Nuclear and Missile Arsenal Policies in China Post-INF Treaty by Erin Frank


Access to Contraception is a Gender and Development Issue: A Comprehensive Look at Georgia and the United States by Summer Hunter-Kysor
Letter from the Editors

Dear Reader,

It is our honor to present to you this 11th Edition of the Pitt Policy Journal, featuring papers on a variety of important topics that discuss challenging policy issues affecting our local communities and those worldwide.

Our editorial board was presented with a challenging task to select among a wide array of incredibly interesting submissions, each of which would have made a significant contribution to the diverse body of literature our journal has published to date. While we were unable to accommodate each and every one of them in this year’s printed publication, we want to thank all the hard-working authors who submitted their important work to us for consideration. It is the participation of aspiring young scholars like yourselves that makes this journal worthwhile.

We also want to thank our editors, as well as the author finalists, who worked tirelessly to bring this publication into shape. Their genuine commitment, professionalism, and the excellent quality of the selected submissions is what made the 11th edition possible. We extend a special thank you to our editor-officers, who—in addition to their editing assignments—found time to help operations run smoothly, provided vital support for the organization of our launch party, and made preparations for the first online version of the Pitt Policy Journal.

Last, but certainly not least, we want to thank Dr. John Keeler, who has served as the Dean of the Graduate School of Public and International Affairs since 2007 and was instrumental in the founding of the Pitt Policy Journal in 2008. Established as a platform where graduate students can share their research with the broader academic community, the Pitt Policy Journal could not have succeeded without his investment and support. We take this opportunity to genuinely thank Dr. Keeler and wish him good luck on his next professional endeavor.

Sincerely,

Alexandria Smith    Dijana Mujkanović
Editor-in-Chief    Editor-in-Chief
Mission

The *Pitt Policy Journal* is a student-led initiative founded in December 2008 with a mission to provide a venue for students to contribute exemplary research, inquisitive debate, and constructive dialogue to peers and practitioners of public policy. Our goal is to foster professional exchange and mutual improvement by motivating students to think critically and analytically about contemporary issues. In recognizing the value of creativity and innovation, not only to academia, but also to public policy, we seek to incorporate novel ideas and approaches in publishing student work.

Vision

By embracing the values and mission of the Graduate School of Public and International Affairs (GSPIA), the *Pitt Policy Journal* enhances the quality of scholarly cooperation and interactive engagement among students regarding critical issues of local, national, and international significance. In striving to build a foundation for leadership and competition beyond academia, the *Pitt Policy Journal* prepares students for careers in public service through the advancement of their analytical, research, and leadership skills. While recognition and awareness of the *Pitt Policy Journal* on campus has grown over the brief history of the journal, our goal is to significantly increase the notoriety and readership of the journal around the country.

Support

The publication of the *Pitt Policy Journal* is sponsored by the Fund for Student Initiatives that was launched in the fall of 2008 by GSPIA Dean John Keeler. We are grateful for the Dean’s support and the generosity of the entire GSPIA community, including faculty, staff, and students.
Selection Information

We welcome submissions that explore diverse policy areas and provide insightful perspectives on domestic and global political, economic, and security matters. Our staff prioritizes the selection of quality, thoughtful scholarship that has practical implications for local and national policy makers. All submissions are reviewed anonymously by the Editorial Review Board, which selects the best among each pool of submissions for publication.

Disclaimer

The views expressed in the Pitt Policy Journal do not necessarily represent the opinions of our editorial staff, GSPIA, or the University of Pittsburgh. While each selected entry undergoes a rigorous editing process, contributing authors are ultimately responsible for the accuracy and integrity of their work.

Contact Information

To reach one of our staff members or contributing authors, please send an email to pittpolicyjournal@gmail.com.
Editors-in-Chief

Dijana Mujkanović, PhD ’23

Dijana Mujkanović is a third-year PhD Candidate at the Graduate School of Public and International Affairs (GSPIA). She holds an MA in Public Policy with a specialization in Conflict Resolution and Mediation from Tel Aviv University and a BA in Political Science and Global Studies from North Central College. Her research centers around intergroup contact and ethnic conflict, migration, and ethnonationalism. Over the past decade, Mujkanović worked with various grassroots and international organizations in the sphere of civil and human rights advocacy, specifically as they relate to refugees, indigenous populations, and other marginalized communities. The past seven years of her life, she spent working in the Middle East, primarily Israel and the United Arab Emirates. Dijana came to the U.S. as a refugee from Bosnia and Herzegovina in 1999.

Alexandria Smith, MPIA/JD ’21

Alexandria Smith is a third-year dual degree student with the law school pursuing a JD and an MA in Public and International Affairs (MPIA) with a concentration in Security and Intelligence Studies. She earned a BA in Political Science from the University of Michigan. Her academic interests include international law and privacy law. Smith was born and raised in Michigan and has also lived in Italy and France. In her free time, she enjoys traveling, hiking, reading, and golfing.

Officers

Erin Frank, MPIA ’20, External Communications Officer

Erin Frank is a second-year MPIA student with a concentration in Security and Intelligence Studies. She earned a BA in Criminal Justice with a minor in Sociology in 2015 from Florida Atlantic University. Erin has worked in law enforcement for the last five years and currently works full time as a Crime Intelligence Analyst with the Domestic Violence Unit of the Pittsburgh Bureau of Police. She is a member of the FBI’s Emerging Technologies to Safeguard Election Security working group in the Ridgway Center and is a contributing editor for Princeton’s Journal of Public
and International Affairs. Her academic interests include organized crime and terrorism, with a particular focus on foreign threats towards the United States. In her free time, Erin enjoys baking, reading, and kickboxing.

Samantha Monks, MID ’20, Online Communications Officer  
Samantha Monks is a second-year Master of International Development (MID) student majoring in Human Security. She earned her BS in Psychology from the University of Pittsburgh with a minor in Linguistics, a certificate in African Studies, and a certificate in Arabic Language and Linguistics. After graduating, she spent five years teaching English as a Second Language in Philadelphia, Spain, and France. While at GSPIA, Monks’ research has focused on social policy, human rights, gender equality, sexual violence, mass displacement, and conflict with a regional focus in sub-Saharan Africa. Upon graduation, she plans to work with post-conflict communities, serving refugees, internally displaced persons, or reintegrated ex-combatants and survivors. Monks’ is passionate about transitional justice initiatives and development programs that promote individual and communal psychosocial healing and peaceful reintegration and reconciliation.

Kristin Ronzi, MPIA ’20, Director of Operations  
Kristin Ronzi is a second-year MPIA candidate with a concentration in security and intelligence studies and a human security minor. She received her BA in Regional and Comparative Studies from Georgetown University. Her academic interests are in organized crime, counterterrorism, and ethnic conflict.

Gabrielle Sinnott, MPIA ’21, Internal Communications Officer  
Gabrielle Sinnott is a first-year MPIA student majoring in Human Security with a certificate in Asian Studies. She is also a Foreign Language and Area Studies Fellow for Mandarin Chinese. Her academic interests include US-China relations, human trafficking policy, refugee and migration studies, humanitarian intervention, and post-conflict reconstruction. She holds a BA in History and Political Science from Daemen College.
Editors

Jemila Tosan Adoki, MPA ’21

Jemila Tosan Adoki is in his first year of the MPA program, with a concentration in Urban Affairs and Planning. He earned his BS from Massachusetts Institute of Technology in History, with a focus in urban and economic history. While there, he worked as a research assistant for the digital humanities lab HyperStudio. His academic interests encompass the intersection of urban economic development and racial equity.

Kelsey Brennan, MPIA ’20

Kelsey Brennan is a second-year MPIA student at the University of Pittsburgh’s GSPIA. She holds a graduate assistantship with the Matthew B. Ridgway Center for International Security Studies and the Ford Institute for Human Security. Brennan has served as project lead for the Ford Institute’s graduate research group studying human trafficking for the past two years. She previously interned at the US Department of State’s Office to Monitor and Combat Trafficking in Persons. Before her graduate studies, Brennan worked for three years in the Massachusetts State Senate as Communications Director. She holds a BA in Political Science from the University of Pittsburgh.

Brian Bayer, MID ’21

Brian Bayer is majoring in Nongovernmental Organizations and Civil Society in GSPIA’s MID program. He graduated from John Carroll University in 2013. Bayer then pursued a year of service in Guayaquil, Ecuador, with the nonprofit Rostro de Cristo, followed by two more years of teaching English and doing freelance social justice journalism throughout Ecuador. Returning to his hometown of Pittsburgh in 2017, Bayer began working full time at the University of Pittsburgh School of Health and Rehabilitation Sciences, where he is currently a Communications Specialist. Once he graduates, Bayer hopes to work with organizations based in Latin America.
Megan Canfield, *MPIA ’20*

Megan Canfield is a second-year MPIA student with a concentration in Human Security. She received her BA in Political Communication for Social Change and Psychology from Wilmington College, a school with Quaker roots that ignited her passion for activism and deepened her commitment to equality, peace, and community. During a year of service, Canfield worked on food justice and environmental sustainability in Little Rock, Arkansas. At GSPIA, she coordinates the flooding and social equity working group for the Ford Institute for Human Security. While learning is one of her great joys, Canfield knows that hammocking, drinking tea, and chatting with friends are essential ingredients to a full life.

William Fitzgerald, *MPA ’21*

William Fitzgerald is a first-year Master of Public Administration (MPA) student with a concentration in Energy and Environmental Policy. He earned his BS in Recreation, Park, and Tourism Management from Pennsylvania State University, and has worked in environmental education and land management. Growing up in Denmark helped spark his interests in foreign policy and renewable energy. Fitzgerald enjoys cooking, John Le Carré novels, and biking.

Laura Gooding, *MPIA ’21*

Laura Gooding is a first-year MPIA student majoring in Security and Intelligence Studies. She holds a graduate assistantship with the Vira I. Heinz Program for Women in Global Leadership and is a graduate student researcher in the Ford Institute for Human Security. Along with editing for the Pitt Policy Journal, Gooding is also an editor for the Princeton University Journal of Public and International Affairs. She holds a BA in Anthropology from the University of Pittsburgh.
Claire Guth, *MPPM ‘20*

Claire Guth is a current Master of Public Policy and Management (MPPM) student and the Director of Outreach for the University of Pittsburgh Manufacturing Assistance Center, an economic workforce development initiative of the Swanson School of Engineering. Guth’s work has garnered numerous awards and accolades, and she is considered a thought leader on upskilling initiatives for the region, US, and developing nations. Her interests include building human capital, advancing racial and gender equity in economic development, and the democratization of manufacturing. She holds a BA from the University of North Carolina at Chapel Hill and lives in Pittsburgh with her husband and three children.

Macy Holloway, *MID ‘20*

Macy Holloway is a second-year student pursuing her MID with a concentration in Energy and the Environment. She earned a BA in Writing and Linguistics from Georgia Southern University in 2016, where she worked as an editor for The George-Anne Media Group. Her interests include renewable energy research and emergency response and disaster recovery management. In her free time, she enjoys watching TV and hiking. Her hometown is Columbus, Georgia.

Deborah Jennings, *MPIA ‘21*

Deborah Jennings is a first-year MPIA student majoring in International Political Economy. She holds a BA in Political Science from the Mansfield University of Pennsylvania. At GSPIA, she is involved in the Matthew B. Ridgway Center for International Security Studies and Pitt Humanitarians. Before her graduate studies, she worked as an English teacher in Chongqing, China. Her academic interests include international trade, economic development, and Asian affairs.
Alan Katruska, *MPPM ’21*

Alan Katruska is a first-year MPPM student with a specialization in Epidemiology and Health Policy. He earned his BPhil in Anthropology and Linguistics through the Honors College at the University of Pittsburgh and is certified in Federal Grants Management. By day, he serves as a Technical Advisor in a knowledge management unit at the National Institute for Occupational Safety and Health. He spends his free time with a large family and three good dogs. Katruska is interested in building skills in research utilization and the health effects of disasters.

Cameron William Lumley, *MPIA ’21*

Cameron William Lumley is a first-year MPIA student with a concentration in Security & Intelligence Studies. His area of focus includes issues in asymmetric warfare relating to armed insurgencies and terrorism. Lumley holds a BA in History with a minor in English from Washington & Jefferson College. Currently, he serves as an Indirect Fire Infantryman in the United States Army National Guard.

Cassidy Martin, *MPA ’21*

Cassidy Martin is a first-year MPA student studying Urban Affairs and Planning. Cassidy received her BA in Political Science and History from the University of Pittsburgh. At GSPIA, Cassidy is a member of the Gender Equality in Public Administration working group. She is interested in local policy, mainly transportation access and gender equality initiatives. She enjoys yoga, trying out new Tasty recipes, and traveling.

continued
Anneliese McCarthy, MPIA ’21

Anneliese McCarthy is a first-year MPIA student studying Security and Intelligence with a minor in Cyber Security, Policy, and Law. She earned dual-BA in Criminology and Political Science with a focus on International Relations and National Security from West Virginia University. McCarthy is interested in the Eastern European and Central Asian security developments as they play a role in geopolitics. This interest stemmed from a 2018 summer program in Eastern Europe studying NATO enlargement in the region. After GSPIA, McCarthy plans to work towards becoming an FSO. In her spare time, she enjoys watching movies and attempting to take care of plants.

Andrew Miller, MPIA ’21

Andrew Miller is a first-year MPIA minoring in Energy and Environment. After graduating with his BA in Intelligence Studies from Mercyhurst University in 2013, he worked in bank compliance and financial investigations for 6 years. He is serving as the Director of Finance for GSPIA’s Student Cabinet, is a member of the FBI’s Emerging Technologies and Election Security research group in the Ridgway Center, and an intern for the National Cyber Forensic Training Alliance in Pittsburgh. His academic interests include foreign policy, climate change, and cyber security. His hobbies include running, reading and writing, and traveling.

Lizz Piccoli, MPH/MID ’20

Lizz Piccoli is a dual degree candidate. She is earning an Master of Public Health in Infectious Disease (MPH), MID, and an MA in International Affairs majoring in Human Security. She earned her Bachelors in Kinesiology in 2015 from the University of Toronto, where she was awarded the Gordon Cressy Leadership Award for her volunteer work at the Hospital for Sick Children, and her research at the Desmond Tutu HIV Center in Cape Town. Her academic interests include infectious diseases, maternal and child health, global health, and migration.
Pelumi Olumbenga, MID ’21

Pelumi Olugbenga was born and raised in Nigeria. He earned his BA in History and International Studies from the Lagos State University at Ojo, Nigeria. There he served as an Editor of the Society for the Study of History and International Studies Press Club and was later awarded the Vice Chancellor’s/President’s Certificate of Honour for Exceptional Leadership. Pelumi is currently obtaining an MID at the University of Pittsburgh (GSPIA) with a major in Energy and Environment and a minor in Cybersecurity, Policy, and Law. Over the past three years, he has mentored young civic leaders at university campuses across Nigeria and beyond and was selected to participate in global youth programs at the World Bank Group, the United Nations, and the Commonwealth People’s Forum. Pelumi is passionate about building a resilient energy sector and promoting sustainable policies that allow greater energy access and tackle energy poverty.

Caelan Hidalgo Schick, MPIA ’21

Caelan Hidalgo Schick is in her first year of the MPIA program, with a concentration in Human Security. She earned her BA from Boston University in Philosophy and Political Science. Before GSPIA, Schick spent a year in Spain teaching English, backpacked in South East Asia, and worked in Immigration Law. Caelan’s research so far in GSPIA focuses on the impact that advancing technology has on human security. In her spare time, she enjoys online shopping, reading, and discussing political philosophy.

Victoria Trimble, MPIA ’19

Victoria Trimble received her MPIA in December of 2019. She had previously received her bachelor’s in political science from La Roche College.
# Table of Contents

14  *Simon Reich Human Security Research Award Winner*
   
   *Presented by the University of Pittsburgh Ford Institute for Human Security*
   
   **Climate Change and Disaster Displacement in Nigeria: Balancing A Rights-Based Approach to Protecting IDPs with Development**
   
   by Paige Alderson

30  **Installing Vermifilter Toilets in Liberian Slums: Can a Can of Worms Solve West Point’s Sanitation Problems?**
   
   by Michael Kuncio

36  **Securing Key Ports, Food Distribution Sites, and Humanitarian Food Relief Operations through United Nations Peacekeeping Operations (PKOs) in Hodeidah**
   
   by Joseph Skibbens

45  **Cybersecurity Meets Big Business: How the Private Sector is Setting the Precedence in Cybercrime Investigations**
   
   by Erin Frank

50  **Access to Contraception is a Gender and Development Issue: A Comprehensive Look at Georgia and the United States**
   
   by Summer Hunter-Kysor

67  **Solar Energy: The Key to Development in Climate-threatened Uganda**
   
   by Justin Giannantonio
74  The Threat of Climate Shocks in Bangladesh—A Case Study  
   by Megan Canfield

86  Protecting the Army National Guard  
   by Zachariah Hoydich

90  Sisyphean Strategies:  
   Cycles of Violence and U.S. Drone Policy in Yemen  
   by Joseph Skibbens

98  Conflict and Crime: Smuggling to Turkey from Iraq and Syria  
   by Rachel McGrath

108  The Fourth Industrial Revolution:  
   The Potential Impacts of Artificial Intelligence  
   and Automation Technologies on Gender Equality  
   by I Younan An

124  Nuclear and Missile Arsenal Policies in China Post-INF Treaty  
   by Erin Frank

132  Algae-Based Biofuels—A Unique Solution for Increasing  
   Regulations in the Shipping Sector  
   by Megan Canfield
Climate Change and Disaster Displacement in Nigeria: Balancing A Rights-Based Approach to Protecting IDPs with Development

Simon Reich Human Security Research Award Winner
Presented by the University of Pittsburgh Ford Institute for Human Security

Paige Alderson
MPIA '19, Graduate School of Public and International Affairs
and JD '19, The School of Law, University of Pittsburgh

Abstract
Unlike the 1951 Refugee Convention (the Convention Relating to the Status of Refugees) and its 1967 Protocol, which restricts the meaning of refugees, the Kampala Convention (formally, the African Union Convention for the Protection and Assistance of Internally Displaced Persons in Africa) provides comprehensive protection to internally displaced persons (IDPs), including those affected by natural disasters. As a state party to the Kampala Convention, the Nigerian Government has the primary duty and responsibility (1) to assist and protect IDPs within its territory and (2) to mitigate and eliminate the root causes of displacement. To nations in the Global North, these obligations seem complementary, but to those in the Global South, they are often competing. As the top oil-producing and most populated country in the continent, Nigeria is unable to do both. Instead, Nigeria has chosen to follow the same path that industrialized nations like the United States and European countries chose before it: development through carbon emissions. By failing to domesticate the Kampala Convention, Nigeria leaves more than two million IDPs without adequate protection while simultaneously fueling their plight. This paper focuses on the state of normative developments on internal displacement and climate change in Nigeria, on its unique challenge to protecting and assisting IDPs while encouraging development, and on the limits of using a rights-based approach.
INTRODUCTION

Although the New York Declaration,5 Nansen Initiative,6 and Secretary General’s 2016 report “In Safety and Dignity: Addressing Large Movements of Refugees and Migrants”7 explicitly acknowledge the challenge posed by climate change and disaster displacement,8 there is no guarantee under existing international law that those affected will receive assistance from the host community. According to the Internal Displacement Monitoring Centre (IDMC), an average of nearly 27 million people were displaced annually from 2009 to 2014 by natural hazard-related disasters.9 In 2017, 61 percent of the nearly 31 million people were newly displaced as a result of disasters, while 39 percent were displaced due to conflict.10 Even though there are currently twice as many IDPs as refugees in the world, climate compacts like the Nansen Initiative and New York Declaration focus exclusively on cross border movement and ignore the majority of individuals displaced within their borders.11 This paper recognizes that internal displacement is a pressing matter in its own right and focuses on those individuals forced to migrate from their homes as a result of sudden onset and long-term changes to their local environment.

It has long been recognized that the single greatest impact of climate change may be on human migration.12 As Robert T. Watson, the Chairman of the United Nations Inter-Governmental Panel on Climate Change (IPCC), said, “It is no longer a question of whether the earth’s climate will change but rather when, where and by how much.” Under the existing framework, as sea levels continue to rise, entire populations, including small island nation-states such as the Maldives and Kiribati, will be rendered uninhabitable, prompting flight into neighboring states and triggering the “climate refugee” debate.

Although a wealth of literature exists debating the status of these affected populations and the shortcomings of the legal definition of refugees,13 little scholarship focuses on the internal displacement of persons brought about by climate change and the choice nations in the Global South must make to ensure their development. In Nigeria, the struggle for development must balance the needs of the state with those of its people in order to prevent today’s IDPs from becoming tomorrow’s refugees. To develop its economic sector, Nigeria has relied on high greenhouse gas and carbon emissions to spur its oil industry at unprecedented rates. Unfortunately, this rise to the top will only plateau as its population faces the consequences of its contributions to climate change. Further complicating matters are violent pockets of extremism in its northern provinces and localized pastoralist conflict in its southeastern states.
Moreover, the increase in Nigeria’s population has put enormous pressure on land and water resources. Specifically, the demographic increase has led to an expansion in cultivated farmland and a reduction in available grazing land for its herders. This search for suitable pastures and water has only spurred conflict as the “effects of unfavorable weather patterns [has] resulted in acute water scarcity and droughts in a few northern states, tsetse-fly infestation, dry pastures, and leaching.” The government must take measures to address the vast movement of people from its northern provinces to the central and southern states as a result of conflict and climate change, and in doing so, ensure protection to its existing—and future—IDP population. Although the Kampala Convention is a revolutionary measure for addressing gaps in climate-related IDP protection, Nigeria’s need to spur development will likely prevent its domestication, thus prioritizing the state over its population.

**Climate Change in Nigeria: A Case Study**

Scholars have generally accepted that climate change will result in large-scale movements of people and that developing states - where the interrelationship between climate change and conflict is particularly acute —will bear the greatest cost. A recent World Bank report projected that within three of the most vulnerable regions – sub-Saharan Africa, South Asia, and Latin America—143 million people could be displaced by the impacts of desertification, water scarcity, floods, storms, and other climate change-related disasters by 2050. Climate change is defined by the IPCC as “any change in the climate over time, whether due to natural variability or […] human activity.” The relationship between climate change and displacement is impacted by population growth, rapid urbanization, increased human mobility and food, water, and energy insecurity. In Nigeria, climate change has exacerbated the risk of conflict, leading to increased competition over scarce resources, thus serving as both an impact multiplier and accelerator. With more than 2 million persons internally displaced as a result of conflict and climate change, Nigeria’s IDP population ranks as the fourth highest in the African continent and the seventh highest in the world. Further displacement and migration to the central plateau region will overwhelm local communities and government initiatives forcing Nigeria’s IDPs to become refugees in neighboring states unless measures are taken to address the root causes of displacement: conflict and climate.

*Conflict and Competition.* The UN Security Council has highlighted the security implications of climate change, including how it can complicate
and aggravate new and existing security concerns in fragile and vulnerable states. Nigeria has been host to a high number of IDPs since the Boko Haram insurgency began in several north-eastern states in 2009. In March of this year, the United Nations High Commissioner for Refugees identified 2,193,769 conflict-related IDPs in Nigeria. Further complicating matters are renewed religious and ethnic tensions between Nigerian farmers and herders, resulting in violent attacks and tit-for-tat reprisals over scarce resources. Access to natural resources has long been a flashpoint for conflict in Nigeria, and if left unaddressed, threatens to become a major source of regional instability.

Climate Change, Population Growth, and Urban Migration. In 2009, the UN General Assembly recognized natural disasters as a cause of internal displacement and raised concerns that climate change could exacerbate the impact of both sudden and slow-onset disasters, such as flooding, mudslides, droughts, or violent storms. Between 1992 and 2007, “the frequency and magnitude of wind and rainstorms not only increased in Nigeria, but also killed 199 people, destroying property worth N85.03 billion in Nigeria.” In 2014, the World Climate Change Vulnerability Index classified Nigeria as one of the ten most climate-vulnerable countries, and Lagos as the 10th most vulnerable city in the world. Lagos, which supports most of Nigeria’s industrial, commercial, and non-oil operations, is expected to grow to more than 19 million people by 2050; however, its expansion and growth have largely been unregulated. The country’s low elevation, topography, and poor infrastructure make it highly susceptible to flooding, posing a direct threat to the nearly 70 percent of residents living in slums within Lagos. Following heavy rains this past August, Nigeria’s two main rivers, the Niger and the Benue, burst—leaving the country exposed to large-scale flooding leaving more than 561,000 people internally displaced and killing more than 100.

An additional concern in Lagos is the threat posed by the rise in sea levels. The current global estimate of sea-level rise is 0.2m and is projected to increase to 1m by the year 2100. The present 0.2m rise has inundated 3,400 km of the coastal region of Nigeria. If the 1m projection is reached, coastal settlements like Bonny, Port Harcourt, Lagos, and others that are less than 10m above the sea-level would be seriously threatened by a meter increase in sea-level. This rise in sea-levels has the possibility of dislocating millions of Nigerians from southern coastal cities; however, militant insurgencies and climate-related desertification in the northern states will force IDPs to the central part of the state. This concentration of IDPs in the central region will
overwhelm host communities triggering a conflict that requires intervention by the state. To remedy this, the government of Nigeria must act to address climate change to prevent further displacement.

