Norton & Company. ISBN 978-0-393-34927-6
- Mohan, R. (2020). IMF quota reforms and global economic governance: What does the future hold? CESP Working Paper-2, October 2020. https://csep.org/working-paper/imf-quota-reforms-and-global-economic-governance-what-does-the-future-hold/
- Moyo, D. (2009). *Dead aid: Why aid is not working and how there is a better way for Africa*. Farrar, Straus, and Giroux. ISBN-13: 978-0374532122
- Narayanan, G. (2023) Myanmar's 2021 Military Coup, Its Impact on Domestic Politics, and a Revolutionary Road to Democratization? Asian Journal of Peacebuilding, 11(2), 311-329. https://doi.org/10.18588/202311.00a392
- Nkrumah, K. (1965). Neo-colonialism: The Last Stage of Imperialism. Panafrican Press. ISBN: 978-0-175-11279-1
- Nye, J. S. (2011). The Future of Power. Public Affairs. ISBN-13: 978-1-610390699

- Ofozoba, C. A., Okelue, C. E., & Okeke, C. C. (2023). Foreign assistance and political stability in restive states: US interventions in Yemen revisited. *American Research Journal of Contemporary* Issues, 1(2), 14–36. https://www.openjournals.ijaar.org/index.php/arjci/article/view/59
- Oberhauser, M. (2023). The Chinese Belt and Road Initiative: Development project with strings attached? *International Journal of Development Issues*, 23(2), 212-244. https://doi.org/10.1108/IJDI-03-2023-0073
- Piketty, T. (2014). *Capital in the Twenty-First Century*. Harvard University Press. ISBN: 978-0-674-43000-6
- Rodríguez, F. (n.d.). Venezuela's economic collapse: Implications for Latin America and the Caribbean. https://eu.docworkspace.com/d/slJrvs7jOAd6B-bwG?sa=601.1093
- Rodrik, D. (2018). *Straight talk on trade: Ideas for a sane world economy*. Princeton University Press. ISBN 978-0691177847
- Sachs, J. (2005). *The End of Poverty: Economic Possibilities for Our Time*. Penguin Press. ISBN: 978-1-59420-045-9
- Sen, A. (1999). Development as Freedom. Oxford University Press. ISBN 1-59420-045-9
- Stiglitz, J. E. (2002). Globalization and its Discontents. W.W. Norton & Company. ISBN-13: 978-0393051247
- Subramanian, A. (2011). Eclipse: Living in the shadow of China's economic dominance. *Peterson Institute for International Economics*. ISBN: 978-0881326345.
- US Department of State. (2018). US-Africa Relations: A New Framework. Bureau of African Affairs. Https://2017-2021.state.gov/u-s-africa-relations-a-new-framework-2/
- Woods, N. (2006). The globalizers: The IMF, the World Bank, and their borrowers. *Cornell University Press*. ISBN 978-0801444241
- World Bank. (2020). The African Continental Free Trade Area: Economic and distributional effects. https://doi.org/10.1596/978-1-4648-1559-1