*Political.* Perhaps the most compelling reason to focus on Nigeria as opposed to other climate-affected nations like Somalia or Sierra Leone, is the political power and strategic importance it possesses to western nations, including the United States. Understanding a state’s security and stability is important in determining “how dynamics of conflict, fragility, and peace may either support or hinder [its] efforts to address climate [change].”38 Within the past five years, Nigeria has become Africa’s largest economy and has played a steady peacekeeping role across the region, helping to quell civil wars in Sierra Leone and Liberia.39 In addition to its role as the top oil-producing country on the continent, Nigeria also plays a pivotal role in U.S. Africa Command (AFRICOM) initiatives making it a vital security interest to the United States and its allies.40 Bearing these in mind, one can examine the international legal framework meant to support conflict-related IDPs face in Nigeria.

**From Kyoto to Kampala**

Starting in the late 1970s, the international community developed a series of agreements to avoid and mitigate the effects of climate change including the 1979 World Climate Conference, the 1992 United Nations Framework Convention on Climate Change (“UNFCCC”), the 1997 Kyoto Protocol to the United Nations Framework Convention on Climate Change (“Kyoto Protocol”) and the 2016 Paris Agreement.41 One of the most contested issues from the climate change regime’s foundational years to the present has been the debate surrounding North-to-South development. Since negotiations in 1990, developing states have largely rejected any requirement that would slow their economic growth, arguing that they were not responsible for the climate problem and, therefore, should be allowed to develop in the same manner as those that came before them.42 While small island and low-lying states pushed for major cuts in greenhouse gas emissions, oil-producing states like Nigeria have opposed such mandates.43 As a party to the UNFCC and its Kyoto Protocol, Nigeria has an obligation to ensure the reduction of its carbon emissions. However, as a fossil-fuel dependent country, it has only developed draft policies to address climate change, focusing on adaptation, mitigation, finance, and technology.44

Negotiations for global agreements like the UNFCC and Paris Agreement have often pitted the nations of the heavily industrialized Global
North against the nations of the developing Global South.45 “The Global North-South negotiating positions are derived from inequality in the historical and current emissions of greenhouse gasses, the emerging consequences of climate change, and the geopolitical negotiation power between nation-states.”46 Unlike the UNFCC, which took place in the context of an ongoing development crisis, the Kampala Convention’s inclusion of only African nations enabled those present to identify socially shared understandings of fair solutions.47 The Kampala Convention focuses more on adaptation, technology transfer and finance, creating an interesting gap for climate change reduction as opposed to other blocks in the Global South that focused on drastically reducing emissions without regard to differentiated responsibilities.48

African nations, including Nigeria, share little responsibility for the accumulation of historical greenhouse gas emissions but a greater share in experiencing firsthand the detrimental consequences, despite having fewer financial resources to adapt. In 2009, the African Union put forth the Nairobi Declaration on the African Process for Combating Climate Change which called for developing nations to receive “at least $67 billion a year by 2020 to support adaptation and $200 billion (0.5% of the GDP of OECD countries) to support mitigation efforts.”49 Moreover, the AU also called for financial support to developing nations equivalent to 1.5% of the GDP of those nations in the Global North to achieve climate justice.50

The Climate Conundrum: Balancing a Green Economy

To sustain the biggest economy in Africa, Nigeria relies on volumes of oil and gas mined from its oil fields in the coastal Niger Delta region.51 However, Nigeria’s oil industry is increasingly threatened by climate change—both through its contributions and its effects. The paradox for Nigeria is that “it is too poor to be rich and too rich to be poor,” and is endowed with enormous natural resources that are all too often exported in low value.52 Most of Nigeria’s oil reserves lie in its coastal regions, which are particularly vulnerable to the impacts of climate change. A one-meter rise in the sea level “stands to wipe the entirety of Lagos and about 40 [meters] from the coast into the hinterland,” which may result in the loss of a “vast amount of our oil installations.”53

To prevent this, Nigeria must drive the conversation about climate change to creating greener renewable energy, similar to those states in the Global North, who have anticipated that a shift towards renewable energy will force oil prices to fall below a level capable of supporting their own economy. However, oil and gas production accounts for around 35 percent of Nigeria’s gross domestic product and roughly 90 percent of its total export revenue.54
Until the government can ensure that renewable energy will produce similar profits, it is unlikely that such efforts will be adopted wholesale. Because the Nigerian government will likely fail to remedy its devastating contribution to climate change, it must instead consider how best to assist those affected.

The 1951 Convention Relating to the Status of Refugees

With close to 150 signatories, the Refugee Convention is the centerpiece of the current system of international protection. Since its entry into force, the Refugee Convention has been subject to only one amendment in the form of the 1967 Protocol, which removed the geographic and temporal limits giving the Convention universal coverage. The Refugee Convention is grounded in the right to seek asylum under Article 14 of the Universal Declaration of Human Rights ("UDHR") and provides the most comprehensive codification of refugee rights. Under the Convention, the term “refugee” applies to any person who:

“[O]wing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality and is unable, or owing to such fear, is unwilling to avail himself of the protection of that country; or who, not having a nationality and being outside the country of his former habitual residence as a result of such events, is unable or, owing to such fear, is unwilling to return to it.”

Unfortunately, the Convention’s restricted definition largely ignores the vast number of people placed into traditional refugee-like and conflict-inducing situations because of climate change. In July 2015, the Supreme Court of New Zealand dismissed an application for refugee status based on the effects of climate change in the Pacific Island nation of Kiribati. Mr. Teitiota applied for refugee status under Part 5 of New Zealand’s Immigration Act of 2009. Mr. Teitiota claimed that he was entitled to be recognized as a refugee “on the basis of changes to his environment in Kiribati caused by sea-level rise associated with climate change.” In its decision, New Zealand’s highest court denied Mr. Teitiota’s application stating “in relation to the refugee convention, while Kiribati undoubtedly faces challenges, Mr. Teitiota does not, if returned, face ‘serious harm’ and there is no evidence that the government of Kiribati is failing to take steps to protect its citizens from the effects of environmental degradation to the extent that it can.”
The decision by the New Zealand Supreme Court is representative of the rigidity of the Refugee Convention and its inapplicability to IDPs and migrants affected by climate change. Despite its limitations, the Refugee Convention is a useful starting point for assessing recent steps towards addressing issues of displacement. For instance, both the *Global Compact for Migration* and *Global Compact on Refugees* finalized in July 2018 address the issue of climate change; however, neither provides specific legal international protection to climate refugees. The *Guiding Principles on Internal Displacement* (“Guiding Principles”) created in 1998, provided a normative framework for protecting IDPs in the context of conflict, human rights violations, natural disasters, and development projects. Though not legally binding, they have been affirmed as an important international framework and have even “been cited as forming part of customary international law.” Nevertheless, the only treaty to comprehensively address the IDP issue is the Kampala Convention.

**The Kampala Convention**

Unlike the 1951 Refugee Convention and its 1967 Protocol, the Kampala Convention provides comprehensive protection to IDPs, including those affected by natural disasters. In October 2009, the African Union Heads of States and Government adopted the Kampala Convention with the primary objective of providing sustainable solutions to the issue of internal displacement in Africa. Of particular concern during the drafting process, was the ability of states to address all aspects of displacement, including prevention, protection, and assistance. Those in attendance recognized that the existing framework, primarily based on the Guiding Principles, fell short of its goal in addressing the nearly “10 million people [sic] internally displaced [on] the continent, making up one-third of the world’s IDP population.” To remedy this, the Convention “significantly advance[d] the normative framework on internal displacement in several key areas [including] protection from arbitrary displacement; the responsibilities of the African Union, multinational companies and private security actors; and the right to a remedy for the wrongs associated with displacement, including the loss of housing, land, and property.”

Under Article 1(k), internally displaced persons are defined as “persons or groups of persons who have been forced or obliged to flee or to leave their homes or places of habitual residence, in particular as a result of or in order to avoid the effects of armed conflict, situations of generalized violence, violations of human rights or natural or human-made disasters, and...
who have not crossed an internationally recognized State border.” (emphasis added). In emphasizing their commitment to resolving climate-related issues, state parties agreed to extend responsibility for protecting and assisting IDPs displaced by “natural or human-made disasters, including climate change. 68 Nigeria was the 12th African country to ratify the Kampala Convention. 69

Traditionally, under international law, once a treaty is signed by a country, it automatically assumes a duty to refrain from acts that infringe on the object and purpose of the treaty. 70 Only after ratification, is a country bound under international law by the provisions of the treaty. However, in dualist states—such as Nigeria—there is a third-level requirement that the treaty is domesticated. 71 Pursuant to Section 12 of the Nigerian Constitution, international treaties only become part of Nigerian law upon the act of domestication by the National Assembly. 72 In the case of Abacha v. Fawehinmi, the Nigerian Supreme Court “emphasized the legal implication of the act of domestication noting that once domesticated, an international treaty becomes applicable within the Nigerian legal system, and by extension, the courts are duty-bound to give effect to the treaty.” 73 Furthermore, “once a country has domesticated the Convention, IDPs can assert a legitimate claim to their protection and assistance which national courts can enforce in instances of non-performance by relevant institutions.” 74

Notwithstanding its significance as the first treaty to proactively and comprehensively address the IDP question, the Nigerian government has failed to pass a national legal framework domesticating its provisions in accordance with Article 3(2)(a). 75 In 2006, the Nigerian government began developing a national policy for the protection of IDPs and has revised its provisions twice in 2009 and 2012. 76 Despite these efforts, the policy remains a draft in the National Assembly, which prevents Nigerian courts from giving its provisions any legal effect. 77 Given the inherent tension between Nigeria’s need to promote development and its reluctance to domesticate the Kampala Convention, the best option for protecting IDPs is to adopt a rights-based approach.

**Recommendation: Adopting a Rights-Based Approach for Climate Displacement**

So long as the climate change debate revolves around scientific and economic factors, the incentive for oil-producing states—like Nigeria—that both benefit from and are harmed by climate change will persist. If domesticating the Kampala Convention creates rights that place the sovereign or its financial beneficiaries at risk, it is unlikely that such measures will be taken. Instead,
the climate change debate must shift its focus to the impact of climate change on social and human rights. In a 2008 study, the Office of the High Commissioner for Human Rights examined how climate change impacts specific rights, vulnerable groups, forced displacement, and conflict. The report’s conclusion suggested that efforts to address climate change must also draw on human rights standards and principles—including analysis of its impact on various sectors including food, housing, water, health, and overall standards of living. Because “climate change-related impacts have a range of implications, both direct and indirect, for the effective enjoyment of human rights,” it is imperative that “human rights obligations and commitments [sic] inform and strengthen international and national policy-making in the area of climate change.”

In Nigeria, a rights-based approach to climate change in regard to mitigation and adaptation must consider in what ways, and to what extent, anticipated changes in the climate will impede economic and social development at relevant levels including considerations of poverty reduction, strengthening human rights and improving human health and well-being.

To develop this approach, a distinction must be drawn between rights-holders and duty-bearers. The former refers to those individuals who have been affected by the effects of climate change, whether IDPs or host communities. It is essential that those affected participate in the design and implementation of adaptation and mitigation projects. The latter, duty-bearers, refers to both state and non-state actors capable of addressing climate change. While the Government of Nigeria bears the primary responsibility for ensuring the protection and welfare of IDPs as a signatory to the Kampala Convention, development actors play an essential role in “improving the capacity of countries to provide solutions for IDPs” in terms of immediate needs, and sustainable outcomes. By identifying the standard of treatment to which IDPs are entitled, the Nigerian government can develop ways to ensure its effective implementation.

The International Bill of Human Rights consists of three core human rights treaties of the United Nations that seek to advance the fundamental freedoms and protect the basic human rights of all people. Together, their provisions influence the decisions and actions of state and non-state actors in prioritizing economic, social, and cultural (“ESC”) rights. While all three conventions discussed the enjoyment of all classes of rights, many countries, including Nigeria, have practiced a division that privileges political and civil rights above ESC rights.
The 1999 Constitution of the Federal Republic of Nigeria provides for ESC; however, its implementation has been lackluster. Even Nigerian courts have recognized this protection problem. In *Archbishop Okogie v. Attorney General of Lagos State*, the court recognized the enforceability problem of all rights contained in Chapter II of the Constitution, including the duty to observe and apply the economic, social, and cultural rights. Despite the failure of the Nigerian government to successfully implement ESC rights, the African Commission held that environmental rights are applicable and enforceable in Nigeria by virtue of Article 24 of the African Charter, which also provides for ESC rights. Cognizant of the government’s inability to adequately protect ESC rights and the tension to promote economic development, the rights for food, housing, medical care, social services, and security of IDPs affected by climate change hangs in the balance.

The downside of Nigeria’s urbanization and industrialization is the increase in roads and buildings, which has “increase[d] the proportion of surface area where water cannot be absorbed into the ground, leading to rapid runoff, which then causes flooding during storms.” To minimize the effects of climate change, Nigeria should invest in climate-resilient infrastructure designed, built, and operated with the current and future climate in mind. For example, proper drainage systems should be developed in its coastal cities to mitigate the effects of sea-level rise and to accommodate the increased runoff during the rainy season. Therefore, the government should design a flexible infrastructure capable of future modification without incurring excessive costs.

Moreover, Nigeria must expand its access to and provision of electricity. Nigeria currently can produce an estimated 7,000 megawatts (MW) of power, but due to weak infrastructure, gas supply problems, and water shortages, only about 4,000 MW reaches the national grid. Ready access to electricity “will reduce youth unemployment and increase productivity,” greatly “reducing the carbon footprint of a growing energy demand by its urban population.” According to Babatunde Fashola, the Minister of Power, Works, and Housing in Nigeria, 90 million Nigerians lack electricity. Key findings by Chatham House suggest that “as many as seven million displaced people in camps have access to electricity for less than four hours a day and that the widespread introduction of improved cookstoves and basic solar lanterns could save $303 million a year in fuel costs after an initial capital investment of $334 million.” The report further suggests that there is “a strong human, economic, and environmental case to be made for improving energy access for refugees and displaced people.” By developing its infrastructure, the government can provide basic services to IDPs focusing on housing, food, and security needs.
Additionally, Nigeria should shift its focus from oil reserves towards renewable energy, thereby reducing its carbon footprint and providing economic sustainability for the future. Fortunately, Nigeria has an equal abundance of renewable energy resources that have the potential to close the energy gap that currently exists through solar and wind.\textsuperscript{97} Recent initiatives to encourage the successful return of IDPs have already been implemented in Nigeria’s northern states. IDPs in Nigeria’s Adamawa State were able to return to their villages thanks to a collaboration between the United Nations Development Program and Energy Commission of Nigeria, which provided solar-powered water, electricity, and healthcare projects.\textsuperscript{98} Similar initiatives should be implemented in the central region, where large concentrations of IDPs threaten to overwhelm the host community.

**CONCLUSION**

Despite the disproportionate impact of climate change and conflict on its population, Nigeria is unlikely to domesticate the Kampala Convention. The increase in its population, detrimental reliance on fossil fuels, and lack of sustainable infrastructure will only worsen the effects of climate change and increase its IDP population. The massive influx of IDPs into the central region from northern and southern provinces will not only strain government resources but also instigate further violence between pastoralist, ethnic, and religious groups. To mitigate the effects of climate change, the government of Nigeria should invest in climate-resilient infrastructure to protect its coastal cities, develop its renewable energy industry, and domesticate the Kampala Convention. Should these efforts fail, a rights-based approach to development should serve as a compromise to ensure protection for its most vulnerable population and prevent current IDPs from becoming future refugees.
ENDNOTES


3. Kampala Convention, supra note 2, Art. 2(a).

4. In its March 2018 report, the UNHCR estimated roughly 2,193,769 Nigerians have been internally displaced as a result of the insurgency between government forces and Boko Haram. The UNHCR’s situation report fails to identify the number of Nigerians internally displaced as a result of climate related disasters and is therefore underinclusive of the total IDP population. Nigeria Situation, UNHCR Regional Update (1-31 Mar. 2018) UNHCR, https://reliefweb.int/sites/reliefweb.int/files/resources/63057_0.pdf. [Hereinafter UNHCR Update].


11. Id.


13. The term climate “refugee” continues to lack a formal definition and protection under international law, however, this paper is concerned with climate affected IDPs (who lack necessary legal protection despite the apparent nature of their condition which mirrors that of refugees). See Tim McDonnell, The Refugees the World Barely Pays Attention To, NPR (June 20, 2018). [Hereinafter McDonell]. Available at: https://www.npr.org/sections/goatsandsoda/2018/06/20/621782275/the-refugees-that-the-world-barely-pays-attention-to.


15. Id.

16. SBM Intelligence, The Pastoral Conflict takes a deadlier turn, RELIEF WEB, at 8 (Jan. 10, 2018). Available at: https://reliefweb.int/sites/reliefweb.int/files/resources/201801_PastoralConflict.pdf.


25 See Orji Sunday, Boko Haram, IDP return and political calculations in Nigeria, Al Jazeer (Jul. 4, 2018). Available at: https://www.aljazeera.com/indepth/opinion/boko-haram-idp-returns-political-calculations-nigeria-180704135508696.html. Because the nature of this paper is focused on climate-related and not conflict-related IDPs, an in-depth discussion on the latter is omitted.

26 UNHCR Update, supra note 4.


29 Beyani, supra note 12, at 1.


31 Nugent, supra note 25.


33 Id.

34 UNOCHA, Nigeria: Large-scale floods affect close to two million people, UNOCHA (Oct. 11, 2018). Available at: https://www.unocha.org/story/nigeria-large-scale-floods-affect-close-two-million-people.


36 Odjugo, supra note 27, at 50.

37 Id.

38 USAID, supra note 14.


41 Jeffrey L. Dunoff et al., International law: norms, actors, process: a problem-oriented approach (2015) at 652. [Hereinafter Dunoff] Discussing how the climate regime has evolved from the 1979 World Climate Conference to the Paris Agreement.

42 Dunoff, supra note 38, at 653-654

43 Id. at 654.

44 The Nigerian Federal Executive Council approved the adoption of the National Policy on Climate Change and Response Strategy (“NPCC-ARS”) but questions remain concerning its monitoring and compliance.

45 Christopher Todd Beer, Climate Justice, the Global South, and Policy Preferences of Kenyan Environmental NGOs, 8 The Global South 2, Interdisciplinary Investigations (Fall 2014), pp. 84-100. Available at: https://www.jstor.org/stable/pdf/10.2979/globalsouth.8.2.84.pdf?refreqid=excelsior%3A18d8c3c24fcfb5cccf43852684d5c49d. [Hereinafter Beer].

46 Id. at 84.

47 See id. (citing Roberts and Parks 23, 27).
48 Id. at 86.
49 Id. at 87.
50 Id.
52 Id.
53 Id.
56 Id.
58 1951 Refugee Convention, *supra* note 1, Art. 1(2).
64 1951 Refugee Convention, *supra* note 1. Article 1(A)(2) of the 1951 Refugee Convention restricted the definition of a refugee to include only those individuals who are unable or unwilling to return to their country of origin owing to a well-founded fear of persecution on account of one's race, religion, nationality, membership of a particular social group, or political opinion.
65 Kampala Convention, *supra* note 2, Art. 2(b).
67 Id.
68 Kampala Convention, *supra* note 2, Art. 5(4).
70 See Vienna Convention on the Law of Treaties, Art. 18(a) [Hereinafter VCLT].
71 See VCLT, *supra* note 70, Arts. 14 & 17.
74 Adeola, *supra* note 69.
See Kampala Convention, supra note 2, Art. 3(2)(a) which states that “States Parties shall: Incorporate their obligations under this Convention into domestic law by enacting or amending relevant legislation on the protection of, and assistance to internally displaced persons in conformity with their obligations under international law.”

Adeola, supra note 69.

Abacha v. Fawehinmi, supra note 73.

Beyani, supra note 12, at 5, citing A/HRC/10/61.


Id.

82 Id. Explaining that mitigation and adaptation strategies can lead to human rights violations where adequate participation of local communities is not assured or if due process and access to justice is not respected.

83 Id.

84 The three treaties that represent the International Bill of Human Rights are (1) the Universal Declaration of Human Rights, (2) the International Covenant on Economic, Social and Cultural Rights, and (3) the International Covenant on Civil and Political Rights (including its First and Second Optional Protocol). Each of these treaties is available at: https://www.escr-net.org/resources/international-bill-human-rights. Nigeria ratified all three treaties in 1993.


86 Id.

87 Id. (discussing Archbishop Okogie v. Attorney General of Lagos State (1981)).


89 UDHR, supra note 57, at 52. Pursuant to Art. 25, “Everyone has the right to a standard of living adequate for the health and well-being of himself and of his family, including food, clothing, housing and medical care and necessary social services, and the right to security in the event of unemployment, sickness, disability, widowhood, old age or other lack of livelihood in circumstances beyond his control.”

90 Slaughter, supra note 32.


92 Gerretsen, supra note 54.

93 Id.


95 Johanna Lehne et. al., Energy Services for Refugees and Displaced People, Energy Strategy Reviews at 134 (2016). Available at: https://ac.els-cdn.com/S2211467X16300396/1-s2.0-S2211467X16300396-main.pdf?_tid=a4ec0c2-1c77-4336-9b13-0645f8111264&acdnat=1544325094_001d6f21025bf61c3a6b4d426f8118. [Hereinafter Lehne].

96 Id.

97 Okereke, supra note 51.

Installing Vermifilter Toilets in Liberian Slums: Can a Can of Worms Solve West Point’s Sanitation Problems?

Michael Kuncio, *MID ’20*
*Graduate School of Public and International Affairs, University of Pittsburgh*

**Executive Summary**

Limited access to toilets in Liberia has forced people to practice public defecation. This practice is especially high in its impoverished slums in West Point, Monrovia, where more than 80 percent of residents do not have access to toilets. Poor sanitation is both a symptom and a driver of economic disparity and contributes to the spread of water-borne disease. To help improve sanitation in West Point, I recommend that the Monrovia City Corporation (MCC) install vermifilter toilets. When properly cared for, these toilets do not require connection to the sewer systems, do not have to be emptied for years, and have lower long-term operating costs than pit latrines or other types of public toilets.

**Public Defecation in Liberia Due to Lack of Toilets**

Forty-two percent of Liberians practice public defecation.¹ Poor sanitation practices like public defecation lead to the contamination of drinking water and food and are linked to the spread of diseases like cholera, diarrhea, hepatitis A, and typhoid, as well as stunting in children.²

Poor sanitation in Liberia disproportionately affects women and the poor. A 2012 report estimated that Liberia loses $17.5 million annually (or roughly two percent of the national GDP in 2012) due to poor sanitation—including costs associated with health care, loss of productivity, and access time. People who practice public defecation spend 2.5 days per year looking for places to defecate. Economic burdens are heavier on women, who act as caregivers for children and the elderly, and have increased contact with the sick.³ Sanitation coverage in Liberia is meager with nine percent coverage among the wealthiest quintile and only one percent among the poorest quintile.⁴
Sanitation coverage is especially low in West Point, Monrovia, one of Liberia’s poorest slums, where 70,000 people shared just four public toilets in 2009—the few public toilets that are available today are wooden commodes that hang on stilts over open water. Pay toilets are likewise uncommon, and residents often cannot afford to use them. Consequently, more than 80 percent of people in West Point practice public defecation. The swampy, low-elevation terrain of the West Point peninsula is prone to floods that disperse human feces and worsen the spread of water-borne disease. The local government spends seven times more on curative health care than on preventative health care. West Point should prioritize preventative health care by improving sanitation through investment in toilets.

**Vermifilter Toilets Reduce Human Waste**

West and Central Africa are the only regions in the world where public defecation is increasing, so there are concerted development efforts to improve sanitation here. One successful effort is Oxfam’s Tiger Worm Toilets (TWTs)—developed to overcome two problems with conventional pit latrines in large refugee settlements: over-accumulation of human waste and vulnerability to floods. Using worms that digest human fecal matter, these vermifilter toilets can last for years without emptying when properly cared for (see Figure 1 in Appendix for a sample schematic of TWT). They are also easy to install and have been successful in densely populated, urban locales.

Oxfam piloted TWTs in the Doe Community slum in Monrovia beginning in 2011, and demand for the toilets was high even before construction began. Through partnerships with MCC and local leaders, Oxfam mobilized support for the TWT project. Households with fewer than ten people volunteered to test the toilets. These households received technical training about operating and cleaning the toilets and caring for the worms. The first TWTs in Doe Community were monitored for maintenance and functionality during weekly visits by Oxfam field officers.

Oxfam received critical commitments from the community to provide building materials (sand and locally sourced worms) and labor to construct the TWTs. Each toilet costs $450 to install. By comparison, constructing a block of six public toilets costs $4,000. TWTs are also cheaper in the long run due to reduced operating costs, and they do not require desludging or water treatment. Oxfam has installed 400 TWTs throughout Monrovia as of July 2017, and they are widely accepted by communities and the Liberian Water and Sewer Corporation.
Project Implementation in West Point

Monrovia already has the institutions (and momentum) to build TWTs. Because the MCC handles sanitation and street cleaning in Monrovia and has partnered with non-governmental organizations (NGOs), outside donors, and the Mayor’s office to upgrade its slums,¹⁷ it should aid the construction of TWTs in West Point. Current mayor Jefferson T. Koijee has committed to installing more toilets in West Point through partnerships and community engagement. Koijee reopened three older latrines rehabilitated by MCC and outside partners last year,¹⁸ but efforts should instead focus on constructing more suitable toilets for West Point.

TWTs are the most suitable toilet design for West Point. Previous public toilet designs in Monrovia had to connect to the municipal sewage system.¹⁹ However, the sewage systems in Monrovia cover just seven percent of the population,²⁰ and there are no sewer pipes in West Point.²¹ TWTs do not have to connect to sewers, nor do they need servicing by pumps and desludging trucks.²² Oxfam altered the toilet design mid-trial in Monrovia after flooding drowned the worms and made the TWTs unusable. These alterations moved the drainage tanks outside of the houses and above ground and sealed the bottom so that they are more resilient to flooding.²³

Previous TWT trials in Monrovia are well-documented. Oxfam and other organizations that funded the TWT trial published user guides for constructing and caring for the toilets in large refugee settlements. These guides are easy to follow, and the plans have been adapted for dense urban settings like West Point. They also include suggested questionnaires for monitors to use during follow up visits with households.²⁴ The MCC can use these detailed reports to replicate Oxfam’s previous TWT trial in West Point.

There is a tradition of community participation in projects in West Point. Participation from the Doe Community during Oxfam’s TWT trial was critical to offset the costs for construction materials and labor. Mayor Koijee expects West Point residents to play an active role in keeping new toilets in good condition.²⁵ A World Bank assessment notes that West Pointers actively participate in local projects, and local organizations have proven track records for capacity building and implementation.²⁶ They even assumed the responsibilities of health professionals during the West Point quarantine in the 2014 Ebola outbreak.²⁷ Through partnerships and technical training with the West Point community, the MCC can reduce construction costs and ensure that the TWTs are properly cared for and have greater longevity.
Challenges

Funding this project in West Point without third-party investment and partnership will be a challenge. The United Nations’ Sustainable Development Goal (SDGs) 6.2 calls for “access to adequate and equitable sanitation” and “an end to public defecation.” But, Liberia’s General Auditing Commission raised serious concerns to Liberia’s President and National Legislature in late-2018 about the country’s ability to finance its developmental commitments under the United Nations’ SDGs. The Commission also found that lack of coordination between agencies was another obstacle to future SDG projects. MCC partnership with outside organizations will be critical to constructing TWTs in West Point.

Conclusion

The local government in Monrovia is well-positioned to improve sanitation in West Point by replicating an earlier pilot program that installed TWTs in neighboring slums. These toilets are easy to install and care for and could be an effective way to reduce public defecation, which could help to reduce the spread of disease.

Appendix

Figure 1: Sample schematic of a TWT, according to Watako et al. (2016).
ENDNOTES


13 Ibid.


25 Liberia: Catholic Relief Services.


Cybersecurity Meets Big Business: How the Private Sector is Setting the Precedence in Cybercrime Investigations

Erin Frank, *MPIA ‘20*
*Graduate School of Public and International Affairs, University of Pittsburgh*

**Abstract**

The rate of cybercrime has grown rapidly within the last decade, igniting international security concerns from policymakers all over the world. While the internet is host to many modern conveniences like social media, online banking, and shopping, it is also rife with fraud, identity theft, and even the opportunity to join terrorist organizations. Private citizens aren’t the only victims of cybercrime; global billion-dollar businesses and government agencies can fall prey to it, leaving even the most secure networks open to breaches. As incidents continue to happen, policymakers must consider the national security issues that come with cybercrime occurrences. Election and infrastructure hacking, terrorist threats, and drug trafficking are just some crimes that have infiltrated the internet and raised new transnational security concerns.

Unlike the physical world, cyberspace knows no borders, which makes jurisdiction a consistent issue for cybercrime investigations. Arbitrary jurisdictional boundaries, combined with several limitations of government organizations, leave concerns over whether public sector agencies are in a position to help attenuate cybercrime. To combat these national security matters, government agencies around the world have spent time and money implementing cyber investigation units and developing cybersecurity software. In spite of these efforts, organized crime groups and terrorist organizations continue to engage in cybercrime activity, knowing the limitations that government agencies may have when it comes to investigating and prosecuting crimes.

Transnational cybercrime policies are difficult to formulate and enforce, which means alternative forms of prevention must be considered. In recent years, a growing number of private sector companies have stepped...
into the crucial role of ‘cyber-crime investigator,’ taking it upon themselves to find the criminals and stop the criminal enterprise. Private sector companies employ the experts to investigate crimes, develop protective measures and software, and ensure long-term security, filling in gaps that the government may not be able to provide.

**The Cost of Cybercrime and Cryptocurrency**

With the invention of cryptocurrency, a digital asset that is used as a medium of exchange to secure financial deals, criminal enterprises can engage in rapid fund transactions, often beyond detection and in immediate time. Cryptocurrency is a decentralized digital currency that does not involve a third-party intermediary to verify the transaction of a buyer and a seller. Cryptocurrency transactions, like bitcoin, pass through a shared public blockchain ledger, which acts as a database for tracking money spent.\(^1\) While the information on the blockchain is recorded, the data does not directly link names, addresses, or other identifying markers, which complicates efforts to correctly identify individuals engaged in transactions.\(^2\) Additionally, the blockchain acts as an impartial intermediary and ensures that coins are irrevocable once spent. Should the sender attempt to recall a verified cryptocurrency transaction, the network can hamper the attempt, a feature that is meant to prevent double-spending and duplication.\(^3\)

Bitcoin and Ethereum remain the most popular cryptocurrency for cybercriminals, largely due to the number of anonymity features that are purposely embedded into the transactions.\(^4\) Unlike bank transactions, cryptocurrency is not governed by a central authority that monitors these exchanges, and the currency and assets cannot be frozen.\(^5\) This allows criminals to commit illicit activity under the radar with less chance of discovery. Due to this gap in security features, investors have become increasingly wary of investing money in the online market, precipitating the market value of cryptocurrencies to drop 75 percent.\(^6\)

In 2019, the online black market was expected to value at over $1 billion in cryptocurrency purchases, edging out the 2017 record of $515 million worth of bitcoin transactions.\(^7\) In a 2018 study by researchers in Sydney, “…estimates suggest that in April 2017, there are an estimated 27 million bitcoin market participants that use bitcoin primarily for illegal purposes. These users annually conduct around 37 million transactions, with a value of around $76 billion, and collectively hold around $7 billion worth of bitcoin.”\(^8\) According to a Chainalysis report, bitcoin transactions that are
tied to illicit deals appear to be diminishing, largely due to bitcoin’s declining value. However, with the invention of other forms of online transactions and illicit marketplaces, cybercrime is still expected to cost governments and businesses over $6 trillion in global damages by 2021.

The Criminals, The Companies, and The Cessation

The Criminals. In today’s technological era, it is unsurprising that many transnational organized crime groups and terrorist organizations have moved parts of their operation online. In North Korea, transnational organized crime groups infect computers with ransomware, only decrypting the computers after demanding a cryptocurrency ransom. In China, criminal groups smuggle money using cryptocurrency, which eliminates the need to move large amounts of cash across borders. In 2017, the transit system in Sacramento, California incurred a cybersecurity breach from an unknown entity; hackers began erasing data and demanded a bitcoin ransom worth over $8,000 in order to return control of the system to officials. European mafia organizations, like the ‘Ndrangheta, have moved their drug trade to the darknet, which has created a shift in the market, as synthetic drugs are now being developed in Canada and Israel instead of Bolivia and Afghanistan. In 2017, the transit system in Sacramento, California incurred a cybersecurity breach from an unknown entity; hackers began erasing data and demanded a bitcoin ransom worth over $8,000 in order to return control of the system to officials. European mafia organizations, like the ‘Ndrangheta, have moved their drug trade to the darknet, which has created a shift in the market, as synthetic drugs are now being developed in Canada and Israel instead of Bolivia and Afghanistan.

While there is no indication that digital currencies have been adopted by terrorist organizations on an institutional level, several organizations use cryptocurrency and the illicit marketplace for terrorist financing and campaigning. Al-Sadaqah (an al-Qaeda linked terrorist organization) is known to use Facebook to campaign for bitcoin funding. In 2017, a woman in New York was arrested for obtaining $62,000 in bitcoin that was to be sent to the Islamic State.

The Companies. When the United Kingdom’s South East Regional Organized Crime Unit was tasked with finding an anonymous drug dealer who sold methamphetamine on the dark web, they reached out to Elliptic, a private sector company in the U.K. that uses cryptocurrency forensic techniques to track down criminals. Using digital forensics, Elliptic’s experts were able to track cryptocurrency blockchain transactions, eventually leading investigators to identify the 26-year old drug dealer. Alongside forensics, the company uses software to track crypto-assets and navigate cryptocurrency compliance, which helps the private sector ensure the security of its assets.
and funds. Using blockchain technology, Elliptic actively identifies dark web marketplaces, proceeds of thefts, and money laundering crimes.  

Elliptic is just one of many startups working to create and license forensic software to law enforcement agencies around the world. Law enforcement often works with less sophisticated technology and a lack of digital forensics equipment, leaving a need for the private sector market to fill in this gap. This lack of governmental resources may be due to cost or a lack of expertise to use the programming. Should law enforcement want to make use of such software, they may reach out to a company like Blockchain Alliance, an organization that combines data analysis companies with law enforcement agencies in order to combat criminal activity on the blockchain. Co-founder Jason Weinstein advises that the forensic software industry is “booming” because it has the ability to track cryptocurrency transactions and intercept crimes like drug sales, money laundering, and kidnapping ransoms.

Cyber-based companies, such as Twitter, PayPal, Amazon, and Netflix, have a lot at stake when it comes to cybersecurity and data protection. A cyberattack could be detrimental to productivity, could cost millions of dollars, and could hinder customer confidence in the business. These companies often hold onto detailed customer information, which could lead to large leaks and private data stolen. Cyber-based private companies will likely have the greatest ability to implement cybersecurity barriers as they develop and work directly with the technology needed to run their respective business. Businesses have invested in firewall software, cybersecurity experts, and encrypted data, which are meant to proactively prevent cybercrime.

While large companies, like IBM and Google, have their own cybersecurity divisions, there are other companies, like Elliptic, that have been created for the sole purpose of investigating cybercrime. These companies often work as contractors to larger businesses or as partners with law enforcement. Unlike law enforcement entities, private sector companies conduct business around the world and are not subject to the same jurisdictional restrictions. Additionally, private sector companies employ in-house experts that conduct cybersecurity measures regularly and are solely dedicated to their respective employer, unlike the public sector, which often balances multiple cases at once. This allows for a rapid response in the event of a cybersecurity issue, which likely establishes consumer confidence and allows additional measures to be taken reactively.

The Cessation. Local police departments often defer to the federal government when it comes to illicit activity investigations on the dark web. Due to the
limitations of the federal government and the overwhelming number of cases
they work on, there is a lack of regular enforcement on the internet, which
provides little deterrence for cybercriminals. Texas cyber police detective Nick
Selby notes that “…in my experience, a cybercrime only becomes “serious”
around $200,000 of loss…federal investigators are busy.”23 A lack of consistent
sentencing for criminals has also done little to deter illicit activity. According
to the Office of Legal Education, the maximum sentencing for cybercrimes is
around ten years,24 but it is rare that defendants receive that length of time.

The varying mechanisms underlying cybercrime presses the need for
cyber expertise to continue to evolve. The private sector predominately owns
and manages the critical infrastructure in countries around the world, which
makes it a constant target for cybercrime. Because of this, it has developed
strategies to deploy security measures that are designed to proactively and
reactively identify and prevent criminal activity. These strategies may
involve technical or financial investigations, often collecting and preserving
digital evidence or conducting cyber forensics, which can be used to obtain
information about the incident and build a case against the criminals.25 The
private sector may collaborate with industry bodies, trade organizations,
and digital forensic services, for which it may hire external investigators or
use expert staff employees. The Federal Bureau of Investigation notes that
the most frequent online scams include phishing scams, email compromise,
romance fraud, spoofing, or identity theft.26 Donna Gregory, Chief of the
FBI’s Internet Crime Complaint Center, notes that “Criminals are getting
sophisticated. It is getting harder and harder for victims to spot the red flags
and tell real from fake.”27

Challenges and Considerations
The disadvantages of private sector involvement must also be considered. The
jurisdiction in the cyber realm is unfeasible to determine, which could lead to an
overlap in investigations between law enforcement, international agencies, and
the private sector. It must also be considered that these companies do not hold
the prosecutorial power that federal governments do, and that any investigation
conducted in the private sector would likely need to be investigated by law
enforcement as well. The most considerable concern is that privately-owned
companies are likely not trained in cybercrime investigation and may not have
the necessary knowledge and tools to handle digital cybercrime evidence in
order to ensure its admissibility into courts of law.28 29
The government faces its own set of challenges, including insufficient resources and funds, which make it difficult to attract and retain expert staff. According to the Cybersecurity and Infrastructure Security Agency, there were over half a million job openings in the cybersecurity field in 2019.\(^{30}\) By 2022, the number of unfilled cybersecurity jobs is expected to rise to nearly 1.8 million.\(^{31}\) The United Nations Office on Drugs and Crime notes that the public sector is experiencing “brain drain,” as cybersecurity experts are leaving the government to work in the private sector.\(^{32}\) Many private sector companies fund and employ cybersecurity experts who have the education and training to investigate criminal activity and create security software. Additionally, the private sector often pays higher salaries, provides better benefits and resources, and surpasses the public sector in morale and company culture.\(^{33}\) The combination of limited expert personnel and competitive benefits packages has caused the U.S. government to see substantial competition due to “The internet…growing faster than the growth of the people to protect it.”\(^{34}\) The disproportionate amount of specialists employed by the private sector makes it better equipped to investigate crimes without the hindrance to staffing or budget issues.

Currently, there is no transnational enforcing body that is responsible for investigating cyber crimes and maintaining security. While there are growing instances of cooperation between the public and private sectors, there are still gaps in information sharing, which often lead to miscommunication and overlapping investigations. International organizations, such as the United Nations Office on Drugs and Crime, are making transnational strides in bridging the gap between the public and private sectors by providing training, tools of investigation, and the expertise needed to prosecute crimes.\(^{35}\) As a result of this effort, training was delivered in partnership with the International Centre for Missing and Exploited Children and Facebook, leading to the arrest and conviction of a high-risk pedophile with over 80 victims.\(^{36}\) Bridging this gap allows for timely investigations with the assurance that the investigations are conducted legally and with expert precision.\(^{37}\) A partnership between the public and private sector acts as a deterrent and offers expanded oversight over the cyber realm.\(^{38}\) Despite the potential benefits of cooperation between the public and private sector, the private sector is under no obligation to partner with government entities and could hinder investigations by refusing to share information.\(^{39}\)
CONCLUSION

Cybercrime activity remains complex and adaptable, which means that the methods of investigating crime must also evolve. The private sector’s strength lies in financial means, expert staff, and the resources to investigate and protect against cyber malfeasance. While cybercrime activity continues to seep into every business, government agency, and individual household, law enforcement agencies and policymakers do not have the resources, technology, nor the expertise to investigate each act of criminal activity. Examinations by the private sector help eliminate gaps in investigations and ultimately ensure that national security is a top priority. Because the private sector manages much of the critical infrastructure worldwide, they remain in the best position to provide proactive and reactive security measures to prevent the crimes, track the criminals, and stop the enterprise.
Endnotes


3 Ibid.


9 Kharif, O. (2019, July 1).


16 Ibid.


18 Ibid.


21 Ibid.


27 Ibid.


34 Ibid.


36 Ibid.

37 Ibid.


39 Ibid.
Securing Key Ports, Food Distribution Sites, and Humanitarian Food Relief Operations through United Nations Peacekeeping Operations (PKOs) in Hodeidah

by Joseph Skibbens, MPIA '20
Graduate School of Public and International Affairs, University of Pittsburgh

EXECUTIVE SUMMARY
The following policy brief describes conditions of the humanitarian crisis in Yemen as of March 26, 2019, and does not necessarily reflect the current situation. What follows here is a consideration of the challenges inherent in the effective distribution of humanitarian aid in a conflict setting. Approximately 20 million Yemenis are experiencing severe levels of food insecurity. The ongoing civil war is impeding humanitarian food operations. Active violence, blockades at key ports in Hodeidah, and road closures across Yemen are making food silos and in-need populations inaccessible to relief workers. Creating protected zones of control through peacekeeping operations in Hodeidah will improve the accessibility of ports and food silos and maximize the benefits of ongoing Food and Agriculture Organization of the United Nations (FAO) and World Food Program (WFP) operations.

Food Crisis in Yemen
Protracted violence in Yemen is exacerbating chronic food insecurity vulnerabilities, which predate the civil war. Despite ongoing humanitarian food assistance operations by the WFP, the FAO, and other aid groups, Yemen faces an acute food crisis. Table 1 shows the estimated needs of over 20.1 million Yemenis falling within Integrated Food Security Phase Classifications 3-5 as of January 2019. Eight-five thousand children under the age of five have died of severe acute malnutrition since the beginning of the conflict in April 2015, according to conservative estimates.
Table 1. Needs Estimates in Yemen With and Without Aid

<table>
<thead>
<tr>
<th>Integrated Phase Classification Ranking</th>
<th>Estimated people in need, not accounting for ongoing humanitarian food assistance</th>
<th>Estimated people in need, adjusted for ongoing humanitarian food assistance</th>
</tr>
</thead>
<tbody>
<tr>
<td>IPC 3</td>
<td>10.1 million(^a)</td>
<td>10.8 million</td>
</tr>
<tr>
<td>IPC 4: Pre-famine</td>
<td>9.8 million(^b)</td>
<td>5.0 million</td>
</tr>
<tr>
<td>IPC 5: Famine</td>
<td>238,000</td>
<td>63,500</td>
</tr>
<tr>
<td>Total: IPC 3-5</td>
<td>20.1 million</td>
<td>15.9 million</td>
</tr>
</tbody>
</table>

Hodeidah’s three ports (Hodeidah, Saleef, and Ras Isa) are crucial points-of-entry for humanitarian aid and imported goods. Blockades and intermittent fighting over Houthi-held Hodeidah limit relief organizations’ ability to both import food and access Yemenis facing deepening levels of food deprivation. The Red Sea Mills silos in Hodeidah contain enough WFP grain to feed 3.7 million Yemenis for a month. These food silos are inaccessible due to blocked roads and active fighting between Houthi and Saudi-coalition forces, and the grain stores are currently at risk of rotting. Progress on agreements for the mutual redeployment of Houthi and coalition forces in Hodeidah, which would grant access to ports and food silos, is jeopardized by recent outbreaks of violence in Hodeidah.

Policy Options and Recommendation:

As a short-term palliative response to an acute food crisis, FAO should seek coordination with United Nations Peacekeeping Operations (UNPKO) to assist in providing the security and logistical support for ongoing FAO operations.

Currently, the Famine Prevention Plan incorporates the Food and Agriculture Organization of the United Nations initiatives with the operations of partner relief organizations (WFP, United Nations Children’s Fund, World Health Organization) from January to June 2019 to address acute food insecurity in Yemen.

Through the FAO Famine Prevention Plan (FPP), three main projects, outlined in Table 2, are being pursued across Yemen to alleviate food deprivation and improve purchasing power.
Table 2. FAO Programs Active in Yemen

<table>
<thead>
<tr>
<th>Program</th>
<th>Details</th>
<th>Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unconditional Cash Transfers</td>
<td>- 54 USD per month to 208,080 food insecure households for five months</td>
<td>45.7 million USD</td>
</tr>
</tbody>
</table>
| ‘Emergency Agricultural Livelihoods’ Inputs  | - Home Gardening Kits: 153 tons of vegetable seeds and 85,000 requisite tools  
                                             | - Emergency Fishery Kits: 11,470 kits                                    | 30.1 million USD |
|                                              | - Poultry Production: 19,350 inputs (includes birds, feed, watering pans) |
|                                              | - Animal Feed Kits: 71,730 kits                                         |               |
| Cash for Work                                | - Targets 20,000 households to rehabilitate roughly 500 community agricultural infrastructure/productive assets | 6.5 million USD |

The effectiveness of ongoing projects is undercut by environmental conditions: 1. Travel bans and blocked roads impede aid workers and the transportation of goods; 2. The precarious security situation prevents access to governorates in experiencing high levels of famine or pre-famine conditions (Hajjah and Taizz). Conducting these projects in peacekeeping-secured zones will improve the safety of both Yemenis and aid workers, while reducing disruptions and threats to these projects.

To meet the requisite assumptions of the FPP, FAO proposes that UNPKO responsibilities include:

- Securing access to key seaports and food silos in Hodeidah.
- Deterring fighting between belligerents and aerial bombing near aid workers and relief operations.
- Maintaining open transportation routes between Hodeidah and key sites of relief operations, eventually expanding to include other governorates in famine or pre-famine (Hajjah and Taizz).
- Facilitating mutual force redeployment in Hodeidah as a neutral third-party force.
- Promote existing humanitarian aid by providing secure areas of control and reducing extortion and theft of relief goods.
Monitoring and Assessment

- Continue to use IPC system monitoring to indicate changes in food insecurity to track negative or positive changes over time.
- Track the percentage of cash-and-aid disbursements that reach completion.
- Conduct qualitative research (interviews, community asset mapping, etc.) to determine the impact of relief projects in Yemeni agricultural communities.
- Monitor incidents of fighting and aerial bombing in peacekeeper-controlled zones.
- Track activity in Hodeidah ports and along peacekeeper monitored roads.

**Figure 1. Acute Food Insecurity Situation (December 2018-January 2019)**
ENDNOTES


7 Ibid.


10 Ibid.


Access to Contraception is a Gender and Development Issue: A Comprehensive Look at Georgia and the United States

by Summer Hunter-Kysor, MID '20
Graduate School of Public and International Affairs, University of Pittsburgh

Abstract
International Development objectives, specifically the Sustainable Development Goals (SDGs), will only be attainable when approached in a manner that incorporates gender equality. The SDGs will be more achievable internationally when access to and awareness of contraception increases. Most significantly, access to contraception stands to impact SDG 3: Good Health and Well-being, by decreasing rates of maternal mortality, neonatal mortality, under-five mortality, new HIV infections, and improving access to sexual and reproductive health services. The comparative cases of the country of Georgia and the United States demonstrate the need for both high-income and low-income countries to improve family planning services and availability.

Literature Review
In recent years, it has been assumed that gender will automatically be taken into consideration when designing a development intervention. However, viewing an initiative through a gender lens oftentimes means approaching women separately from men. In Gender and Development, Janet Momsen explains why gender roles are important to incorporate in development initiatives from the outset instead of as an afterthought. Taking women's distinct needs, priorities, constraints, and aspirations into account in designing and implementing projects empowers women. Society assigns women socially and biologically reproductive roles and jobs that align with those expectations. This impacts women's lives in all areas, including income, education, and employment.
Economic growth and modernization are not naturally gender-neutral. *Why Gender Matters in Economics* by Mukesh Eswaran and the United Nations Development Programme (UNDP) *Gender in Development Programme: Learning & Information Pack* provide economic arguments for gender-equal initiatives. The differentiation between productive work and reproductive work in a society leads to significant differences in pay and the value of labor. Community and kinship roles are traditionally the responsibility of women in addition to uncompensated reproductive labor and informal labor.

Access to contraception, specifically, is a major economic advantage for countries. Many women with large families are prevented from working outside of the domestic sphere. This means that they are not compensated for their daily labor, and this contributes to financial issues for the family. More women are able to work outside of the home and lessen the financial burden on their families with methods of preventing or delaying pregnancies.

*Advancing Women’s Sexual and Reproductive Health* by Jennifer Parsons and Jennifer McCleary-Sills, *Origins of Family Planning Programs* by Judith Seltzer, and *The Right to Know* by Sandra Coliver investigate the benefits of contraception on society. With access to contraception, the number of deaths resulting from unsafe abortions would decrease by between 100,000-200,000 per year, and 80 million unintended pregnancies would be prevented. Childhood marriage rates inversely decrease when access to contraception increases. Moreover, women’s rights increase and they have more economic and social opportunities, given control of their sexual and reproductive health.

In this paper, data collected by international development organizations and national health agencies regarding access to contraception in the United States is compared to the same data from the country of Georgia. The availability of data in this field extends from around 1995 to 2019. With respect to contraception rights in the United States, *Guttmacher* and the *American College of Obstetricians and Gynecologists* were consulted among other sources. Each provided information about the history of family planning in the United States in addition to relevant statistics. In the case of Georgia, *Abortion and Contraception in Georgia and Kazakhstan* by Suzanne Olds and Charles Westoff and “Contraception Matters: Two Approaches to Analyzing Evidence of the Abortion Decline in Georgia” by Florina Serbanescu *et al.* were vital sources to understanding the background of contraception and abortion.
Contraception is a Development Issue

Gender equality must be an assured aspect of enacted policies if the objective of international development projects is to achieve sustainable and equitable growth. A significant change is necessary for gender equality to be guaranteed within societally defined gender roles. Men and women have different needs, priorities, limitations, and ambitions. True gender equality will only be reached when both have equal opportunity to lead equally fulfilling lives.10

This paper observes the inequality between men and women based on gender norms that stem from a lack of access to reproductive health care. Globally, every region struggles with securing women’s access to contraceptive services. In failing to provide these vital health services, major economic, social, health, educational, and human rights inequalities have emerged.

Economically. Women have the lowest-paying jobs and the lowest socioeconomic status in every nation in the world.11 This is due in part to the separation of productive work and reproductive work based on biological sex. Women are almost always associated with reproductive work, such as the bearing and rearing of children, domestic duties, and care of family. Productive work, which is generally linked to financial income, is instead associated with masculinity. Since productive work is often more visible in the public arena, it is more heavily valued within society at large, thus granting women a subordinate status.12

However, every year more and more women participate in the labor market while simultaneously being held responsible for a majority of their households’ domestic work.13 Although these women also earn an income from the hours spent working outside of the home, hours they spend performing domestic labor are not remunerated. Unlike male members of the family, women are generally held responsible for childbearing and nurturing (health, education, and socialization of children), care and maintenance of the household (household chores, food preparation, and caring for ill family members), and managing social traditions (community networks, familial ties, and ceremonies).14 Due to the commitment required of these responsibilities, women sacrifice a significant amount of time, which could be dedicated to leisure, education, or employment to lessen the financial burden of their families.

Increasing women’s access to contraception will address many of these economic issues. Many impoverished families cannot expend additional resources for a child. Without contraception, however, many families continue to have more children than they can afford or desire. Many women
are pushed to find methods of terminating or avoiding pregnancy that are physically, mentally, and financially costly. Having more children also means more domestic responsibilities and time dedicated to the well-being of others, thus reducing the power to pursue other opportunities. When women have more children than desired, many are prevented from working for additional income that the family may need. These issues feed into the extent of a family’s economic poverty.

This paper acknowledges that there are financial barriers preventing women from accessing the necessary healthcare facilities and services required for increased access to contraception. These barriers are dependent on national healthcare policies and the implementation thereof. This topic is further explored in the specific cases of Georgia and the United States.

Socially. Fertility is the most commonly measured aspect of women’s lives in national and international databases. Research indicates that there is a correlation between a woman’s high level of fertility and her access to education and family planning. Many women with lower levels of education and higher levels of fertility do not know how to prevent pregnancy or protect themselves from sexually transmitted infections (STIs). Even populations that have access to various methods of contraception cannot properly and safely utilize them without being educated on proper utilization methods. Societal norms, prejudices, and lack of trust dictate which methods families decide to use in many situations. With one-third of women in developing countries pregnant or lactating at any given time, it is important for women to have access to and information regarding contraception.

Gender equality cannot be reached without women and girls having the ability to control their own sexual and reproductive health. Contraception gives women control and a sense of empowerment, yet 20 percent of married women in developing countries have an unmet need for family planning. Due to societally-disapproved premarital behavior, unmarried and younger women have much less access to contraceptives. Consequently, this puts millions at risk because of an inability to access contraception and millions more at risk for attempting to access contraception when deemed socially unacceptable.

Health Impacts. Access to contraception does not have a positive impact on women’s empowerment alone; it also has a major impact on women’s, children’s, and families’ health. Unsafe sex is the second leading cause of health problems in low-income countries and will remain so until access to contraception is thoroughly improved.
Pregnancy-related causes of death are most frequent among youth (ages 15-19) in developing countries. Teenage pregnancy increases maternal mortality, decreases educational attainment, and has long-term negative impacts on one’s economic earnings throughout life, creating a poverty cycle. Roughly 16 million youth between the ages of 15 and 19 are pregnant annually; about 2.5 million are under 16, and 90 percent of pregnant youth are already married. Adolescent pregnancy increases the risk of an unhealthy child. A mother’s responsibility to take care of an ill child leads to decreased time spent dedicated to the rest of her family and a lower quality of life for the entire family. Young mothers are already less able to care for children properly, and additional health problems only intensify existing difficulties.

The high percentage of pregnant youth already married reflects cultural pressure to have a united family and young women, especially mothers, in positions of dependency. The younger the mother, the less decision-making power she typically has within her family. When contraception is made more accessible—especially to younger populations—the chance that a woman will give birth to her first child before the age of 22, decreases by 14 percent.

Without contraception, women may be unable to space out pregnancies sufficiently. Not only is this better for their own health, but it is also better for their children’s health. High fertility negatively impacts maternal, infant, and child mortality rates. Every year 500,000 women die in pregnancy and childbirth, most of whom reside in developing countries. If contraception were accessible to all women who do not want any more children, the maternal mortality rate would decrease by 25 percent or 125,000 deaths. Additionally, smaller families increase a child’s health and lead to a higher level of education. When the fertility rate decreases, life expectancy increases. Seventeen percent of all women in the developing world have an unmet need for family planning services. If family planning needs were met, the level of fertility would decrease significantly, therefore positively impacting levels of education, decreasing mortality rates, and improving overall health for the entire family.

In recent years, there have been roughly 208 million pregnancies annually worldwide, 41 percent of which are unintended. Around one-quarter of all pregnancies end in abortion, but they are not always medically supervised or safe procedures. There are an estimated 20 million unsafe abortions annually, with 90 percent percent of those occurring in developing countries. The risk of abortion is high in these scenarios, whether a woman has decided she does not want another child, cannot afford another child, or needs to space out children. Complications include sepsis, hemorrhaging,
genital and abdominal trauma, tetanus, perforation of the uterus, and poisoning from abortion-inducing medicines. Deaths from these injuries make up about 13 percent of the maternal mortality rate and account for 100,000 to 200,000 deaths per year. With greater access to contraception, pregnancies can be more spaced out, and there is less of a need for women to undergo risky practices to terminate a pregnancy.

Unprotected sex has health implications aside from pregnancy, such as possible exposure to sexually transmitted infections (STIs). As of 2017, HIV was the leading cause of death for women between the ages of 15-49. The rate of death from HIV/AIDS has declined tremendously in recent years, but women are still three to five times more susceptible than men, especially in countries where they have lower levels of decision-making power. This can be especially dangerous in combination with the absence of contraception, because HIV/AIDS is more easily and rapidly spread via unprotected sex. Children of women with HIV/AIDS may also be born with the virus.

Without access to various birth control methods, many other STIs are also very easily spread, leading to health problems including chronic abdominal pain, pneumonia, blinding eye infections in infants at birth, discomfort and genital erosion, infertility, stillbirths, cervical cancer, and ectopic pregnancies. Greater access to contraception not only decreases these risks, diseases, and injuries, but also provides additional health benefits that allow women to lead more fulfilling lives. Access to oral contraceptives specifically, prevents anemia, reduces menstrual bleeding, reduces the intensity of premenstrual symptoms, and lowers the chance of developing certain types of cancer. By meeting the unmet need of millions of women to contraceptive services and family planning, women’s, men’s, and children’s health and quality of life increase significantly.

**Education and Human Rights**

Education and information about reproductive health are lacking in virtually all countries and among all cultural and socioeconomic groups. Even with access to family planning services, many people will not reap the benefits if they are not properly informed about the proper contraceptive methods. The United Nations attempted to close this gap with a 1969 General Assembly Resolution calling on governments to provide families with the knowledge and means necessary to control fertility with the intention of assuring greater opportunity to each person in reaching their full potential. It is a basic human right to be able to decide when and how many children one has. The UN Universal Declaration of Human Rights of 1948, which identified civil and
political rights, personal freedoms, and economic and social welfare as basic human rights, also supports this later call to action.35

Research in various developing countries has shown that an increase in sexual education in the school system leads to more overall knowledge about sex and contraception and higher rates of condom use. This works best when combined with empowerment education, which enables women to lead more autonomous lives by providing access to resources and knowledge through leadership and skills-focused courses.36 Conversely, people who are more educated are more likely to seek out preventative services in all aspects of health care.

The Case of Georgia: A Country Dependent on Abortion
The development of family planning programs in Georgia is a prime example of the benefits access to contraception provides to a nation. Abortion has been the most frequently chosen method of birth control in Georgia. Between 1995 and 2005, the average Georgian woman was thirty years old, had a high school degree, a job, a husband, two kids, and four abortions. Around two-thirds of pregnancies were aborted annually,37 making it the highest abortion rate in the world. Though abortion laws in Georgia remain lenient, citizens had very limited access to legal and safe abortions due to high cost, geographic location, religious restriction, and the doctor’s personal views—meaning that most abortions performed on women were harmful “at-home” or “back-alley” procedures.38

Lack of access to and information about other contraceptive options was another major factor leading to Georgia’s extreme rate of abortion. Sixty percent of women said their most recent pregnancy was not wanted or mistimed.39 Of those pregnancies, 96 percent ended in abortion.40 That is 2.2 abortions per live birth.41 While those women may have been able to prevent pregnancy instead of being forced to risk their physical health, many did not realize they had other options.

The enactment of sexual education in schools was abandoned in 1999. Only 46 percent of women in Georgia knew where to obtain oral contraceptives. Even those who knew how to prevent pregnancy had a difficult time utilizing that knowledge due to the scarcity of pharmacies in rural and mountainous regions. The people who managed to reach a pharmacy received no medical guidance. Pharmacists who supplied alternative methods were not trained in family planning, the benefits and disadvantages of contraceptives, and were not legally permitted to provide counseling.42 Due to these barriers, only 25 percent of women between the ages of fifteen and
forty-four were using any form of contraception. Of those, 88 percent were using traditional methods, including rhythm and withdrawal. Traditional methods have higher rates of failure in preventing pregnancy than modern methods, yet again leading vulnerable populations to unintended pregnancies and abortions.

Cost and social pressure were additional factors prompting women to opt-out of modern methods of contraception. Clients of family planning services had to pay for counseling, physician examinations, and prenatal care. In 1999, the cost of an abortion was roughly $12.50, whereas modern contraception cost $8 per month ($96 annually). This price was too high for nearly three-quarters of Georgians to save and spend, especially when the failure rate of the pill and other methods were high as a result of misuse.

Socially, contraception was not viewed positively. Most Georgians viewed childcare as a woman's main job and it was extremely important to have as many children as possible. The government encouraged this through pronatalist family planning policies in order to halt major population decreases. Furthermore, men generally had negative feelings about condom use. Because most doctors and other healthcare professionals had no information on family planning, misinformation spread easily. Most people thought that condoms caused cancer and infertility, gave them HIV, and made them gain weight.

The Georgia Orthodox Church was also able to greatly sway public opinion. They did not think favorably of abortion or contraception, since a woman's main duty was to raise children. The public looked down upon any woman seeking an abortion, contraceptives, or treatment for an STI. Women dealt privately with pain and discomfort contracted from STIs and resorted to unsafe abortions. With great feelings of sin and guilt, women drank boiling water, milk with vodka, or herbal teas to induce abortions. They used quinine tampons, lifted extremely heavy objects, put their legs in hot water, and jumped from high places. They performed these actions to avoid giving birth to children they had not intended or could not afford.

The Impact of Access to Reproductive Health Care
The Georgian government, the United States Agency for International Development (USAID), and the United Nations Population Fund (UNFPA) proposed policy changes to address major issues stemming from unsafe abortions in Georgia. Georgia did not have a national family planning program until 1995 when the government implemented a major health reform. However, progress remained limited due to an ongoing civil war throughout
various regions of the country. Focused on resolving these ongoing conflicts, Georgia limited the funds available to health care, including family planning and reproductive services.

The USAID began a family planning program in Georgia in 2000. Their program entailed the creation of a commercial market for contraceptive implants offered at affordable prices. The program followed a four-step approach based on a successful program implemented in Romania in the early 1990s. By 2003, over 55 women’s wellness centers and family planning clinics were established. Doctors, pediatricians, midwives, and nurses were trained in contraception and family planning practices. Educational materials, including contraceptive and counseling information, were distributed to practitioners and the general public.

These efforts were extremely successful, and by the end of 2012, there were more than 800 sites nationwide providing family planning services, compared to 16 in 2002. The program also effectively decreased waiting time for care, increased modern contraceptive use to 35 percent (from 25 percent), and more than halved the abortion rate from 3.7 to 1.6 per woman by 2010. Overall, the implementation of this program was a great accomplishment: The unmet need for contraception was decreased to 31 percent, and changes in contraceptive use patterns were responsible for an approximate 77 percent reduction in the abortion rate. As a whole, the programs and policies implemented in Georgia to address the major abortion, contraception, and healthcare disparities were effective and provided an adjustable model upon which other countries can base their programs.

The Case of the United States
Many international organizations and nations regard the Organization for Economic Co-Operation and Development (OECD) average rates of contraception and maternal health as goals. The OECD is made up of 36 industrialized countries, including the United States, that aim to advance global economic and social development. On average, OECD countries meet 78 percent of the need for contraception. The average maternal mortality rate in OECD countries is 14 deaths per 100,000. Compared to many other nations in the world, the OECD is extremely successful in its efforts to expand access to modern contraception, among other healthcare services. However, some of the member states do not meet all expectations regarding reproductive rights.

Though the United States is an OECD country, it too could benefit from better access to and information about contraception. Just as in developing
countries, the more family planning services women have access to, the fewer children they have and more spacing between pregnancies leads to better overall health and income for women, men, and children. Yet, the United States does not have a universal health care system, thus limiting the benefits of family planning programs.

Two-thirds of women in the United States of reproductive age obtain family planning services from private physicians. The United States has the most expensive health care system in the world. Even with health insurance, women and their families are forced to pay for both the consultation and the prescribed form of contraception. Few birth-control methods are available without a prescription, further limiting access to affordable and suitable contraception. Families without health care (roughly 14 percent of women of reproductive age) must pay more out-of-pocket for appointments and prescriptions, and they are most likely to be below the poverty line. In fact, as of 2014, 20 million women were in need of publicly funded contraception due to their income level or because they were under 20-years-old. With access to contraception, two million unintended pregnancies could have been avoided. Though policies regarding health care and birth control in the United States have changed under the Bush, Obama, and Trump administrations, between 2000 and 2010, the number of women in need of contraception increased by 17 percent. With an international goal of increasing access to birth control and gender equality, this increase remains a serious deterrent.

Youth in the United States have a more difficult time attaining contraception than adults. Four out of 10 physicians, three out of 10 family practitioners, and two out of 10 OBGYNs will not provide contraception to a minor without parental consent. Furthermore, fewer than one-third of states require any sexual behavior topic other than abstinence education in schools, resulting in less than ten percent of students receiving a comprehensive sexual education. Without proper education on the matter, youth may not know where or how to obtain contraception or how to use it, leading to more STIs and unintended pregnancies. As a result of such policies in the United States, the adolescent fertility rate is higher than most other high-income countries at 21.15 per 1,000 women between the ages of 15-19. This may also impact the maternal mortality rate due to the correlation between youth pregnancy and the risk of giving birth, which is also higher than most high-income countries and many lower-income countries, including Georgia.

Access to contraception is proven to increase one’s level of education, quantity and quality of work experience and job training, and overall lifetime
earnings. This has also been shown to increase the family’s income by two percent and the number of children to attend and finish a college education by 207 percent.\textsuperscript{62} If the cost of contraception decreased, there would be a higher level of educational attainment than under many other federally-funded programs, including Headstart and Upward Bound.\textsuperscript{63}

Access to legal and safe abortion is another major issue in the United States. Distance, cost, time, harassment, and restrictive state policies prevent women from seeking abortions. A majority of counties, which are home to one-third of women of reproductive age in the United States, have no abortion provider. Furthermore, fewer than 50 percent of clinics will provide abortions after 12 weeks. This limits options for women of low socioeconomic status—who must pull together the financial resources necessary for the procedure that is not publicly funded and or privately insured—to access abortion services without the risk of maternal death.\textsuperscript{64} Due to the inadequate sexual education and contraception provided by the U.S. education system, 45 percent of pregnancies are unintended,\textsuperscript{65} and the abortion rate is more than double that of other industrialized countries.\textsuperscript{66}

**Contraception and the Sustainable Development Goals**

By increasing women’s access to contraception worldwide, many of the SDGs stand to become more attainable. Based on the cases of Georgia and the United States, family planning programs, directly and indirectly, address the following goals: SDG 1: End Poverty in all its Forms Everywhere, SDG 2: End Hunger, Achieve Food Security, SDG 3: Good Health and Wellbeing, specifically targets 3.1, 3.2, 3.3, 3.7, and 3.8; SDG 4: Quality Education; SDG 5: Gender Equality, SDG 8: Productive Employment and Economic Growth, and SDG 10: Reduce Inequalities.\textsuperscript{67} The most impacted goal is SDG 3.

**SDG 3: Good Health and Wellbeing**

The third Sustainable Development Goal aims to increase global health and well-being by focusing on nine specific targets, five of which pertain directly to contraceptive services. The first target is to reduce the global maternal mortality ratio to less than 70 per 100,000 live births.\textsuperscript{68} The current ratio has declined by 37 percent since 2000, but with 86 of the 178 recorded countries at a rate of over 100 deaths per 100,000 births, the goal does not appear to be attainable by 2030. If all women wanting of more children, were to have access to contraception, this goal would be over 25 percent closer to being accomplished.
The United States has already reached the target decrease to 14 maternal deaths per 100,000 births. However, this rate is still higher than 69 other countries or 40 percent of those measured. Additionally, the maternal death rate or the probability that a woman will die as a result of giving birth in the United States, is higher than 122 other countries, at 550 per 100,000 despite the fact that its level of access to contraception is higher than in many countries. In comparison, Georgia’s maternal mortality rate is 36 per 100,000 and 19 maternal deaths—thus also achieving the target set in SDG 3.1.

The second target related to contraceptive services is 3.2: “By 2030, end preventable deaths of newborns and children under five years of age,” with all countries aiming to reduce neonatal mortality to 12 per 1,000 live births and under-five mortality to 25 per 1,000 live births.” In relation to family planning, these targets will be most achievable by increasing young women’s access to contraception and information. Younger mothers are less able to care for young children and face greater problems with pregnancies, which may lead to disorders or harm to their newly born children. Finally, if younger women are less educated on sex and contraception, they are more likely to pass STIs on to children and impact their quality and length of life as well.

When looking at Georgia and the United States specifically, it seems that this goal may be achievable within the set time period. Georgia recorded 7.1 neonatal deaths per 1,000, and the United States documented 3.4. However, the goal will be challenging to accomplish with 78 of the 188 countries measured, logging over 12 neonatal deaths. The current global rate of neonatal mortality is 18 deaths per 1,000, with an average decrease of 3.1 percent each year. If that rate continues, the global goal will be reached exactly in 2030, but the focus must be placed on Africa and the Middle East, as both regions have extreme neonatal mortality rates. One in 26 children died before age five in 2017, compared to one in 11 in 1990. If the current four percent annual rate of reduction for deaths under the age of five continues for the next ten years, the SDG target will be reached by 2029. If these decreases continue, both goals will be attainable.

The third objective 3.3: “By 2030, end the epidemics of AIDS, tuberculosis, malaria, and neglected tropical diseases and combat hepatitis, water-borne diseases and other communicable diseases” may also be attainable when access to contraception is increased. Contraception certainly will help reduce the new number of HIV/AIDS infections per 1,000 people. Women are three to five times more susceptible to HIV than men. With better and
cheaper access to condoms, the rate of new infections would be decreased immensely. The global rate of new infections has already decreased by 35 percent since 2010. 78

Although the rate of new HIV/AIDS diagnoses has decreased since 2011, the rate of newly diagnosed HIV cases has continuously increased in Georgia. Three-quarters of its new diagnoses are related to unsafe sexual practices. 79 Though not hopeful statistics, many of the newly diagnosed cases in Georgia could be prevented with access to certain kinds of contraception. Target 3.3 aims to end the epidemic, which means increasing related health care services accompanied by educational brochures, programs, and professionals to guarantee that all populations correctly use this form of birth control.

The fourth target associated with access to contraception is 3.7, and it states “By 2030, ensure universal access to sexual and reproductive health-care services, including for family planning, information and education, and the integration of reproductive health into national strategies and programmes,” 80 specifically focusing on the percentage of women still in need of contraceptive services and the number of women giving birth in adolescence. 81 The fact that one of the SDG’s main intentions is to increase access to reproductive health care services, various methods of birth control, and information about them, demonstrates the issue’s significance. This goal will be difficult to reach, especially in rural and isolated areas. However, many countries, including Georgia, have already made significant progress. In contrast, the United States’ recent policy changes more difficult for women and vulnerable populations to access these health services.

The final goal related to contraception is 3.8: “Achieve universal health coverage, including financial risk protection, access to quality essential health-care services and access to safe, effective, quality and affordable essential medicines and vaccines for all.” 82 This includes coverage of reproductive, maternal, newborn, and child health as well. Though the idea of affordable and accessible health care is largely supported, this means that both Georgia and the United States must completely change their health care systems. The political and financial feasibility of that happening is very low.
**Conclusion**

Improved access to contraception and family planning services can unquestionably be improved upon in high-income and low-income states alike. The implications of progress in this capacity will mean progress in health and well-being globally, thus improving the chances of achieving SDG 3. Georgia is one of the various cases exhibiting the positive impacts of increasing access to contraceptive services. The United States, conversely, has much need for improvement. Without effort from all nations to increase access to contraception, the achievement of SDG 3 will be more difficult, and perhaps unattainable, with respect to many of its targets and indicators.
ENDNOTES

6 Ibid.
7 Ibid.
11 Ibid.
14 Ibid.
17 Ibid.
Access to Contraception is a Gender and Development Issue

51 Ibid., 9-10.
69 IndexMundi. (2018b).
72 Inter-Agency and Expert Group on Sustainable Development Goals Indicators. (2016).
73 IndexMundi. (2018b).
76 Inter-Agency and Expert Group on Sustainable Development Goals Indicators. (2016).
81 Inter-Agency and Expert Group on Sustainable Development Goals Indicators. (2016).
82 Ibid.
Solar Energy: The Key to Development in Climate-threatened Uganda

by Justin Giannantonio, MID ’20
Graduate School of Public and International Affairs, University of Pittsburgh

Executive Summary
To meet the electrification needs of the rural population, the government of Uganda is focusing its efforts on the 600-megawatt Ayago Hydroelectric Power Station on the Victoria Nile. However, declining water levels and variations in weather patterns have led to significant socio-economic concerns. Financial cost-benefit analysis indicates that Ayago is an unsustainable project. Under the Global Energy Transfer Feed-in Tariff (“GET FiT”), we recommend a 100-megawatt solar photovoltaic (PV) power plant in the Kotido District as an alternative to the Ayago Hydroelectric Power Station. By reducing investment costs and increasing rural electrification in the region of Kotido, the 100-megawatt solar PV plant will prove more cost-effective and sustainable.

Threatening Water Levels of Lake Victoria Lead to Declining Hydropower Generation
Though Uganda has abundant renewable energy resources, the country’s energy sector faces considerable challenges, including acute power shortages, increased demand, and low levels of rural electrification. Climate change is interwoven into many of these issues because it reduces the generation of hydropower and intensifies unpredictability, while investment in other forms of renewable energy is hampered by the high upfront cost of technologies. To increase hydropower generation from 78 percent to 90 percent by 2030, the Ministry of Energy and Mineral Development (MoEMD) seeks to construct hydroelectric power projects for increased rural electrification (See Figure 1). A total of three hydropower projects have been earmarked for immediate development, including the Ayago hydropower dam. The construction of the dam is planned on the Victoria Nile at Ayago, the Nwoya District (See Figure 2).
The water in Lake Victoria has fallen to threatening levels. In 2005, the water level of 10.89 meters was reported as the lowest level since 1961. While Uganda’s total installed capacity is 822 megawatts, over-abstraction from Lake Victoria has shown a 50% distribution loss. This has led to only half of the installed capacity being utilized for electrification. Additionally, numerous droughts between 2003 and 2007 have declined hydropower generation over 70% in the last decade. Based on natural run-of-the-river flows and Lake Victoria water elevations, the planned 600-megawatt Ayago dam will only add a 100-megawatt output of electricity to the national grid.

The Government of Uganda has invested US$1.1 billion into financing the Ayago hydroelectric project. The construction contract of the dam has been awarded to the China Gezhouba Construction Company with construction beginning in 2020. Comprised of resettlement and environmental mitigation costs, a cost overrun of 30% exceeds the initial investment of US$800 million. Thus, due to the vast externalities associated with the project, the MoEMD will incur a significant financial loss.

The Success of 100-Megawatt Jasper Solar PV Energy Project

Due to similar geographic characteristics, the success of the Jasper Solar Energy Project suggests that a similar project can easily be transferred to rural Uganda. The Jasper Solar Energy Project is a fixed-tilt solar PV power plant located in South Africa’s Northern Cape (See Figure 3). The total cost of the project was US$260 million, financed through a combination of equity and debt, by a group of companies including Google and the Development Bank of South Africa. By adding 100-megawatt to South Africa’s national power grid, the plant has connected an additional 30,000 people that otherwise might not have had access to electricity. Furthermore, electricity is generated at the cost of 0.11 USD per kilowatt hour (kWh), allowing energy prices in South Africa to remain low.

Cost-Benefit Analysis

When considering the internal and external costs, the Ayago Hydroelectric Power Station will prove economically unsustainable. A financial cost-benefit analysis with an economic comparison of the Ayago Hydroelectric Power Station and a proposed 100-megawatt solar PV power plant is conducted below.
Solar Energy: The Key to Development in Climate-threatened Uganda

| Cost-benefit Analysis and Economic Comparison of the Ayago Hydroelectric Power Station and Solar PV Power Plant: |
|---------------------------------------------------------------|---------------------------------------------------------------------------------|
| **OPTION 1:** Ayago Hydroelectric Power Station on Victoria Nile | **OPTION 2:** 100-megawatt Solar PV Power Plant in the Kotido District + GET FiT Mechanism |
| **Total Output** | **Unit Cost per kWh** | **Initial Investment** | **Total Construction Cost** | **Operation and Maintenance Costs** | **Cost Overrun** |
| 100-megawatt (considering the lower output capacity due to lower water levels) | US$0.21 per kWh | US$1.1 billion | US$1.9 billion | US$30 million | 30% |
| 100-megawatt | US$0.15 per kWh | US$300 million | US$260 million | US$4 million | 5% |

In Option 1, the total cost of the hydroelectric project will be US$1.9 billion, thus exceeding the initial investment of US$1.1 billion by the MoEMD. The planned hydro project also faces a substantial cost overrun risk of 30% due to construction delays, implementation of environmental management plans, and resettlement policies. In Option 2, the total cost of the project amounts to US$264 million, with a cost overrun of only 5%. If constructed, the Ayago Hydroelectric Power Station will cost the MoEMD an additional US$800 million for an equal output of 100 megawatts. Therefore, it becomes clear that constructing a 100-megawatt solar PV power plant in the Kotido District is a more cost-effective method for adding electricity to the national power grid and increasing rural electrification.

**Recommendation**

The installation of a 100-megawatt solar PV power plant is recommended to diversify Uganda’s portfolio of electricity generation resources. As an alternative to the Ayago Hydroelectric Power Station, the solar plant will be constructed in the Kotido district, given the 400,000-terawatts per hour of...
solar energy reaching the region’s surface area annually (See Figure 4). The analysis above demonstrates that this approach would cost-effectively increase the country’s rural electrification. Thus, the Uganda Solar Energy Association suggests the following to the Ministry of Energy and Mineral Development:

- Shift investment from large hydropower projects to large solar projects in order to more cost-effectively provide electricity to rural Uganda;
- Utilize the Jasper solar project in rural South Africa as a model for designing, implementing, and operating a 100-megawatt solar power plant;
- Collaborate with the Green Technology Bank (GTB), which promotes green technology, scaling up low-carbon solutions for development challenges, and the transfer of innovative technologies to developing countries, to design and fund the solar power plant in the Kotido district;
- Apply the Global Energy Transfer Feed-in Tariff (a program to stabilize Ugandan power sector finances by adding least-cost generation capacity) for funding support.

Challenges to Overcome in Developing Large Scale Solar Energy Projects

Economic/financial barriers: There are high initial costs of installation, maintenance, and repairs, as well as the risks related to the suitability and reliability of technologies and to the solvency degree of the project. Although Uganda is one of the pioneers of the GET FiT Program, this policy needs to be properly managed with the intention of attracting possible investors.25

Legal/institutional barriers: The lack of consistency of incentives for the adoption of PV, like inconsistencies between policy measures and socio-economic factors, or the sudden removal of existing subsidies, hinders large solar investment.26

Public awareness barriers: General information and awareness in relation to new technologies and understanding the practical problems in implementing and maintaining projects are limited. The absence of vital technological information and proper awareness has generated a disparity in the solar energy market that has given rise to high-risk perception.27
Figure 1: Electricity Supply and Specification of Electricity Mix—Renewable Energy Scenario

Figure 2: Map of Ayago Hydroelectric Power Station Location
Figure 3: Location of 100-MW Jasper Solar PV Power Plant—South Africa

Figure 4: Global Horizontal Irradiation: Average Annual Sum
ENDNOTES


7 Ibid.


9 Ibid.


12 Ibid.

13 Ibid.


16 Ibid.


18 Ibid.


27 Ibid.


The Threat of Climate Shocks in Bangladesh—A Case Study

by Megan Canfield, MPIA ’20
Graduate School of Public and International Affairs, University of Pittsburgh

Abstract

In Bangladesh, people face a ‘perfect storm’ of factors that expose them to more intense shocks in the face of climate change. Climate shocks are a driver of poverty and inequality because they systematically yield disproportionate outcomes for women, children, and chronically poor individuals. Though Bangladesh has received hundreds of millions of dollars of international aid, ongoing complexities have prevented it from becoming truly resilient to such shocks. Strategic planning for future programs should include deliberate attention to vulnerable groups. In particular, the Government of Bangladesh should focus on the UN Sustainable Development Goal 1.5, which is to build resilience to environmental, economic and social disasters, by continuing to support the work of the World Bank and other organizations and building capacity within its own ministries and among the broader population for the application of best practices for coping with climate-related shocks.

Factors that Cause Climate Shocks

Shocks are “external short-term deviations from long-term trends…that have substantial negative effects on people’s current state of well-being, level of assets, livelihoods or safety, or their ability to withstand future shocks.”¹ According to the World Food Programme (WFP), 30 percent to 50 percent of Bangladesh suffers severe climate shocks every year.² The Global Climate Risk Index, which tracks impacts from extreme weather events in terms of fatalities and economic losses, also ranked Bangladesh among the top ten countries in terms of climate-related economic losses.³ Such costly disruptions are especially harmful in a country like Bangladesh, where roughly one-quarter of the population (around 40 million people) are food insecure, and over 30 percent of the population (roughly 53 million people) live in poverty.⁴ These numbers show that many people in the country do not have the resources necessary to withstand and recover from disruptions to their livelihoods.
without sacrificing their well-being. Bangladesh is uniquely prone to, and threatened by, climate shocks due to natural disasters, internal displacement, population density, and the economic role of agriculture.

**Natural Disasters**

In Bangladesh, shocks come in the form of natural disasters, such as unusually heavy rains, floods, landslides, cyclones, earthquakes, tropical storms, tornadoes, and severe storms. Between 1980 and 2008, the country faced 219 of these natural disasters. The country is disaster-prone because of its geographic location. It is a low-lying country with more than 310 rivers and tributaries that originate from the Ganges, Brahmaputra, and Meghna Rivers, and empty into the Bay of Bengal and form a delta in southern Bangladesh. The Bay is known to generate tropical storms and cyclones that devastate the country, damage that is further compounded by the lengthy monsoon season lasting from June to November. In 2019, this especially impacted the refugee camps negatively. The increased rate of melting of the Himalayan mountain glaciers also poses a particular threat to downstream nations like Bangladesh that experience heavy water run-off and suffer acutely when water supplies are low.

Roughly ten percent of the total land area of Bangladesh is below five meters elevation. Throughout the country, very heavily populated areas are concentrated around the Ganges River and its tributaries in these low-lying areas. Projections show that a one-meter rise in sea level would affect the lives of 15 million people and submerge 17,000 km² of land, while one-and-a-half meters rise in sea level would affect the lives of 18 million people and submerge 22,000 km² of land. By 2050, up to one-fifth of Bangladesh’s landmass could be submerged, and more than 20 million people affected by the rising sea levels. These numbers are highly concerning as the country itself is only 147,570 km² (smaller than the state of Illinois), and its total population is 160 million people.

The Ministry of Disaster Management and Relief (MoDMR) is the umbrella agency in Bangladesh that oversees the work of the Department of Disaster Management (DDM) and the Cyclone Preparedness Programme (CPP). The DDM and CPP are responsible for disseminating information about natural disasters, building the capacity of local communities to withstand them, and carrying out relief and rehabilitation operations. Its work has successfully curbed some of the adverse effects of natural disasters, evident in the lowered mortality rates, through the institution of innovative disaster relief programs. For example, it designed the “dense network of small
cyclone shelters in vulnerable areas that can also serve as everyday public buildings, such as schools, [which have] proven much more efficient than large scale cyclone centers.’’

**Internal Displacement**

Climate shocks can be detrimental to people’s well-being because an unusually intense weather event will often force people to leave their land and their home, either because it is temporarily uninhabitable or has been destroyed. In 2017, flooding in Nepal, Bangladesh, and India left “tens of thousands of houses and vast areas of farmland and roads destroyed.” Migration that occurs as a result of disaster-induced losses results in the disruption of agricultural production, children’s education, and much more (see Figure 1 for annual displacement statistics and Figure 2 for annual risk of future displacements from climate-related shocks in Bangladesh).

Furthermore, the Internal Displacement Monitoring Center reported that in 2019 alone, 187,000 people were displaced due to floods from July 7 to July 21 alone. Additionally, 5,600 refugees were displaced from refugee camps due to monsoon related events from April 21 to July 11, and two million people were evacuated to 5,500 shelters because cyclone Bulbul had made landfall from November 9 to 10. For hundreds of thousands of Bangladeshis, extreme weather events force them away from their homes, communities, and support systems, threatening any stability the household may have. Since such displacements frequently occur each and every year, it becomes nearly impossible for vulnerable groups to accumulate assets or savings.

**Population Density**

Bangladesh is one of the most densely populated countries in the world (see Figure 3), with more than 1,227 people per square kilometer. As sea level rise overwhelms coastal and low-lying communities, inhabitants face a choice between migrating to urban areas or neighboring rural areas where they face similar climate-related challenges. Urbanization of the capital is destroying the city as roughly 2,000 people enter Dhaka every day. Given the lack of suitable housing, migrants have begun occupying marginal spaces, such as wetlands and river valleys, and destroying the natural defense mechanisms that guard the city against flooding and landslides. To accommodate rapid development, the city filled in historic canals and eliminated important drainage systems. As a result, Dhaka now has more than 44,500 people per square kilometer (ranking as the world’s most crowded city), which strains
the infrastructure and causes sewer backups and mass flooding that lead to a host of developmental problems. Notably, densely populated urban slum dwellings lack the necessary public services and infrastructure to prevent the spread of diseases. Additionally, during the monsoon season, Dhaka becomes severely flooded, which slows down or halts transit to work or school and effectively impedes economic development.

**Role of Agriculture**

Agriculture is a critical component of Bangladesh’s economy. Between 2005 and 2010, agriculture accounted for 90 percent of the reduction in poverty. Roughly 77 percent of the country’s workforce lives in rural areas, and almost 50 percent of all workers are primarily employed in agriculture. In addition, some 87 percent of rural households rely on agriculture for at least part of their income.

Climate change and climate shocks threaten future agricultural productivity and viability. Today, Bangladesh devotes 70 percent of its land area to agriculture, and farmers are already losing viable land to the effects of climate change. By 2009, 105.6 million hectares were damaged as a result of increased salinity. A local Bangladeshi from the south-western part of the country shared, anecdotally, that farmers used to be able to collect an Aman paddy harvest (large rice harvest in November and December), but due to excess salinity, they can no longer farm during that time. Flooding caused by any source is detrimental to food production and places food security at risk. In 2019 alone, floods washed away from cropland that would have yielded 400,000 tons of rice. The damage was mostly centered in the northern region of the country, highlighting how each region of Bangladesh faces its own unique risks from climate shocks.

**Groups Most Affected by Climate Shocks**

Examining drivers of climate-related shock in Bangladesh naturally brings attention to the persistently vulnerable in the country who face unequal access to opportunities. In Bangladesh, women, children, and those who are chronically poor are systematically disadvantaged by the effects of climate shocks.

In terms of outcomes for women, Bangladesh has made some progress since 2000. Maternal mortality decreased by 33 percent from 322 to 210 out of 100,000 live births. But, while gender parity in basic education has improved, at least ten percent more men complete upper secondary education than women. Further, the gender wage gap is between 15
percent and 23 percent greater for men than women, doing the same work with the same background and experience. Among the reasons causing such gender differences are a nondiscrimination clause that mentions gender as not present in the constitution until 2009, a lack of legal frameworks that mandate gender nondiscrimination in hiring, and cultural norms that limit women’s freedom outside of the home and income-earning opportunities outside of it. All of these make women more vulnerable to the negative consequences of natural disasters.

One cultural norm known as purdah (meaning “curtain”) has created gendered spaces, where the women’s sphere is private, and the men’s sphere is public. Purdah played a significant role during the 1991 cyclone, as women were often dying at home, sometimes together with children and the elderly, while waiting for their husbands’ instructions. The norm also makes men reluctant to take women to shelters during a disaster, forcing them to stay with the home. Since women’s central role is often as the family caretaker, they are the ones who are holding children’s hands and carrying infants during disasters, leaving them, literally, with no free hands to help themselves. Furthermore, the traditional sari garment and cultural tendency to keep hair long physically impedes women's movement during a disaster. After disasters have occurred, purdah makes it difficult for women to access information and resources like water, food, and health care. Finally, displaced or deserted women in or after disasters often find themselves coerced into prostitution, human trafficking, or other similar acts. Climate shocks reinforce and magnify women's secondary status in Bangladeshi society.

For children, progress has been made on primary education, with a nearly 68 percent completion rate and infant mortality that has decreased by nearly 40 percent since 2000. Still, 36 percent of children under five are stunted, and 5.5 million children under five are chronically malnourished. Furthermore, 46 percent of children live below the poverty line.

Children globally are among the most disadvantaged populations, and Bangladesh is not an anomaly. However, understanding the causes of this disadvantage is, and will continue to be, critical for bringing equity to the opportunities and outcomes of children in Bangladesh. In rural areas of the country, when drought or flood threaten crops, teenagers from poor households are at higher risk of dropping out of school and entering an early marriage. Indeed, the WFP cited child marriage and adolescent pregnancies as main impediments to development goals in the country. Approximately eight percent of teenage girls ages 15 to 19 become pregnant, and 59 percent of girls are married by age 18 (22 percent are married by age 15). “Another
vulnerability factor is that...children’s food needs are not prioritized within the household, which increases their food and nutritional insecurity.” In cities, urban working children, street children, and orphans all fall into the poorest quintile of the population and are generally the most vulnerable group of people. Unfortunately, the government has not invested much in protecting and helping them, with less than one percent of the social safety net budget going to such programs.\textsuperscript{32}

The poverty gap in Bangladesh has been decreasing steadily (see Figure 4) so that at the $1.90 level, the gap is under three percent. At “every stop on dollar street”—as Hans Rosling refers to the vast life improvements that occur with each dollar increase in income per day—Bangladesh has made progress (see Figure 5 on progress Bangladesh has made in combating poverty). However, in 2016, the WFP estimated that Bangladesh’s social safety net programs covered less than half of the food for the most insecure people in the country.\textsuperscript{33} Furthermore, the income share held by the lowest quintile has remained at eight percent since the 1990s, and only one and a half percent of the population was covered by social insurance programs in 2010.\textsuperscript{34} Together, these outcomes show that progress has been made on the low-hanging fruit of poverty reduction, in part because of the agricultural progress described above. An evaluation of several anti-poverty programs in Bangladesh found that poor households tend to have very low spending, more dependents in the house, low levels of savings, and low levels of assets.\textsuperscript{35} These findings likely speak to broader trends across Bangladesh insofar, as those who have not been helped out of poverty by the efforts of nongovernmental organizations (NGOs), or the government of Bangladesh, are burdened with additional responsibilities and compounding disadvantageous factors.

**Long-term View: The 2030 Development Agenda**

A single Sustainable Development Goal (SDG) alone does not track resilience to all the ways shocks can disrupt an individual’s life, but unexpected deviations in people’s livelihoods may push them into a state of hunger and poverty, which threatens the goals of no poverty (SDG 1) and zero hunger (SDG 2).\textsuperscript{36} Similarly, people’s access to clean water and sanitation (SDG 6), their good health and well-being (SDG 3), and access to quality education (SDG 4) are all at risk if they do not have the skills or assistance to successfully navigate shocks. Therefore, shocks remain a critical policy issue because, by nature, traditional safety nets and development programs do not prevent the sudden decline in people’s well-being and subsequent long-term effects.
The Government of Bangladesh should prioritize SDG 1.5, which is to *build the resilience of the poor and those in vulnerable situations and reduce their exposure and vulnerability to climate-related extreme events and other economic, social and environmental shocks and disasters* by 2030, through ongoing support for the World Bank and other nongovernmental organizations and by building internal capacity within its own ministries to prepare for, work through, and safely recover from climate-related shocks. Such actions should include awareness-raising programs to disperse knowledge about how to protect their lives and well-being (such as livelihood, education, and health) from climate-related shocks.

Many SDGs aim to improve outcomes for vulnerable groups, such as those discussed above. A second priority for the Government of Bangladesh should be to pay special attention to the indicators for these SDGs and take special steps to equalize outcomes across groups. Doing so will not be without its challenges, as Bangladesh is one of the most rural countries in the world, with Dhaka alone bearing the weight of urbanization. The increasing concentration of people will make it more difficult to protect people from shocks and will place a greater burden on life-saving services. Furthermore, the changing climate is threatening the viability of farmland, and shocks, such as floods or cyclones, could increase the amount of land at risk. Ultimately, progress will be challenged by the fact that climate shocks are not going to ease but only get worse. Therefore, the status quo progress will not be sufficient.

Climate shocks, resulting from rapid climate change, will cause backsliding and increase inequalities among the most vulnerable globally. The international development community needs to pay special attention to regions of the world where shocks are expected to increase because they threaten global progress towards the achievement of the Sustainable Development Goals by 2030.
**APPENDIX**

**Figure 1. Yearly new displacements from disasters in Bangladesh, 2008-2018**

<table>
<thead>
<tr>
<th>Year</th>
<th>New Displacements from Disasters</th>
</tr>
</thead>
<tbody>
<tr>
<td>2008</td>
<td>61,000</td>
</tr>
<tr>
<td>2009</td>
<td>1,342,000</td>
</tr>
<tr>
<td>2010</td>
<td>569,000</td>
</tr>
<tr>
<td>2011</td>
<td>400,000</td>
</tr>
<tr>
<td>2012</td>
<td>651,000</td>
</tr>
<tr>
<td>2013</td>
<td>1,160,000</td>
</tr>
<tr>
<td>2014</td>
<td>543,000</td>
</tr>
<tr>
<td>2015</td>
<td>531,000</td>
</tr>
<tr>
<td>2016</td>
<td>614,000</td>
</tr>
<tr>
<td>2017</td>
<td>946,000</td>
</tr>
<tr>
<td>2018</td>
<td>78,000</td>
</tr>
<tr>
<td>Avg:</td>
<td>635,000/ year</td>
</tr>
</tbody>
</table>
Figure 2. Risk of Future Displacements Annually from Disasters in Bangladesh

Figure 3. Most densely populated countries, 2017

<table>
<thead>
<tr>
<th>Rank</th>
<th>Country</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Macao SAR, China</td>
<td>20,479.77</td>
</tr>
<tr>
<td>2</td>
<td>Monaco</td>
<td>19,196.00</td>
</tr>
<tr>
<td>3</td>
<td>Singapore</td>
<td>7,915.73</td>
</tr>
<tr>
<td>4</td>
<td>Hong Kong SAR, China</td>
<td>7,039.71</td>
</tr>
<tr>
<td>5</td>
<td>Gibraltar</td>
<td>3,372.80</td>
</tr>
<tr>
<td>6</td>
<td>Bahrain</td>
<td>1,920.40</td>
</tr>
<tr>
<td>7</td>
<td>Maldives</td>
<td>1,654.67</td>
</tr>
<tr>
<td>8</td>
<td>Malta</td>
<td>1,462.50</td>
</tr>
<tr>
<td>9</td>
<td>Bangladesh</td>
<td>1,226.63</td>
</tr>
<tr>
<td>10</td>
<td>Sint Maarten (Dutch part)</td>
<td>1,193.35</td>
</tr>
</tbody>
</table>
Figure 4. Poverty gap at different income levels (2011 PPP), 2000 vs. 2016

<table>
<thead>
<tr>
<th>Income Level</th>
<th>2000</th>
<th>2016</th>
</tr>
</thead>
<tbody>
<tr>
<td>$5.50/day</td>
<td>51.4%</td>
<td>39.2%</td>
</tr>
<tr>
<td>$3.20/day</td>
<td>27.8%</td>
<td>15.6%</td>
</tr>
<tr>
<td>$1.90/day</td>
<td>8%</td>
<td>2.7%</td>
</tr>
</tbody>
</table>

Figure 5. Decreasing poverty in Bangladesh in percent (left axis) and millions of people (right axis), 1991-2010
ENDNOTES


6. Ibid.


11. Ibid.

12. Ibid.


23. Ibid.


The Threat of Climate Shocks in Bangladesh


34 Ibid


37 Especially relevant are the following SDGs targets for 2030. SDG 1.2 aims to reduce at least by half the proportion of men, women and children of all ages living in poverty in all its dimensions according to national definitions. SDG 2.2 aims to end all forms of malnutrition, including achieving, by 2025, the internationally agreed targets on stunting and wasting in children under 5 years of age, and address the nutritional needs of adolescent girls, pregnant and lactating women and older persons. SDG 4.5 aims to eliminate gender disparities in education and ensure equal access to all levels of education and vocational training for the vulnerable, including persons with disabilities, indigenous peoples and children in vulnerable situations. SDG 5.1 aims to end all forms of discrimination against all women and girls everywhere. SDG 5.3 aims to eliminate all harmful practices, such as child, early and forced marriage and female genital mutilation. SDG 8.5 aims to achieve full and productive employment and decent work for all women and men, including for young people and persons with disabilities, and equal pay for work of equal value. SDG 13.3 aims to improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning.


Protecting the Army National Guard

by Zachariah Hoydich, Psychology '13
University of Pittsburgh

EXECUTIVE SUMMARY
Weak recruitment, retention, and the Army National Guard (ARNG) 4.0 initiative, risk degrading the strength of the ARNG. Recently updated recruitment methods show strength improvement but do not address the full problem of recruitment nor the future impact of the 4.0 program. Two policy changes are likely to increase the strength of the ARNG: 1) re-introduction of senior specialist ranks and 2) expansion of the Work Opportunity Tax Credit to ARNG servicemember employers. These policies can ensure the continuation of the ARNG’s strength and prepare the force for future operations.

Background
In 2018, Army recruitment failed to reach its goal for the first time since 2014 with the Army National Guard (ARNG) missing its target strength by 8,000 soldiers. Independent analysis finds all military branches at marginal effectiveness and operating below capacity. Contributing to this marginal effectiveness is the pattern of junior officers commissioned through the Reserve Officers’ Training Corps (the most costly commissioning source), serving only their initial contracts. Potentially responsible is the fact that serving reservists are less likely to be hired in civilian jobs than non-serving peers. It is crucial for ARNG personnel to succeed in civilian careers while maintaining readiness to conduct emergency and combat operations. High frequency of deployment (OPTEMPO) historically tests the ARNG’s limits. The new ARNG 4.0 program anticipates high OPTEMPO and correspondingly increases training frequency by up to 60%. This initiative desires increased unit readiness, but new training assessments require a 60% minimum strength to score higher than “untrained” on Mission Essential Task Lists (METLs). Strength is the foundation of training and readiness, and the ARNG is understrength and bleeding skilled personnel.
Actions Taken

The Army and ARNG met their recruitment goals in 2019. While a prima facie success, it may not last and was not easy. The recruitment problems of 2018 led to reduced future recruitment goals. High active duty retention reduced ARNG recruitment, and we still do not know the full impact of ARNG 4.0 on strength. With manning challenges on the horizon, the ARNG must pursue policies that improve both recruitment and retention. Two of the most promising are the reintroduction of senior specialist ranks, and the expansion of the Work Opportunity Tax Credit.

Policy Options

1. Re-introduction of senior Specialist ranks: Senior specialist ranks allowed for continued job specialization and increased pay without leadership responsibilities. Reintroduction will prepare the force to recruit and retain technical experts.

Advantages:

- Reward Expertise: Increased pay for specialization increases the ARNG’s attractiveness as an employer. Senior specialist ranks are especially advantageous to highly technical branches of the U.S. Army such as Cyber Command.

- Increased Readiness: Specialists remain in their areas of expertise and are not forced into supervisory roles. This increases the number of total trained soldiers, allowing for accurate METL assessments.

Disadvantages:

- Difficult Implementation: This change cannot occur only in the ARNG but must be instituted Army-wide. Large-scale change is time-consuming and difficult.

- Higher Cost: Senior specialists require increased compensation and the dual NCO-senior specialist track results in more soldiers overall.

2. Expansion of employer tax credits for ARNG-member employers: Employing veterans allows businesses to utilize the Work Opportunity Tax Credit (WOTC). Expanding the WOTC to ARNG soldiers will ease employer burden and increase recruitment and retention.
Advantages:

• *Reduced Friction:* Subsidizes employment of ARNG soldiers, making training and deployment absences less costly to employers. Employers may make profits depending on employees’ training intensity.

• *Increased Strength:* Work conflicts have less impact on enlistment and reenlistment decisions. Employers may encourage continued military service to receive tax credits.

Disadvantages:

• *Increased Cost:* Costs increase as strength, and the number of employers receiving tax credit increases. The National Defense Authorization Act for Fiscal Year 2018 authorized total ARNG strength of 343,500. If the program existed and was utilized by 50% of soldiers, the cost for the credit alone would have exceeded $1.6 billion per year.

• *Untested Efficacy:* Current program limited to $9,600 yearly benefit for two years. Elimination of the two-year limit required for long-term usefulness.

Policy Recommendation

While 2019’s recruitment and strength goals were met, the continuing rollout of ARNG 4.0 threatens to reverse this trend. Diminishing strength, coupled with and caused by increasing OPTEMPO, threatens reduction in readiness and combat capability. Policy Option 2 is the most effective means to combat this threat. While Option 1 would increase recruitment, retention, and readiness, it may be an excessive reaction to a serious but manageable problem. Should strength concerns endure, we can revisit senior specialist ranks. Option 2 directly addresses the problem, is limited in scope, and is politically viable. Expansion to include ARNG service members must be accompanied by elimination of the two-year limit. It is essential to promote both the hiring and retention of America’s citizen-soldiers. In 2019, U.S. Virgin Islands Representative Stacy Plaskett introduced legislation to expand WOTC credits to small businesses hiring ARNG or Ready Reserve members. Languishing in the House Ways and Means Committee, the legislation is unlikely to pass. By expanding the WOTC to include ARNG service members and eliminating the two-year restriction, we recognize the sacrifices that citizen-soldiers and their civilian employers make and ensure the long-term strength and effectiveness of our oldest fighting organization.
Endnotes


9 Ibid.


by Joseph Skibbens, MPIA ’20
Graduate School of Public and International Affairs, University of Pittsburgh

Abstract
American involvement in the Yemeni civil war, through its support of the Saudi coalition, is a foreign policy fiasco. The conflict has been internationalized with no discernable victor in sight, the humanitarian crisis continues to grow, and the United States is failing to curb the growth of terrorist organizations in the region despite intensifying its drone program. The United States’ drone program limits the strength of the host country’s central government, cultivating territories wherein governance is more difficult. Drones also have a corrosive effect on U.S. regional influence by alienating host nation populations and giving symbolic cover to terrorist organizations, which can increase recruitment rates. Reliance on killer drones raises several legal and ethical questions and risks damaging the United States’ reputation in regions of the world where skepticism over U.S. foreign policy is endemic.

Yemen, al-Qaeda, and the United States
The United States’ primary interest in Yemen is to eliminate al-Qaeda in the Arabian Peninsula (AQAP). Prior to the Yemeni civil war, the U.S. worked closely with Yemeni Presidents Ali Abdullah Saleh and Abdrabbu Mansour Hadi to strengthen the government against AQAP and to expand the American covert drone program into Yemen.1 Between 2007 and 2012, the U.S. gave Ali Abdullah Saleh $326 million in security assistance funds for weapons and surveillance equipment, armored vehicles, aircraft, and sea vessels.2 By 2012, Yemeni military forces had rooted AQAP out of its footholds in the Abyan and Shabwa governates.3 Following the political instability of the Arab Spring and President Saleh’s replacement by then-Vice President Hadi, AQAP exploited the opportunity to re-entrench itself in the area as the government in Sanaa turned its focus to internal threats from the north (Houthis) and the south (separatists).4 The United States gave
$100 million in counterterrorism funds to President Hadi’s administration, which failed to achieve notable results before being ousted by the Houthis in 2014.⁵ AQAP, called al-Qaeda 2.0 by some, features characteristics that make it particularly difficult to combat. Compared to al-Qaeda, AQAP maintains a decentralized command structure, makes better use of technology and the internet in recruiting and communication, and has members who possess dual citizenship status and are U.S. passport holders.⁶

AQAP is a common enemy of all belligerents in the Yemeni civil war, yet, the terror organization continues to thrive in the political vacuum and wartime economy.⁷ The U.S. supports the Saudi-led coalition, which backs Hadi’s ousted government through the sale of arms used in coalition aerial bombing campaigns.⁸ The internationalization of the conflict creates a deadly parity between the Iran-backed Houthis, the Saudi-backed Hadi regime, and the United Arab Emirates-backed Southern Transitional Council, a separatist movement lead by President Aidaroos Qasim al-Zubaidi. The result, a hurting stalemate, has led only to the accumulation of war crimes and to the deepening of the acute humanitarian crisis. Since 2015, the estimated death toll exceeds 100,000 people, a fifth of whom were killed in 2019.⁹ Saudi-led airstrikes have violated international humanitarian law in at least 119 cases by targeting civilian facilities such as hospitals, schools, and mosques.¹⁰ Over half of Yemen’s 29 million inhabitants are food insecure, and over one million people are afflicted by cholera. Thus far, the U.S. has not distanced itself from the Saudi government, nor has it withdrawn support for Hadi’s regime. Instead, while Yemen deteriorates, the U.S. maintains a single-minded focus on combating AQAP by using targeted airstrikes carried out by unmanned aerial vehicles (UAVs).

The U.S. Drone Program

From 2002, the year of first use, until 2010, the American drone program expanded to 40 times its original size at the cost of $3.9 billion. Notably, this figure does not include the cost of the covert drone programs operated by the Central Intelligence Agency’s and the Department of Homeland Security’s classified black box budgets.¹¹ The first known use of a killer drone as a counterterrorism tool occurred in November 2002 when a Predator UAV killed Abu Ali al-Harithi in Yemen for allegedly planning al-Qaeda’s attack on the USS Cole. Ahmed Hijazi, an American citizen and al-Qaeda recruiter accompanying al-Harithi, was also killed in the strike. Hijazi’s death raised concerns within the U.S. over the legality of the unintentional killing of an American citizen outside of an officially declared war zone.¹² These concerns remain unresolved.
Anwar al-Awlaki, an American cleric preaching radicalization on the internet, and Samir Khan, an American editor of AQAP’s recruitment magazine, were killed by a covert drone strike in Yemen.\textsuperscript{13} Awlaki’s sixteen-year-old son was also killed in a drone strike some years later.\textsuperscript{14}

‘Kill or capture’ as a tactic of counterterrorism originates from George W. Bush’s global war on terror. Yet it was as a result of Barack Obama’s strategic pivot away from counterinsurgency and move towards precise targeting of terror organizations that the U.S. drone program rapidly expanded.\textsuperscript{15} The first massive regional drone program was developed in the Federally Administered Tribal Areas (FATA) in Pakistan. During the Bush administration, from the time that the program started in 2004 to January 2009, about 50 drone strikes occurred. During Obama’s first two years in office, 2009-2010, the number of strikes tripled.\textsuperscript{16} Pakistan’s constitution does not govern the FATA; rather, the region is ruled by the Frontier Crimes Regulation (FCR). Under the FCR, foreign journalists are prohibited from traveling to and around the tribal lands without permission from the Interior Ministry and an escort from the military or intelligence services.\textsuperscript{17} The information vacuum that exists within the FATA was instrumental in the development and secrecy of the American drone program.\textsuperscript{18} By the time Obama acknowledged the existence of an American drone presence in Pakistan, sixty drone bases were already built within the United States and abroad.\textsuperscript{19}

Doublespeak by Pakistani government leaders sowed confusion over how their domestic audience should view the U.S. drone program. Publicly, officials condemned the use of drone strikes as an infringement on national sovereignty, stating, “these strikes have a negative impact on the government’s efforts to bring peace and stability in Pakistan and the region.”\textsuperscript{20} Behind closed doors, however, the government maintained a willing partnership with the United States.\textsuperscript{21} These secret agreements generated uncertainty regarding civil-military relationships within the Pakistani government, and among civilians, and intensified anti-American views held by some Pakistanis.\textsuperscript{22} Even when UAVs eliminated people who were actually members of terrorist organizations, in many cases, their family members perceived the target to have been innocent or at least not deserving of death.\textsuperscript{23} The most important lesson coming out of the U.S. counterterrorism experience in Pakistan, which experts failed to internalize, was that drones have the potential to create more terrorists than they eliminate.\textsuperscript{24}

The U.S. counterterrorism strategy in Yemen mirrors similar pathologies. Operating a clandestine drone campaign in Yemen required close coordination with the central government.\textsuperscript{25} Both Saleh and Hadi, each
in their own way, expended significant political capital to legitimize U.S. drone strikes. Saleh’s promise to General Petraeus—“we’ll continue saying the bombs are ours, not yours”—was to deny cooperation with the U.S. and to claim responsibility for all drone strikes as Yemeni airstrikes. Hadi had a harder sell to the Yemeni people. When the fact of American drone strikes became undeniable, Hadi claimed to have final approval over all drone operations in Yemen and argued that the only strikes permitted were ones he felt benefited the country. Attempting to obfuscate the danger UAVs might pose to Yemenis, Hadi promoted the idea that “the drone technologically is more advanced than the human brain.”

It is difficult to ascertain exactly what costs Saleh’s and Hadi’s acquiescence to the United States’ counterterrorism strategy incurred to their regimes or how significantly the U.S.-Yemeni partnership contributed to eroding political stability in Yemen. The origin of the civil war lies in the confluence of longstanding political grievances and economic dislocation. However, parallels between the drone programs in Pakistan and Yemen elucidate how such a policy alienates the host government from popular support and fuels negative attitudes towards the intervening state. Other consequences shared between experiences in Pakistan and Yemen include increased recruitment for and retaliation by targeted terror groups, strategic confusion over responsibility for drone operations by multiple U.S. departments, and the continued destabilization of the host country along with the deterioration of its government’s relationship with the United States.

An Inevitable Fiasco

Killer drones failed to increase, and actually undermined security in the environments in which they were deployed. Bad outcomes are all but guaranteed by two main types of process flaws: tactical errors, containing procedural mistakes, and strategic errors, resulting in detrimental outcomes.

The most galling tactical error inherent in the drone program is the risk of killing civilians either as collateral damage or as misclassified, but intended, targets of drone strikes. Pro-drone arguments, similar to one offered by Senator Diane Feinstein, who sat on the Senate Select Committee on Intelligence in 2013, claim that civilian deaths number in the “single digits.” What such statistics hide is the fact that civilians are routinely counted as combatants due to flaws built into target identification processes. Prior to 2012, the only types of drone strikes carried out in Yemen were personality strikes, which require the President’s authorization via Executive Execution.
Although targets are not indicted in U.S. courts, personality strikes require a substantial burden of proof required for target identification that may include satellite imagery, phone intercepts, and other sources of intelligence.\(^{31}\) The second type of drone strike, which is growing in frequency of use, is the signature strike. These types of strikes are authorized at lower levels in the chain of command and rely on probabilistic inductive logic to identify targets.\(^{32}\) Patterns of behavior, or signatures, such as a potential target being a military-aged male, carrying a weapon, and moving towards a known hotspot, can greenlight a strike.\(^{33}\) It is inescapable that the identities of the targets of this second type of strike are not known, a fact that government officials acknowledge.\(^{34}\) One study found that in Yemen, between 2002 and 2014, 71 to 83 U.S. drone strikes were confirmed to have killed between 362 to 531 people, including 64 to 83 civilians and seven children.\(^{35}\) A different study determined that out of 230-270 drone deaths in Yemen, only four individuals were considered high-value targets (HVT), and this ratio (1:60) is similar to the HVT ratio displayed in Pakistan.\(^{36}\)

In committing a strategic error, drone programs hollow out the institutional capacity of the host state. A consequence of relying on UAVs is that they perpetuate the un-governability of frontier regions. Essentially bifurcating state territory as either belonging to the metropole or periphery, drone programs entrench instability beyond a state’s traditional reach.\(^{37}\) The un-governability of a state’s frontier regions creates a niche that drone operations are well suited to fill. However, the desire to keep drone operations covert requires more secrecy to operate with impunity. This self-reinforcing cycle stands in contrast with the understanding that negotiations are far more effective in dissolving terrorist groups.\(^{38}\)

Given the scale of the United States’ drone program, and the ubiquity of drone technology internationally, critics of killer drones face a great deal of resistance. A rationalist may claim that the benefits clearly outweigh the costs. The F22 Raptor, the newest generation of piloted jets, costs $100 million more than the newest UAV, the MQ-9 Reaper.\(^{39}\) Not only do drones reduce the strains on—and direct risks to—military personnel, they also have longer flight times than manned aircraft and consume less fuel.\(^{40}\) The strategic costs are relatively nebulous; increased recruitment by terror organizations and anti-American sentiment are more difficult to quantify or explicitly link to
drone use. Additionally, other avenues of research deserve investigation to understand the comprehensive costs, including the long-term negative psychological stress impacts on both American military personnel and the inhabitants living under the shadow of killer drones.

The data are insufficient to adequately account for the long-term consequences of drone use, but U.S. counterterrorism objectives continue to prioritize immediate gains, and each presidential administration faces narrow windows of time to maximize the short-term benefits. With relevance to the margins, the American drone program offers advantages over the global war on terror’s boots-on-the-ground strategy. UAVs save money, save American lives, and, as such, are far more politically palatable. Yet, if near-global drone coverage becomes America’s primary tool of power projection, how much money is truly saved in the context of perpetual, global operations? How many lives will be taken, rightly or wrongly, with little accountability from the U.S.? Perhaps most disturbingly, if covert drone use is so politically acceptable, what new norms will emerge on extrajudicial killings, and on the use of force as a first resort? UAV technology has outpaced the ability of norms and international laws to adjudicate and delineate acceptable and unacceptable behavior. Despite the political, not to mention corporate interests, the U.S. should exercise caution before wholeheartedly normalizing this technology that has already changed the nature of warfare.

**Conclusion**

American killer drones may be effective tools of lethal force but simultaneously subvert U.S. power projection. Drone programs thrive in frontiers where the host government is anemic but further undercuts that government’s capacity. When misused drones also produce grievances among the host nation’s population, which, when combined with weak central government capacity, increase the risk for civil unrest or war, as the case of Yemen demonstrates. The use of drones poses legal and ethical concerns that, in a broad sense, risk undermining the basic agreements of the international system that the U.S. helped build. Drones are an inescapable part of the future and will remain utilized by U.S. allies and enemies alike. The U.S. should, therefore, lead the international community in conversations about what role drones should play in managing violent conflict.
ENDNOTES


3 Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 142.


12 Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 146.


14 Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 146.


   Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 143.


18 Ibid.


22 Ibid.

24 International Human Rights and Conflict Resolution Clinic at Stanford Law School and Global Justice Clinic at NYU School of Law. (September 2012).


26 Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 143


29 Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 144


34 Columbia Law School Human Rights Clinic and Center for Civilians in Conflict. (2012). p. 33


36 Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 150.

37 Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 145.


40 Hudson, L., Owens, C. S., Callen, D. J. (Fall 2012). p. 149.
Conflict and Crime: Smuggling to Turkey from Iraq and Syria

by Rachel McGrath, MPIA ’20
Graduate School of Public and International Affairs, University of Pittsburgh

ABSTRACT
Turkey plays an important role internationally as a transshipment state between the Middle East and Asia to Europe. Given its strategic location, the country plays a part in three main smuggling routes into Europe. It is a well-known hub for narcotics, antiquities, oil smuggling, cigarette smuggling, transshipping of nuclear material, human trafficking, human smuggling, and money laundering. Advantageously located, Turkey has a comparative advantage as a destination and transit point for smuggled items out of conflict zones. Turkey’s strategic advantage in location is compounded by the transformed market during conflict. As conflict zones create new opportunity structures for organized crime, Turkey’s importance as a transshipment state is used by actors in these reemerging markets. In particular, this paper will discuss the impact of the conflict on smuggling with regards to oil, antiquities, and humans out of Iraq and Syria into Turkey during times of conflict.

Conflict Zones and Smuggling
Conflict zones transform illicit markets as they change the opportunity structure of illegal activities. With the breakdown of the state through violence, the state is unable to enforce laws that it was able to during times of peace. Conflict zones, and the following post-conflict reconstruction, create an environment in which state structures are weakened, thereby providing an opportunity for organized crime to flourish. Violence allows criminal activity to operate under the threshold of government impunity, as the government must split its focus among multiple threats, one of which is organized crime. This allows organized crime to exploit the new level of mobility afforded to it within conflict zones. Practitioner and Professor Dr. Phil Williams noted in his analysis of Iraq that “organized crime flourished in countries with weak state structures, questionable levels of legitimacy, and chaotic, dislocated, or dysfunctional economies.” Moreover, the market is transformed, allowing...
for organized crime groups to provide goods and services that are either not viable or not lucrative in a peaceful state.

The idea of paying bribes can also be seen as a fixture of organized crime in conflict zones. As Williams notes, in Iraq, contractors and subcontractors made protection payments to organized crime groups. Williams argues that corruption and violence are not necessarily substitutes for each other, but rather play into one another. The utilization of corruption by organized crime groups illustrates the interaction between the groups and the political infrastructure. When considering the role of organized crime in conflict zones, one should take note of the interactions between the strength of governance and the role of corruption and organized crime. Williams also notes that “corruption is not only a condition characterizing governments and bureaucracies but also an instrument used by criminal organizations to advance their illicit business interests and protect the illicit markets in which they operate.” Similar to the amorphous way in which organized crime can be both a tactic, as well as a group, corruption can also be a tactic, as well as a condition. In considering the role of corruption within conflict zones, one should see it as both the context in which transactions are occurring, as well as the catalyst for interaction between different actors.

**Actors in Smuggling**

Turkey has been a transshipment state for antiquities, oil, and humans smuggled out of Iraq and Syria during times of conflict. The smuggling of these products and persons are not done by unitary actors, but rather reflects the historical and situational realities of more ad-hoc actors.

Smuggling can often take on a subsistence level of activity. As noted by Bozcali and Kolay, oil smuggling and bunkering have been taken on by poorer individuals as a method to make money. Kolay specifically approaches the topic of oil smuggling through the lens of poverty evasion. Touching upon the historical and familial ties to smuggling, Kolay also mentions the saying in Habur of “no customs, no life” as a way to emphasize the role transborder commerce plays at this point on the border of Turkey and Iraq.

Similar to oil smuggling, antiquities smuggling can also be perpetrated by individuals. As noted in the Joint Special Operations University publication “IS and Cultural Genocide: Antiquities Trafficking in the Terrorist State,” unemployment rates in the area lead to those in poverty to employ themselves through illicit trade. They note, “looters are often ‘subsistence diggers’ who earn very low wages (less than 1 percent of the profit from the eventual sale)
and sell looted artifacts to middlemen.”9 It is also noted that looters in Iraq are also usually “those who have no job opportunities or alternate forms of income” due to the labor-intensive nature of looting.10

In conflict zones, combatants in the conflict also become involved in the criminal market, including terrorist organizations. While terrorist organizations have their own ideological goals within the conflict zones in which they are active, they also work in an opportunistic manner to raise funds for themselves to continue fighting. Flinn notes that “ISIS specifically, which earns $3 million per day in revenue from oil fields, is largely funded from the illicit oil trade.”11 ISIS is also known to partake in the antiquities market as well for its own funding, specifically the taxation of the right to loot archaeological sites in its territory.12

The International Council of Museums’ International Observatory on Illicit Traffic in Cultural Goods noted in “Countering Illicit Traffic in Cultural Goods,” that ISIS was not the only combatant group in the Syrian Civil War who was looting antiquities, but rather, looting occurred in regime-controlled areas, ‘opposition’-held areas, as well as Kurdish-held areas.13 The breakdown of the state in conflict zones allows for non-state actors to take advantage of black markets due to lesser obstacles by law enforcement.

Within conflict zones, actors involved in the illicit market may participate due to increased opportunities to engage in the black market, or they may participate due to a decrease in opportunities within the legal market. Given the historical ties to smuggling in Turkey and the surrounding area, those who participate in looting or smuggling may not see it as a crime, but rather as a means to survival.14

With regard to human smuggling, the impetus for engaging in the market is a bit more nuanced. In human smuggling, the illicit product is the travel to another country, and the demand for this market is coming from those who are being moved across borders. As Demir et al. note, Turkey has become a host and transit state for those who are trying to escape the violence of their home country.15 While not specifically connected to a state of conflict, Biner notes that, in the case of Iranians being smuggled into Turkey “the experience of crossing the border with the smuggler, while an arduous trek through mountains, is nevertheless a trek with a well-defined goal: to pass from illegality to legality.”16 Demir et al. note that there is evidence that human smuggling is carried out by smaller groups versus large criminal networks, as these groups rely on ethnic ties when working together as ‘facilitators.’17 They further state that,
Migrant smugglers in Turkey are mostly from Iraq, Iran, Pakistan, Afghanistan, Ukraine, Palestine, Syria, Bangladesh, and Greece. Smugglers are, in fact, usually from the same nationalities as those of the irregular migrants being smuggled. However, the majority of smugglers in Turkey are of Turkish citizens but with a different ethnic background. This note coincides with the utility of ethnic ties in building the trust needed in the human smuggling business. The diversity of actors within migrant smuggling could perhaps be an outcome of smaller networks operating out of Turkey, versus one large mafia-style network.

**Oil Smuggling**

Turkey has some of the highest oil prices in the world, which creates a lucrative opportunity for those who smuggle oil into Turkey. The price discrepancy between Turkey and its neighbors regarding the price of oil creates a flow into Turkey, as price differentials create demand and profit. “Its oil-producing neighbors, Iran, Iraq, Azerbaijan and Syria, supply petroleum products to their own national markets at remarkably low prices. The cheap oil rolls by the barrel over the borders into Turkey.”

Oil smuggling can be conducted in a variety of ways, such as overfilling gas tanks from trucks in the source country and selling the excess in Turkey, as well as bunkering oil from pipelines. Bozcali notes that the “pipeline on wheels” first described the illicit oil trade from Kurdish Iraq to Turkey during the 1990s as a way to evade the double embargo from “the trade sanctions imposed by the UN and the regional closure imposed by Baghdad.” Unable, and perhaps unwilling, to reign in the illegal oil trade, Ankara decided to regulate the oil trade between Iraq and Turkey—legalizing the practice. Bozcali notes that the trade between Iraq and Turkey picked back up after the 2003 U.S. invasion. However, the oil trade in 2003 was responding to the lack of refined oil in Iraq, as refineries and other infrastructure needed to refine oil had been destroyed in the conflict. Turkey, therefore, played the role of a refinery for crude oil in Iraq, as oil was transported to and from Iraq. This interaction between Iraq and Turkey regarding the oil trade over time illustrates the interaction between need and resources. While Iraq has oil supplies, the illicit trade between the countries adapted when Iraq lost the infrastructure to refine oil due to conflict.

In Syria, oil smuggling has been used by ISIS as a form of funding. In her article, “Black Gold in the Black Market,” Flinn notes that ISIS is dangerous due to the fact it is able to fund itself through oil smuggling.
While Flinn states that the realm between the licit and illicit oil market in Syria is muddied due to historical involvement of the government in oil smuggling, she notes that “the Syrian civil war will be prolonged by oil smuggling that occurs there. Furthermore, the profitability from oil smuggling in Syria has not diminished, and is driven by the activity of insurgent groups.”

The profitability of oil, as well as a group’s own ability to use it, makes oil a strategic natural resource for an insurgent group to take advantage of within a conflict zone. As noted by Bozcali, illicit oil can be mixed with licit oil in gas stations, allowing for it to be integrated into the licit market, in effect, laundering the oil.

In 2015, the Arab Press Service noted that Russia targeted oil extraction sites and refineries, as well as truck columns in Syria, in an attempt to disrupt oil smuggling by ISIS to Turkey. According to the Arab Press Service, “Moscow said militants had been looking for new ways to smuggle oil out of Syria to avoid Russian.” This observation highlights the need for flexibility in illicit smuggling, as new opportunities, such as availability of oil, can come with new challenges as well, such as airstrikes. Local smuggler strikes would have the advantage of being able to fall back on their historical knowledge of the terrain and smuggling routes to be able to adapt. Having a history of smuggling in Turkey, would provide these border regions with more institutional knowledge of smuggling to be utilized by smugglers.

**Antiquities Smuggling**

Turkey’s role in antiquities smuggling can be explained in part by its comparative advantage in location. As noted by Toktas and Selimoglu, the flow of illicitly procured antiquities and art moves from producers in the East to consumers in the West. Turkey is placed in the crux of East and West, which has allowed for a long history of smuggling in Turkey and allows Turkey to play a large role in three smuggling routes into Europe.

Cases of antiquities smuggling paralleled conflict in both Iraq and Syria. In Iraq, as in Syria, looters were able to take advantage of the lack of guards for the multitude of archaeological sites. Conflict in Syria has allowed for the pillaging of cultural property, or antiquities, by actors such as ISIS, the Kurdish forces, opposition forces, and the Syrian regime. In Phil Williams’ analysis of antiquities trafficking out of Iraq post-2003 American intervention, he notes that the looting of cultural artifacts from the national museum of Iraq, The Iraq Museum, was carried out by, not only professional looters, but also by amateurs. In this case, some of the artifacts stolen were taken by museum employees for safekeeping during the unrest.
Smuggling antiquities can bring profits to organized crime groups through both the smuggling and selling of the cultural property, as well as through the taxation of territory in which the goods are transitioned through. Colonel Bogdanos, from the U.S. Marine Corps, who was placed to head the investigation into looting at The Iraq Museum “suggested that antiquities were playing the same role for the insurgency in Iraq as opium was for the Taliban in Afghanistan and that they had even generated ‘an underground tariff system.’” In this sense, antiquities had become a ‘natural resource’ in Iraq that insurgents could use for financing themselves. Rebel groups and terrorist organizations in Syria have also been able to take advantage of antiquities as a ‘natural resource’ for financial exploitation. Cengiz and Roth note that, between Turkey and Iraq, some of these corridors are controlled by the PKK, which taxes goods coming through its territory as a source of financing. Coming out of Syria, ISIS has been known to tax those who are smuggling antiquities. The hearing “Preventing Cultural Genocide: Countering the Plunder and Sale of Priceless Antiquities by ISIS” before the House Financial Services Committee’s Task Force to Investigate Terrorism Financing, notes that through trade-based money laundering “ISIS used to smuggle cash in and out of the territory it controls…[and] many of these routes run through Turkey and Jordan.” As the state is unable to provide a deterrent force against looting, illicitly acquiring antiquities becomes relatively easier.

For invading forces in a conflict zone, the looting and destroying of cultural artifacts has been a long-standing occurrence. The International Council of Museums notes:

Within conflict antiquities trading, there are intertwined strands of cultural property crime, including might-makes-right plunder, which has persisted in the sack of vulnerable States by powerful States…This too, has persisted in the State crimes of the Ottoman Empire, Bolshevik Russia and the Soviet Union, Nazi Germany, the People’s Republic of China and Khmer Rouge Cambodia, for which the expropriation of vulnerable communities’ cultural property was also a constituent element of persecution.

The symbolic nature of plundering cultural property by invading powers can play into the invading power’s desire to show dominance over the territory they control. ISIS’ destruction of cultural property can be seen within this tradition.
Human Smuggling

Human smuggling to Turkey is apparent in both cases of Iraq and Syria and the conflict that has occurred there. However, human smuggling in Turkey is not confined to the market that is created from refugees of conflict zones; rather, Turkey is also the transit and destination state of those who are being smuggled out of other areas, such as Iran. As Demir et al. explain, the increase in human smuggling into Turkey seems to coincide with the conflict occurring in neighboring countries, especially with the influx of migrants from Syria since 2015. Based on his analysis of human smuggling out of Iraq, Williams claims that human smuggling can be seen as an alternative to seeking a visa. In the case of Syrian migration to Turkey, Achilli comments that if Syrians had proper documentation, many did not need a visa to fly to Turkey and, thus, would not need someone to smuggle them.

Williams also explains that conflict in 2003 impacted human smuggling out of Iraq, specifically looking at the number of asylum applications in Europe. The number of applications doubled from approximately 9,000 to 18,000 between 2006 and 2007. Baird notes that “The U.S. invasion of Iraq in 2003 spurred the international smuggling of weapons, petrol, and refugees into the region.” While these items take the same route, Demir et al. note that it is more likely that human smugglers will only engage in human smuggling to reduce the risk that they would incur by coordinating with other organized crime groups. Moreover, many smugglers between Syria and Turkey do not see smuggling as a crime, but rather as “a legitimate form of labor, albeit criminalized, but a moral duty.” A great number of migrants fleeing the conflict in Syria has created such a large market for migrant smuggling that human smugglers advertise their services overtly through social media, though recently, the Turkish authorities and the EU have been working to curb human smuggling, causing the market to become more clandestine. This change in how producers and consumers interact within the migrant smuggling market illustrates the large opportunities migrant smugglers had due to conflict pushing Syrians to flee. In both the case of Kurds leaving Iraq, as well as Syrians fleeing the civil war in Syria, human smugglers have been known to approach migrants to help them find their smuggler, using ethnic and tribal connections to build trust. While human smuggling is a fee-for-service industry, trust and ethnic ties play an important role in smuggling from Iraq and Syria through Turkey.
Conclusion

Turkey has a long tradition of smuggling through its borders. Located along three major smuggling routes, as well as between Europe, Africa, and the Middle East, Turkey has become a hub for illicit trade. Depending on the illicit product or the specific case, Turkey can be considered a source, transit, or destination country. Turkey’s proximity to conflict zones has also fed illicit trade into and through the country. Conflict zones transform markets as they create a new opportunity structure for participation.

The new opportunity structure created through conflict may foster few opportunities for income outside of the illicit market, such as the 1990s oil embargo on Iraq, which “pushed” participants into the illicit sector of the economy. To provide a livelihood for themselves, those on border towns illegally smuggled oil into Turkey. Oil smuggling into Turkey was compounded by high levels of profit potential in Turkey, as national prices for oil there are extremely high.

Conflict could transform the market by providing lower barriers to entry, which ‘pull’ individuals into the illicit market. For example, by controlling territory in Syria, ISIS has been able to exploit oil reserves and archaeological sites to fund itself. Similarly, Demir notes that the influx of Syrian refugees encouraged smaller smuggling groups to appear.

The combination of push and pull factors into the illicit market created by conflict, the proximity of Turkey to conflict zones, and the historical smuggling routes and traditions, have made Turkey a key point in the illicit markets of oil, antiquities, and human smuggling from Iraq and Syria. Criminal enterprises must be flexible as they adjust themselves to the demands of the consumers, as well as the ability to exploit new opportunities, as seen through the adjustment of smuggling networks from Syria and Iraq to Turkey for oil, antiquities, and human smuggling.
ENDNOTES


5 Ibid. p. 159.

6 Ibid. p. 207.

7 Ibid. p. 209.


13 Ibid. p. 84-85


19 Ibid. p. 379


21 Ibid. p. 24

22 Ibid.

23 Ibid. p. 25


25 Ibid.


27 Ibid. p. 125


31 Ibid.

35 Ibid. p. 174-176
36 Ibid. p. 176-177
39 United States. Congress House Committee on Financial Services Task Force to Investigate Terrorism Financing.
   (2017). Preventing Cultural Genocide: Countering the Plunder and Sale of Priceless Cultural Antiquities by ISIS:
   Hearing before the Task Force to Investigate Terrorism Financing of the Committee on Financial Services, U.S. House
   ProQuest Ebook Central. p. 58.
   trafficking of cultural property. p. 74-75.
The Fourth Industrial Revolution: The Potential Impacts of Artificial Intelligence and Automation Technologies on Gender Equality

by I Younan An, MID '21
Graduate School of Public and International Affairs, University of Pittsburgh

ABSTRACT

In the fourth industrial revolution, the world is changing at a rapid rate with innovative integrated digital technology, and to an even greater extent with artificial intelligence (AI) and automation technologies. Industry 4.0 has the goal of digitally transforming the manufacturing sector production line to promote productivity with less physical labor by using artificial intelligence (AI) and automation technologies. This paper examines the likely detrimental effects of AI and proposes to change the structure of the labor force by reducing the share of female employment in the manufacturing sector through employer’s male preferences, demand for high skilled labor, and the status of women’s work. AI and automation technologies are also likely to perpetuate gender inequality due to the unequal access of men and women to information and technical and vocational training. Empirical research shows that AI and automation technologies are putting 88 percent of waged garment workers at high risk of replacement in Cambodia. Women make up approximately 80 percent of the textile, clothing, and footwear (TCF) industries in Cambodia. Women, therefore, are at a higher risk of being replaced by those technologies because they are low-skilled workers who perform repetitive tasks.

Introduction

Industry 4.0, a term that refers to a rapid digital technological process filled with highly automated and intelligent machines in production and lifestyle, is conquering the world. It is not only embedded in the industrial and manufacturing sector, but also in the service sector and the everyday lives of people. According to the World Economic Forum, “Part of this ‘revolution’s promise’ is that AI and similar technologies will be used to drive economic
growth, development, and positive societal change. But, critical inquiry is urgently needed to gauge what effects the fourth industrial revolution is having and will have on vulnerable, marginalized populations. The expansion of AI and automation technologies can potentially displace millions of workers, especially female, from their current jobs, cause radical changes in the labor force, and shift population dynamics. Through shifting in employment and skills, the fourth industrial revolution can lead to an increase in gender inequality. Across the Association of Southeast Asian Nations (ASEAN) region, women may fare worse than their male counterparts in losing existing jobs and attaining higher-skilled ones. ASEAN countries are especially vulnerable to the expansion of AI due to their dependence on a low-skilled workforce. The future of women's employment and progress towards gender equality may be stalled with the increasing role of AI and automation technologies.

The rise of new technologies across a range of industries may continue to widen gender gaps because it has the potential to change the composition of the labor force. It is likely to impose a decline in the share of female employment in the manufacturing sector, especially the textile, clothing, and footwear (TCF) sector. Then, it can deepen gender inequality in terms of access to information and communication technologies (ICT) and access to technical and vocational education training (TVET). Many young female workers are at risk of being replaced by AI and automation technologies due to the nature of their work and the unequal access to technological opportunities and skills.

AI and the Automation Revolution: A New Set of Critical Gendered Issues and the Structural Change in the Manufacturing Labor Force

The goal of industry 4.0 is to transform the manufacturing industry digitally by using innovative AI technology to turn factory floors into flexible self-maintaining operations. Technological upgrades in the manufacturing sector will be good for the production line by producing items more efficiently, but low- to medium-skilled workers tasked with repetitive jobs may be at risk. The majority of women who work in manufacturing hold positions that are at high risk of automation. Technology is an important driver in ensuring an equitable composition of the manufacturing sector. Previous declines of female employment in notable countries such as Taiwan, South Korea, Malaysia, Thailand, and Indonesia can all be attributed to various industrial and technological upgrades such as the installation of new automated machines and capital-intensive production. It is very important to note that
AI and automation will have a likely chance of exhibiting the same effect. However, the impact seen from the implementation of AI technology might be quite different from earlier technological upgrades.

In the future, a relatively large proportion of human jobs will be lost as a result of AI technology. The TCF industry is one of the major labor-intensive manufacturing sectors that is susceptible to digital technology upgrades in its production to promote industry profits. Sewbots, computer-aided design, and robot machines are being integrated into the TCF industry to increase productivity by lowering labor costs and shrinking the human labor force. For example, Sewbots can potentially cut down labor work and increase the rate of production by more than double. China has already produced more of its TCF exports with fewer workers, and the production gap continues to increase as they add more automated and innovative technologies. In Dongguan, China, the labor force decreased by 280,000 workers over the past five years due to the installation of 91,000 robots. Factories in Bangladesh that once had 300 workers now employ only 100 workers due to technological upgrades.

The preference for male employees, the demand for high-skilled labor, and the status of women’s work have contributed to the decline of female employment in the textiles, garments, and footwear industries. Many manufacturing organizations demonstrate gender bias by favoring males in positions of authority. In Taiwan, South Korea, and Malaysia, textile and apparel employers have a strong preference for male workers over female workers, and as a result, female employment declined. In Confucian society like South Korea and Taiwan and in an Islamic society like Malaysia, the preference for promoting men’s status permeates all spheres of traditional society. Employers often associate women with common stereotypes about their caring nature, greater manual dexterity, and the ability to do housework. This limits women’s employment options to knitting, weaving, sewing, and other service positions such as social workers and nurses. Employers’ discrimination against female workers and other barriers to women working in the better-paid, skill-intensive jobs and capital-intensive processes has decreased the opportunities for women in the manufacturing labor force.

Female textile workers tend to be tasked with repetitive, low-skilled work, which hinders their progress toward advanced and technological tasks that often are considered male jobs. Female workers tend to be reluctant to exercise authority and are less trained in hard science tasks, which disqualifies them from tasks that involve advanced technological responsibilities. The new AI technological upgrades not only favor male workers but also reflect...
a new barrier for female workers. Female workers are likely to remain at the factory floor, where moving up the ladder to higher skilled jobs or positions is limited to those with technological skills and knowledge of new automated and AI technologies.

During the late 1980s, Taiwan saw technological changes that resulted in the decline of wage and salaried female workers and the rise of a gender wage gap.²¹ When the production shifted in the 1980s from a labor-intensive to a more capital intensive one, the composition of the workforce also changed.²² Since then, there has been a significant decline in female employment in many industries, including the metal industry in Buenos Aires, the TCF industry in Spain, others in Singapore, and maquiladoras in Mexico.²³ The AI and the automation revolution are likely to further gender inequality in the workforce on a global scale by retaining men in the workforce with capital incentives and well-paying jobs and overlooking women. This is likely going to decrease female employment in industries such as TCF.

Second, the AI and automation technologies will prioritize highly skilled labor and place female workers at a disadvantage. Female workers will be at risk of losing their jobs because their skills are no longer relevant. In the TCF manufacturing sector, women are concentrated in the assembly line, where they supply low skilled labor.²⁴ Due to a technologized restructuring, the industries will require more specialized skills, which often translates into increased demand for male labor and a decreased demand for female labor.²⁵ The increased demand for high-skilled labor is unlikely to attract female workers due to their lack of access to upskilling opportunities to learn new software and equipment.²⁶ With the adoption of AI, these effects will be increased. AI technologies such as robots, innovative cutting machines and computer-aided design can substitute human labor, especially in displacing low skilled labor on the factory floor. Moreover, AI technologies can lead to a decrease in the share of female employment because AI and automation aim to replace repetitive tasks in the assembly line. The nature of women’s work in the TCF industries is often repetitive and labor-intensive. These types of tasks earn workers low wages and little job security. This will especially be the case with the implementation of AI and automation. The demand for routine job-specific skills will continue to decline as machines replace workers most easily when routine tasks that are codifiable.²⁷

The TCF industries are more likely to invest their budget in implementing AI and automation to offset the labor costs, which also means that female workers are more likely to become unemployed. In each of the ASEAN-5 countries,²⁸ women are more likely than men to be employed in
an occupation at a high risk of automation technologies.\textsuperscript{29} In the Japanese labor market, female workers have very little opportunity to advance their career within AI technology. Male workers are more likely to get decision-making positions and professional jobs that are more difficult to replace with AI technologies.\textsuperscript{30}

Deepening Gender Inequality: Access to Information and Communications Technologies

AI and automation are likely to widen gender equality because they may expand the technology gap between men and women. Having access to opportunities such as ICTs is important in society and extremely useful in manufacturing occupations in a rapidly growing AI landscape. However, women have less access to ICTs compared to men.\textsuperscript{31} They have lower digital literacy compared to their male counterparts as well.\textsuperscript{32} AI and automation will likely contribute to gender inequality because they will depend on high-skilled labor and the ability to access opportunities to help build those skills.\textsuperscript{33} In order to harness the full potential of AI, employees will need to be better equipped and trained with digital competencies. Without access to proper training to learn these digital skills, women are more likely to be discriminated against by the workforce.

Digital literacy is a critical component for everyone in the workforce, especially young women. The digital divide is a gap between those who have access to computers and the internet and those who have limited or no access.\textsuperscript{34} The digital divide reflects inequalities in access and barriers to productive use.\textsuperscript{35} Accessing ICTs is difficult for many women, especially those in non-OECD countries. This is where they can gain digital skills to catch up with their male counterparts. In Africa, for example, only 12 percent of women have access to the internet compared to 18 percent of males.\textsuperscript{36} In low and middle-income countries, there were 250 million fewer women online in 2017,\textsuperscript{37} 197 million fewer women than men who own mobile phones in 2019, and only 48 percent of women who have access to mobile internet.\textsuperscript{38} This lack of access to ICT training has real consequences and perpetuates gender inequality in the ICT workforce. For example, as seen in the tech industry such as Facebook, Google, and Apple, only 17 percent, 19 percent, and 23 percent of their respective technology staff are women.\textsuperscript{39} Moreover, in the AI field, women makeup only 22 percent of AI professionals.\textsuperscript{40}
It is crucial for women to have adequate access to ICTs in order to remain relevant in the AI and automation revolution. Mobile phones are tools that can improve autonomy, social mobility, enhance skills, and productivity to participate in the labor market and save money and time.\textsuperscript{41} It is critical for women to have access to ICTs. Mobile phones can allow women to access new information, services, and life-enhancing opportunities.\textsuperscript{42} Owning mobile phones also provides women with the distinct benefits of access to educational, health, business, and employment opportunities.\textsuperscript{43} Having access to ICTs allows women to explore employment opportunities through the use of technology.

The technology gap between men and women further exemplifies the inequalities women continue to face in the labor force. If the gender digital divide continues to persist, the role of AI and automation will further set back gender inequality not only in the labor force but also in other sectors. Closing this gap can empower women both online and offline in their economic and social conditions.\textsuperscript{44} Women’s access to ICTs, mobile ownership, and internet access is an integral component in preparation for the impact of AI and the automation revolution.

**Deepening Gender Inequality: Access to Technical and Vocational Education Trainings**

Access to technical and vocational training can be an integral part of performing jobs in advanced manufacturing. The gender gap in technical and vocational training can have significant negative implications for women’s participation in this digital society of the fourth industrial revolution.\textsuperscript{45} AI technologies are likely to perpetuate gender inequalities in terms of access to technical and vocational training because men have historically outnumbered women in the sector. The demand for a skilled labor force in AI and robotics will require workers to have pertinent technical and vocational skills.\textsuperscript{46}

Looking solely at a traditional college education cannot explain the technical competencies of an employee. A college degree might be the only path to qualify for jobs today because employers will shift to prioritize technical education.\textsuperscript{47} Science, technology, engineering, and mathematics (STEM) education can provide a base to develop advanced digital skills and a pathway to a career in tech or advanced manufacturing.\textsuperscript{48} However, the gender gap in access to STEM or technical and vocational training is significant. Girls in secondary education tend to have lower self-efficacy and interest in studying
STEM subjects as well as lower aspirations for STEM careers. Technical and vocational education training teaches people the necessary skills that are useful in preparing for future work with AI technologies. Women have less time to reskill because they spend much more time than men on unpaid care work and they have lower access to digital technology and participation in STEM fields than men. Women continue to be subjected to the time constraints of pursuing a double work-life standard of balancing paid work (in labor market) and unpaid work (housework). Compared to men, they have less time to pursue other opportunities to participate in technological upskilling opportunities. As new technologies emerge, employers prioritize relevant technical education. Workers who supply low skilled labor and have less access to skills training or technical education remain at risk. Innovative technology not only demands highly skilled workforce, but also discourages low-skilled labor.

Case Study of Cambodia: Potential Effect in the TCF Labor Force

The effects of AI in the manufacturing industry can be seen by looking at cases like Cambodia’s garment industry, where around 88 percent of waged workers in the garment industry of Cambodia are at risk of losing their jobs due to automation. This trend is similar across the region as seen in Vietnam, where approximately 86 percent of the waged workers in garment industries are at risk.

The TCF manufacturing is the cornerstone of Cambodia’s GDP and export growth. More than one million Cambodians are employed in this sector. As shown in Figure 1, women makeup approximately 80 percent of the TCF manufacturing sector and face disproportionate risks of being replaced by automation technologies. As shown in Figure 2, 72 percent of female employees in the TCF workforce completed 11th grade, and three percent of the female employees successfully received and passed the national baccalaureate exam. Lower educational attainment often results in low-skilled jobs, especially labor-intensive assembly tasks in the TCF sector. With repetitive and labor-intensive tasks, jobs are easily codifiable and replaced by the technologies to cut the cost of wages.

AI and automation technologies are also more likely to replace jobs that are repetitive and labor-intensive, such as those requiring manual and physical tasks. As shown in Table 1, 93 percent of the TCF employees work as factory floor workers and around 75 percent to 95 percent of women are employed in lower-ranked factory floor positions such as sewer operators. As women in
factory floor positions largely perform repetitive tasks, the AI technology can easily substitute them through computerization and codification.

**The Gendered Technology Access Divide**

In Cambodia, women have less access to technology compared to men. There is a 20 percent gender gap in terms of mobile ownership; whereas 78 percent of Cambodian men own mobile phones, only 62 percent of Cambodian women own mobile phones. Mobile phones allow people to become better connected and digitally competent, which allows them to remain competitive and relevant in the digital age. Access to the internet is also a critical component of technological skills. Only 30 percent of Cambodian women have access to the internet compared to men, as shown in Figure 3. Similarly, there is a 32 percent gender gap in access to social media. Whereas 37 percent of Cambodian men use social media, only 25 percent of Cambodian women do.

There are also clear gender disparities in smartphone use. Smartphones are key indicators of wealth, independence, and digital literacy. In Cambodia, only 46 percent of women own smartphones compared to 52 percent of men. However, 46 percent of women-owned basic phones compared to only 36 percent of men used basic phones. In addition, women are more likely to be newer phone owners compared to men who are more experienced users. Mobile phones generally improve individual autonomy and connectivity, and enhance skills for productive participation in the labor market. As shown in Figure 4, over half of Cambodian women who own phones have owned them for less than six years. In contrast, 34 percent of male phone owners in Cambodia have owned them for at least a decade. Thus, women continue to lag behind men in access to mobile phones, internet and social media use, and overall technological experience.

**The Gender Gap in Technical and Vocational Trainings**

Women struggle significantly to enroll and attain technical and vocational education. Technical and vocational education is an important and integral part of learning new skills, especially those pertinent to AI and the automation revolution. The technical and vocational training offered in Cambodia is divided into two systems: degree programs and non-degree programs. In degree programs, students spend a significant amount of time pursuing degrees (certificate, associate, undergraduate, and graduate). Non-degree programs are often immersive and accelerated, where students spend less than one year being trained on specific skills. There are more men than women enrolled in
all of these programs. As shown in Figure 5, with the exception of 2013 and 2014, women enrolled in continuing education at a significantly slower rate than men. In 2018, only 17,893 female students were enrolled in all TVET institutions, both public and private, in Cambodia. Male students dominated all TVET institutions at a 2:1 ratio. The gender gap in the technical and vocational training seems to close in 2014 and 2018. As per Figure 6, in the short-term program enrollment in information technology (IT), women outnumbered men only in the basic computer course of 56.7 percent, but that only corresponded to 17 women in real terms. Women lag behind their male peers in computer design (37 percent), computer repair (39.8 percent), and computer service courses (46.5 percent). Aside from IT-related subjects, women tended to outnumber men, including in agricultural and farming related courses and sewing. This shows that men continue to dominate the IT sector and will continue to benefit from the AI and automation revolution as they have more compatible skills in the labor force.

In the long-term degree programs, the gender gap persists in the IT major. The female enrollment exceeds male enrollment in the certificate programs in relation to IT degrees, but in higher education, diploma, and bachelor’s degree levels, women lag behind men significantly. As shown in Figure 7, only 33.8 percent and 23.5 percent of High School diplomas and undergraduate degrees are held by female students. In majors other than IT, women make up a much smaller percentage of students than men across degree levels. In graduate programs for other majors, women make up only 7.4 percent of the student enrollment. Similarly, they make up only 31.9 percent of enrollees of other undergraduate programs. Women, in fact, continue to fall behind men in enrollment in all technical and vocational programs. As a result, the future of the workforce with AI and automation technology is likely to be more segregated and unequal across genders.

**Conclusion**

The impact of AI and the automation revolution will likely cause a more detrimental effect on the lives of women as compared to their male counterparts. In terms of changing the labor force, there is likely to be a significant decline in female employment, especially in the TCF industry, due to the male preference from employers, demand for high skilled labor, and the status of women’s work on the garment floor factory. Moreover, women already lag behind men in terms of access to ICTs and technical training. This is likely to further set them back in terms of participating in the economy as
it will be filled with AI and automation technologies. Women also have less access to phone ownership and internet usage. Lastly, women are less likely to enroll in TVET institutions and are more likely to enroll in short-term courses and enroll in non-IT-related courses or classes. Since women overwhelmingly occupy jobs with low-skilled responsibilities and repetitive tasks, they are more vulnerable to replacement by AI and automation technologies.

**APPENDIX A: FIGURES**

**Figure 1:** Demographic of workers in the TCF industries in Cambodia.

![Diagram showing demographic distribution of workers in TCF industries in Cambodia.]

**Figure 2:** Educational Attainment of Female TCF Workers in Cambodia.

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grades 1-4</td>
<td>13%</td>
</tr>
<tr>
<td>Grades 5-11</td>
<td>72%</td>
</tr>
<tr>
<td>Diploma</td>
<td>3%</td>
</tr>
<tr>
<td>Bacc. II</td>
<td>2%</td>
</tr>
<tr>
<td>Bachelor Degree</td>
<td>2%</td>
</tr>
<tr>
<td>Not stated</td>
<td>4%</td>
</tr>
<tr>
<td>Grade 12 (no certificate)</td>
<td>4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Grade Level</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Grades 1-4</td>
<td>13%</td>
</tr>
<tr>
<td>Grades 5-11</td>
<td>72%</td>
</tr>
<tr>
<td>Diploma</td>
<td>3%</td>
</tr>
<tr>
<td>Bacc. II</td>
<td>2%</td>
</tr>
<tr>
<td>Bachelor Degree</td>
<td>2%</td>
</tr>
<tr>
<td>Not stated</td>
<td>4%</td>
</tr>
<tr>
<td>Grade 12</td>
<td>4%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Industry</th>
<th>Male Percentage</th>
<th>Female Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Footwear</td>
<td>20.3%</td>
<td>79.7%</td>
</tr>
<tr>
<td>Garment</td>
<td>20.8%</td>
<td>79.2%</td>
</tr>
<tr>
<td>Textile</td>
<td>32.1%</td>
<td>67.9%</td>
</tr>
<tr>
<td>Total industries</td>
<td>21.2%</td>
<td>78.8%</td>
</tr>
</tbody>
</table>
**Figure 3:** Percentage of Men vs. Women access to ICT in Cambodia.

**Figure 4:** Years of mobile ownerships by Male and Female.
**Figure 5:** Total enrollment of students in TVET institutions in Cambodia.

![Total Enrollment of Students](image)

**Figure 6:** Enrollment of students in short-term programs in 2018 in Cambodia.

**Short Term Enrollment of related IT subjects in 2018**

<table>
<thead>
<tr>
<th>Subject</th>
<th>Female</th>
<th>Male</th>
<th>Female%</th>
<th>Male%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic Computer</td>
<td>17</td>
<td>13</td>
<td>56.7%</td>
<td>43.3%</td>
</tr>
<tr>
<td>Computer Design</td>
<td>71</td>
<td>121</td>
<td>37.0%</td>
<td>63.0%</td>
</tr>
<tr>
<td>Computer Repair</td>
<td>174</td>
<td>263</td>
<td>39.8%</td>
<td>60.2%</td>
</tr>
<tr>
<td>Computer Service</td>
<td>175</td>
<td>201</td>
<td>46.5%</td>
<td>53.5%</td>
</tr>
</tbody>
</table>
**Figure 7: Enrollment in Other Majors vs IT Major by Degree Level in 2018 in Cambodia.**

<table>
<thead>
<tr>
<th>Degree Level</th>
<th>Female %</th>
<th>Male %</th>
<th>Female %</th>
<th>Male %</th>
</tr>
</thead>
<tbody>
<tr>
<td>Certificate 1</td>
<td>15.8%</td>
<td>84.2%</td>
<td>54.8%</td>
<td>45.2%</td>
</tr>
<tr>
<td>Certificate 2</td>
<td>8.3%</td>
<td>91.7%</td>
<td>45.5%</td>
<td>54.5%</td>
</tr>
<tr>
<td>Certificate 3</td>
<td>13.5%</td>
<td>86.5%</td>
<td>51.3%</td>
<td>48.7%</td>
</tr>
<tr>
<td>Higher Diploma/...</td>
<td>24.1%</td>
<td>75.9%</td>
<td>33.8%</td>
<td>66.2%</td>
</tr>
<tr>
<td>Bachelor Degree</td>
<td>31.9%</td>
<td>68.1%</td>
<td>23.5%</td>
<td>76.5%</td>
</tr>
<tr>
<td>Master Degree</td>
<td>7.4%</td>
<td>92.6%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

**APPENDIX B: TABLES**

**Table 1: TCF workers by occupation types.**

<table>
<thead>
<tr>
<th>Occupation Type</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>Garment floor workers</td>
<td>93.08%</td>
</tr>
<tr>
<td>Handloom weavers in textile</td>
<td>2.61%</td>
</tr>
<tr>
<td>Building Frames and related trade workers</td>
<td>2.47%</td>
</tr>
<tr>
<td>Architect planners, surveyors and designers</td>
<td>1.33%</td>
</tr>
<tr>
<td>Tailors, dressmakers, furriers and hatters</td>
<td>1.07%</td>
</tr>
<tr>
<td>Handicraft workers</td>
<td>0.64%</td>
</tr>
<tr>
<td>Heavy Truck and bus driver/transport</td>
<td>0.26%</td>
</tr>
<tr>
<td>Business and Administration Managers</td>
<td>0.23%</td>
</tr>
<tr>
<td>Material-recording and transport clerks</td>
<td>0.22%</td>
</tr>
<tr>
<td>Manufacturing supervisors</td>
<td>0.19%</td>
</tr>
<tr>
<td>General office clerks and secretaries</td>
<td>0.12%</td>
</tr>
</tbody>
</table>
Endnotes


4 ASEAN is the Association of South East Asian Nations, a regional organization composed of ten Southeast Asian countries: Brunei, Cambodia, Laos, Indonesia, Malaysia, Thailand, Philippines, Singapore, Myanmar, and Vietnam.


7 Ibid


23 Ibid


ASEAN-5 countries are Cambodia, Thailand, Indonesia, Philippines, and Vietnam. 


Ibid. 


Ibid. 


Ibid. 


Ibid 


Ibid.
The data in this section received from the International Labor Organization Garment Sector Bulletin on Cambodia garment industry and a study on the future of work from automation impact from International Labor Organization.  


The empirical data in this section received from the LIRNEasia and After Access study of ICT use and Access in Asia and the Global South volume 3. This data was reported based on nationally representative surveys of households and individuals conducted by DIRSI, LIRNEasia and Research ICT Africa. 


Nuclear and Missile Arsenal Policies in China Post–INF Treaty

by Erin Frank, MPA ’20

Graduate School of Public and International Affairs, University of Pittsburgh

Abstract

China and the United States continue to maintain a tense relationship, particularly after the United States formally left the Intermediate Nuclear Forces (INF) Treaty with Russia at the beginning of August 2019. The disbandment of the INF Treaty, which was designed to ban signatories from developing several types of missiles, has paved the way for potential attacks against the United States by both Russia and China. This framework was largely disbanded due to allegations that Russia had violated the treaty by developing illegal weapons. Juxtaposed with China’s continued growth in its missile forces, President Trump decided to withdraw the United States from the treaty on August 20, 2019. Thus, the United States has been prompted to re-evaluate its national security policies against China as threats continue in the region, particularly along the South China Sea.

Chinese Missile Arsenal

The Intermediate-Range Nuclear Forces Treaty was signed into effect in 1987 by the United States and the Soviet Union. This arms control treaty was designed to eliminate the creation and testing of nuclear and ground-launched ballistic and cruise missiles within the 500-5,500 kilometers range. The INF Treaty only included the United States and Russia as signatories, leaving China immunity to develop and test nuclear and ground-based ballistic and cruise missiles without consequence.

In the last three decades, China’s nuclear arsenal has continued to grow, fueled even further by the disbandment of the INF Treaty and the freedom that the United States is now experiencing to develop and test missiles. In an impressive exhibit for China’s 70th anniversary parade on October 1, 2019, Beijing displayed a sophisticated weapons arsenal and a new “strategic triad” of weaponry.¹ The current nuclear arsenal, which includes land-based bombers, intercontinental cruise missiles, and ballistic-missile submarines, is...
being replaced by hypersonic cruise missiles, stealthy drones, and the use of advanced helicopters and high-speed boats for Special Forces. \(^2\)

Inside the arsenal is China’s hypersonic cruise missiles, which can fly ten times faster than conventional cruise missiles. The DF-41 is an intercontinental ballistic missile with a range of up to 15,000 km. \(^3\) The DF-41 is considered to be the most powerful missile in the world with the capability of carrying ten independently targeted nuclear weapons. Each warhead yields about 150 kilotons and would take only 30 minutes from launch for it to reach the United States. \(^4\) In addition, China has been testing hypersonic glide vehicles, with the expectation of deploying the first model in 2020. The DR-8 supersonic drone also has the capable speed of flying up to five times the speed of sound, getting close enough to aircraft carriers to send targeting information to missile launchers. \(^5\) The DF-21D is an anti-ship missile, which has a range of more than 1,500 km and presently surpasses any warplane on U.S. flight decks today. Lastly, the HSU-001 robotic underwater vehicle is most useful for reconnaissance and secretly mining an enemy harbor against submarines and other ships by diving into the water from flight. \(^6\)

**Chinese Goals, Policies, and a Dangerous Bilateral Partnership**

During the INF Treaty’s 32-year lifespan, China continued to develop a missile arsenal with launch ranges that the treaty prohibited. \(^7\) By 2017, nearly 95% of China's missiles would have violated the agreement. \(^8\) In an attempt to avert further growth of China’s arsenal, President Trump announced that, during the United States’s intent to withdraw from the INF Treaty, the only way the agreement would stay intact would be if China became a signatory. China has already rejected the proposition, citing that it would take away their current nuclear deterrents. \(^9\) China’s goals currently seek to produce such a large and powerful arsenal that the United States would have no incentive to actively engage. Beijing’s investments into the weaponry have brought on multiple-range ballistic missiles that travel faster than the speed of sound, ultimately providing little opportunity to be intercepted or brought down by countermeasure technology. \(^10\)

In a strategic partnership, Russia is assisting China with building a highly sophisticated missile-defense early warning system. \(^11\) Russia and China seek to continue to build their strategic bilateral partnership, not only to forge cooperation between both militaries, but due to their respective distrust of the United States and its allies. In a public declaration, Russian President Vladimir Putin said, “We are now helping our Chinese partners to create
a missile warning system….This is a very serious thing that will drastically enhance the defensive capacity of the People’s Republic of China as currently, only the United States and Russia have such systems.”

Even though China’s economy has outpaced Russia’s, China remains reliant on Russian military technologies. From 2014-2018, Russia was the world’s second-largest arms exporter, with China as its second-largest customer. China has yet to develop the technological capabilities that match Russian suppliers and, thus, they are reliant on certain arms technologies for combat aircraft and large ships. In July 2019, Russia and China took part in a coordinated military exercise over the Sea of Japan. Even more recently, in September 2019, 1,600 Chinese troops participated in a large-scale joint exercise at a Russian training base. Both countries have a new bilateral agreement for military cooperation in place for the next two years.

In 1964, China achieved nuclear weapons capability and has since maintained a “No First Use” (NFU) policy. This NFU policy forbids China from using nuclear weapons first, at any time or under any circumstance. There are some concerns by experts that parts of the policy remain ambiguous and that there may be circumstances in which China’s NFU policy would no longer apply. Much of China’s policy surrounds a minimum deterrent force with no evidence that they seek to pursue nuclear warfare with the United States. The current Chinese nuclear arsenal aims to ensure that China’s nuclear forces are more survivable and less vulnerable to a first strike. Chinese sources note that China is concerned about the development of U.S. missile defenses and the impacts of those systems on its strategic nuclear deterrent.

**United States Arsenal Post-Treaty**

On August 3, 2019, U.S. Defense Secretary Mark Esper was quoted as saying he was in favor of “placing ground-launched intermediate-range missiles in Asia relatively soon.” These comments come as military tensions are ramping up with fear that a new arms race is coming. The United States has already begun testing a version of the nuclear-capable Tomahawk cruise missile that was originally banned under the INF Treaty. In response, Moscow has claimed that they will refrain from using missile systems unless the United States begins deploying them around the world. Recent flight tests by the United States have led Russian and Chinese officials to call out the United States, citing a constant stronghold over cold war-era mentality. Continuance in the development of ground-launched cruise missiles, and other weaponry, has incited Russia to potentially match the U.S. ‘missile for missile’.
The United States is in the process of developing post-INF Treaty missiles, such as a “…cruise missile with an expected 1,000 km range and an intermediate-range ballistic missile with a 3,000-4,000 km range.”19 Before talks of pulling out of the INF, China pushed for the United States and Russia to maintain the treaty but ruled out its own participation.20 China’s refusal to become a signatory in the INF has forced the United States to consider placing intermediate-range conventional missiles in the region. It is unclear where post-INF missile systems would be based and, while Guam is a likely candidate, shorter-range systems would likely need to be located closer to China’s mainland.21 In an interview with South Korea’s Presidential Chief of Staff, Noh Young-min, it was revealed that South Korea is not keen on housing U.S. weapons with fear that it could put a target on the country from both China and Russia.22

In October 2019, the U.S. Navy ship, the USS Gabrielle Giffords, fired a Naval Strike Missile (NSM) at a surplus U.S. Navy frigate, which was part of a target exercise called SINKEX.23 The ship is the first Navy ship to deploy Naval Strike Missiles, allowing the United States to become one step closer to matching the missile arsenal in the Pacific, where China currently holds a 3-to-1 advantage in cruise missiles over the United States.24 The Pentagon seeks to build a military force that is more sustainable and has a greater chance of surviving combat with the People’s Liberation Army (PLA).25 The Gabrielle Giffords is a Littoral Combat Ship (LCS) that is designed for operations in shallow water, particularly around coastlines and islands.26 The U.S. Navy continues to grow its LCS fleet, which will reach more than thirty ships in an undesignated timeframe. All of the LCS ships will be armed with the Naval Strike Missile.27

In February 2020, U.S. Defense Secretary Mark Esper took part in a classified military exercise in which the United States and Russia traded nuclear strikes.28 This exercise played out a scenario in which Russia decides to use a low yield, limited nuclear weapon against a site on NATO territory. During the course of the exercise, the United States responded with a nuclear weapon instead of a more common conventional strike. This strategic move is meant to allow military officials to become familiar with the decision-making and order-giving process, should the scenario ever become a reality. This exercise reaffirmed that modernizing the U.S. nuclear weapons arsenal is a top priority for Pentagon leaders. For its 2021 fiscal budget request, the Pentagon asked Congress: to approve $28.9 billion to maintain its existing weapons and buy new intercontinental ballistic missiles, stealth bombers,
submarines, cruise missiles, warheads, and communications equipment. The Energy Department’s National Nuclear Security Administration has requested $15.6 billion for its nuclear weapons projects.29

**United States Goals and Policies**

After China’s weapons demonstration at the 70th anniversary parade, the United States is forced to consider Beijing’s growing arsenal and how China must be brought into future United States-Russian arms control talks.30 While the United States and Russia are facing the countdown for extending New START (Strategic Arms Reduction Treaty), critics wonder if China would ever join an agreement or whether inclusionary efforts would be fruitless.31 In May 2019, several U.S. government officials introduced legislation that would withhold any funding for an extension of New START without China as a signatory.32

For decades, U.S. national security policy has been shaped by the INF Treaty and the policies that juxtapose it. Officials continue to ensure that conventional forces are strong enough to act as a deterrence to protect U.S. allies and interests, as well as to have credible deterrence for nuclear threats. Field experts claim that without U.S. missile deployments, there is no leverage to convince Russia and China to sign a new arms agreement.33 Currently, both the United States and Russia indicated intentions to deploy only conventionally armed missiles instead of engaging with nuclear weapons. Deterrence in the region will affect, not only national security, but it will affect the current United States-China trade war, as well as other regional considerations, such as concerns over North Korean nuclear weapons.

The South China Sea remains a strategic location for ensuring U.S. national security, as it provides important trade routes and military access and is key to ensuring regional influence. In order to maintain a foothold in Asia, the United States must consider long-term strategies for their continuous presence in the South China Sea. The United States currently seeks an ally to store deterrent ground-launched missiles; several regional nations, namely South Korea and Australia, have already denied access, citing fear of instigating Russian and Chinese military forces.34 While ground-launched missiles may pose an issue, the United States does hold air-launched and sea-launched missiles that were not banned under the INF Treaty, which could relieve the issue of regional location. The most important aspect of United States national security is a focus on deterrence and opening up dialogue between Russia and China (and potentially other concerning nations like North Korea and Iran) with arms control agreements that will improve global stability.35
Implications and Recommendations

With China continuing to build its nuclear forces and missiles arsenal, it is imperative that the United States focus its objectives on countering China’s efforts in order to maintain military superiority. China’s focus stems from attempts to force the United States hand in a balance of powers by continuing to build a conventional weapons force with asymmetric capabilities. Now that the United States is no longer constrained by terms under the INF Treaty, the opportunity to develop a formidable arsenal must be seized, particularly since China is decades ahead in development. China is aware that space-based assets are the key to the United States’ ability to operate globally, particularly with U.S. military satellites. In addition to a large nuclear arsenal, China has devoted resources to developing anti-satellite systems, including jammers and kinetic kill systems. The United States must consider defenses in securing global satellite access and countermeasures.

Beijing is not only strengthening traditional warfare systems but has developed offensive cyber-attack capabilities as well. Much of these cyber-based defenses are designed to attack U.S. critical infrastructure. China’s persistent threats must be considered, particularly with emerging technologies like anti-satellite measures and cyber weapons. President Trump’s recent tri-lateral arms control proposal is strategically sound, given China’s freedom to develop and deploy missiles unconstrained. China remains a long-term competitor, and keeping the nation out of a future framework will likely have negative consequences. China, however, remains adamant that they will not be joining any agreement, whether New START or a similar treaty. The United States must consider laying the groundwork to engage China on becoming a signatory for a new proposal, something the Trump administration has been negligent about.

Multiple news sources advise that the United States is developing plans to continue to modernize its strategic nuclear forces and support infrastructure, particularly with weapons like the Columbia-class ballistic missile submarine and the B-21 strategic bomber. The United States will likely need to enhance its resiliency of countermeasures in cybersecurity and critical infrastructure. Additionally, the United States must ensure that its conventional-strike capabilities are on-par or superior to China, particularly in the Asia-Pacific region. While the United States continues to develop and deploy weapons that were once constricted by the INF Treaty, leaders should focus on air and sea-launched cruise missile capabilities, while also enhancing relations with current allies.
CONCLUSION

As China and Russia continue to strengthen their strategic partnership, the United States must find a way to open dialogue with China in order to bring a strategic, stable framework into the conversation. Russia continues to support China in the form of weapons, security, and defense capabilities. The United States must consider the implications of allowing a Chinese-Russian partnership to advance while the United States remains outside of the conversation. Inclusion of China into New START, or tri-lateral cooperation on a new INF Treaty, could prevent the competing world powers from achieving global superiority and enhanced weapons capabilities. Experts continue to raise concerns over a potential new arms race and, should U.S. policies remain focused on offense and competition versus defense and cooperation, the United States may find itself engaging two of the world’s most powerful nations in the next arms race.
ENDNOTES


2 Ibid.

3 Ibid.

4 Ibid.

5 Ibid.

6 Ibid.

7 Ibid.

8 Ibid.


13 Ibid.

14 Ibid.


16 Ibid.


18 Ibid.

19 Ibid.

20 Ibid.


24 Ibid.

25 Ibid.

26 Ibid.

27 Ibid


29 Ibid.


31 Ibid.

32 Ibid.

33 Ibid.

34 Ibid.

35 Ibid.


37 Ibid.

38 Ibid.

39 Ibid.

40 Ibid.
Algae-Based Biofuels—
A Unique Solution for Increasing Regulations in the Shipping Sector

by Megan Canfield, MPIA ’20

Graduate School of Public and International Affairs, University of Pittsburgh

EXECUTIVE SUMMARY

Biofuel demand in the shipping sector has increased 70 percent, or 210 million tons of marine fuels, will need to change to meet more stringent standards, costing the industry $50 billion per year.1 Algae has the potential to become the most sustainable, cost-effective source of biofuels for the shipping sector. Therefore, the Department of Energy (DOE) Bioenergy Technologies Office and private companies should meaningfully increase and redirect their investment in algae research and development to capitalize on this impending “clean fuel” demand. The DOE is integral in the distribution of funding and in setting the public research agenda, while private oil companies own the infrastructure for storing and transporting liquid fuels, rendering both sides critical to the success of future research. Companies will need to focus research and development on scaling up production volume and production technologies and cost competitiveness.

Algae: Promising Price Trend and Fewer Resources Required

Under present production practices, the United States has the ability to produce approximately 132 million dry tons of algae per year, which is greater than or equal to the potential tonnage from any single biofuel source the DOE is researching.2 Although algae biofuels cost an average of $12–$16 per gallon gasoline equivalent (GGE), considerably higher than other biofuel sources, new processing methods and more productive strains of algae are leading to a promising downward trend in the cost of production.3

While increased demand for gasoline-alternatives in automobiles has led to more efficient production and greater usage of biofuels, the shipping sector cannot utilize the same resources as its engines require a different molecular structure.4 Algae is uniquely fit for marine biofuel as it contains a
compatible cell-wall structure and is far more environmentally friendly than other crops in this category, like wood residue or grasses.\textsuperscript{5}

More broadly, algae are an attractive biofuel because it requires far fewer resources and inputs than other biofuels, and it has a much higher yield and lipid content per unit of area per unit of time.\textsuperscript{6} More specifically:

- Equal amounts of bioenergy can be produced on one-tenth of the land compared to traditional biofuels.\textsuperscript{7}
- Algae grows significantly faster than terrestrial plants, some estimates say up to 10 times more rapidly.\textsuperscript{8}
- Algae can be grown on non-productive, non-arable, marginal land so it does not compete with feedstock crops.\textsuperscript{9}
- It requires nontrivial amounts of water, but different species can be grown in fresh, salt, brackish or wastewater from industrial, municipal, or agriculture uses, and water used in oil and gas drilling.\textsuperscript{10}
- It is viable as a wastewater treatment option; treatment plants would cost municipalities 70 percent less than traditional active-sludge ponds.\textsuperscript{11}
- The variety of species allows for potential production in nearly any climate.\textsuperscript{12}

Algae requires carbon dioxide and other nutrients to be productive commercially. The need for carbon dioxide means that facilities will have to be located near waste carbon dioxide sources.\textsuperscript{13} However, carbon dioxide emitting sources are usually surrounded by non-productive land and may also create wastewater that could be used for algae generation. There is also promising research splicing bacteria into algae to feed on carbon dioxide from the atmosphere to meet its nutrient needs.\textsuperscript{14}

**The Shipping Sector Needs a Fuel Substitute**

The shipping industry is already experimenting with biofuels on a small scale. Now worth approximately $7 trillion, the shipping sector has experienced slow, steady growth as more economies industrialize and enter world trade.\textsuperscript{15} Shipping also represents three percent of carbon dioxide, nine percent of sulfur oxide, and 15 percent of nitrogen oxide emitted globally.\textsuperscript{16} Even so, it is the cheapest and most fuel-efficient method of transport on a per ton basis.\textsuperscript{17} For these reasons, the shipping sector is expected to flourish in the future.
The International Maritime Organization (IMO) recently limited sulfur content in marine fuel. Within Emission Control Areas (ECA), sulfur limits are 0.1 percent, while outside, they rise to 3.5 percent.\(^\text{18}\) By 2020, however, new outside ECA regulations will require ships to lower their sulfur emissions to 0.5 percent.\(^\text{19}\) About 70 percent of marine fuels need to change to meet the IMO standards—a transition expected to cost $50 billion per year.\(^\text{20}\)

On transcontinental shipping routes, it is crucial that fuel sources remain stable in storage and are compatible as a “drop-in fuel” which is able to be combined with or substituted for traditional fuel sources. Algae is uniquely fit to meet these needs as it can be processed in a way that renders it molecularly compatible with diesel and does not require special storage like other options.\(^\text{21}\)

**How to Strategically Invest in Algae R & D**

The DOE and energy companies should focus research and development on the following considerations if they are to capitalize on the potential returns of the marine biofuel market:

*Scaling up production volume and production technologies.* Approximately 210 million tons per year of the marine sector’s fuel will need to be replaced with cleaner-burning fuels. Commercial production needs help to overcome scalability issues in terms of volume grown and technology to process large amounts of algae at a time, as current algal biomass production is about 15,000 tons per year.\(^\text{22}\)

*Achieving cost competitiveness.* Groundbreaking research from 2014 found that the price of algae could reach just over $5 per GGE with current production methods, and was confident a further decrease in price was likely once production obstacles were overcome.\(^\text{23}\) Though this is encouraging for cost competitiveness, overcoming the hurdle of processing efficiency to make algae a true competitor will be easier if it has the benefit of subsidies like other fuel sources. For perspective, $237.5 billion is spent by various levels of the government every year to subsidize fossil fuels (Figure 1).\(^\text{24}\)

Algae research is still in its infancy compared to other biofuels. Strategic investment in research and development to meet the specific needs of the shipping industry will render algae the best long-term biofuel solution for the sector.
**APPENDIX**

*Figure 1. Annual Fossil Fuel Subsidies, 2015*\(^{25}\)

<table>
<thead>
<tr>
<th>Source (2015 numbers)</th>
<th>Subsidy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Federal government</td>
<td>$14.7 billion</td>
</tr>
<tr>
<td>State government</td>
<td>$5.8 billion</td>
</tr>
<tr>
<td>Consumption side subsidy</td>
<td>$14.5 billion</td>
</tr>
<tr>
<td>Fed. government for fossil fuel exploration</td>
<td>$$2.5 billion</td>
</tr>
<tr>
<td>Social cost of carbon</td>
<td>$200 billion</td>
</tr>
<tr>
<td><strong>Yearly Total</strong></td>
<td><strong>$237.5 billion</strong></td>
</tr>
</tbody>
</table>
**ENDNOTES**


