BUGS Africa
Implementation report for Uganda

PREVENT
Waste Alliance

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Executive Summary

This implementation report evaluates the potential of the Black Soldier Fly (BSF) technology in Uganda, specifically in the regions of Entebbe and Jinja, which were identified as key areas for deployment during a stakeholder workshop in March 2024. The primary goal of the project is to tackle organic waste management challenges while advancing sustainable agriculture and food security. By converting organic waste into valuable products, such as animal feed and soil amendments, BSF technology can help address waste disposal issues and promote environmental sustainability. The expected outcomes of the project include improved waste management practices, increased agricultural productivity, and economic growth in these regions.

The assessment revealed that BSF technology holds significant potential for managing organic waste in Uganda, particularly in Entebbe and Jinja, where substantial amounts of organic waste are generated. BSF technology could contribute to Uganda's climate goals by reducing greenhouse gas emissions and diverting organic waste from landfills. This aligns with the country's national waste reduction goals and presents an opportunity to transform waste into valuable economic resources.

This report also highlights several challenges encountered during the implementation process. A key challenge to reaping the potential benefits of BSF application in Uganda is the lack of specific regulatory standards for BSF-based products, such as insect-based animal feed and fertilisers. This regulatory gap could hinder the widespread adoption of BSF technology and highlights the need for clear guidelines and regulatory standards. While a promising market demand for BSF products in Uganda's animal feed and fertiliser sectors is expected, raising awareness among farmers and retailers is crucial. During the workshops and interviews, it was shown that many of them remain unfamiliar with the benefits of the BSF technology.

Another challenge identified relates to infrastructure and climate suitability. While Uganda's prerequisites are generally favourable for BSF farming, some regions require additional investment in infrastructure to enhance waste sorting and temperature control for optimal BSF production. Locating BSF facilities near industrial zones and peri-urban areas could help mitigate challenges related to land availability and waste transportation.

To successfully scale BSF technology, the report recommends developing clear regulatory standards for BSF products, establishing demonstration sites to increase awareness and acceptance, and fostering partnerships with local industries to ensure a reliable supply of organic waste for BSF farming. Additionally, investments in local infrastructure for waste sorting and temperature control are crucial for optimising BSF operations.

While challenges exist, the implementation of BSF technology in Uganda offers a valuable opportunity to address waste management issues and promote sustainable agricultural practices. By closing regulatory gaps, raising awareness, and investing in the necessary infrastructure, BSF technology can be scaled effectively, generating significant environmental, economic, and social benefits for Uganda.

1 Introduction

The Black Soldier Fly (BSF) technology receives increasing attention as an innovative and sustainable solution to some of the most pressing challenges in waste management, animal feed and organic fertiliser production. Through the rearing of BSF larvae (Hermetia illucens), this technology offers an efficient way to convert organic waste into high-value products such as protein-rich animal feed, biofuel, and organic fertilisers. The application of BSF technology can improve food security, waste management, and environmental sustainability, making it a promising solution for both developed and developing economies.

In sub-Saharan Africa, BSF technology presents a compelling opportunity to address the oftentimes underdeveloped waste management systems, and to support the agricultural sector in securing affordable, sustainable animal feed. Uganda is one of those countries that rely heavily on agriculture, with nearly 70% of its population being engaged in agriculture[1], and faces challenges in both waste management and the production of cost-effective animal feed. The domestic demand for protein-rich feed is rapidly increasing, especially in the poultry and aquaculture sectors, and urbanisation intensifies organic waste disposal issues. Hence, BSF farming offers a dual benefit: it addresses waste management challenges while producing affordable animal feed and organic fertiliser. This also contributes to Uganda's broader environmental and economic objectives.

This project, funded by the PREVENT Waste Alliance and the Climate and Clean Air Coalition (CCAC), aims to advance the implementation of BSF technology initiatives in Uganda, focusing on improving waste treatment processes and advancing a circular economy. The project seeks to assess and implement a sustainable model for BSF technology that aligns with Uganda's needs and goals. Therefore, it applies a structured approach that includes comprehensive assessments of key factors such as legislative barriers, substrate availability, and market potential. The initial phase of the project has already included an assessment and stakeholder workshops, which identified crucial elements for successful implementation. This report builds upon those findings and outlines the next steps necessary for the upscaling of BSF farming in Uganda while ensuring it aligns with both local needs and broader sustainability goals.

[1] World Bank Group (2025). https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS?locations=ET-UG

2 Background info about the country

Uganda generates significant amounts of organic waste primarily from markets, households, and agricultural activities. Major waste sources include market waste (fruits and vegetables), animal manure, brewery waste, and kitchen scraps. While much of this waste was previously discarded or used informally, BSF farming offers an innovative avenue for its valorisation.

The integration of BSF into Uganda's agricultural landscape has been driven by its efficiency in converting organic waste into high-protein animal feed and nutrient-rich frass, benefiting poultry, pig, and fish farmers. Although BSF farming is relatively new in the country, early initiatives have highlighted its potential to address critical environmental and agricultural challenges.

The BSF value chain in Uganda is in its nascent stages, with a few commercial producers and research institutions actively engaged. Key players include the Department of Entomology at the Ministry of Agriculture, Animal Industry and Fisheries (MAAIF), Makerere University, and several private BSF producers. The Ministry of Health, the Ministry of Science, Innovation, and Technology, research institutions like Makerere University and the National Agricultural Research Organization (NARO) play pivotal roles in advancing BSF research. Private sector players, including commercial BSF producers and waste management companies, alongside community-based organizations and youth groups, are essential in scaling up BSF technology and promoting sustainable waste management practices. For example, Marula Proteen Ltd, an agribusiness company in Uganda specializing in BSF production collects 350 tonnes of organic waste per month from Kampala City and processes it into products. Each month, Marula Proteen produces 60 tonnes of organic fertiliser and 4 tonnes of feed. This scale of production highlights the potential contribution of BSF to waste management, sustainable agriculture, and feed production in Uganda.

Currently, Uganda lacks specific policies dedicated to BSF production. BSF activities fall under general agricultural and environmental regulations managed by the National Environment Management Authority (NEMA) and Uganda National Bureau of Standards (UNBS). However, the upcoming national livestock policy and the animal feed bill, which include provisions for insect-based feeds are expected to advance the definition of framework conditions for BSF production. Additionally, standards for dried insect products for animal feed have been established, promoting quality and safety in the sector.

Uganda's evolving BSF landscape therefore holds immense potential to transform waste management, enhance food security, and foster economic growth through innovative, sustainable practices.

3 Project activities

The project activities to assess the potential for BSF technology in Uganda included field assessments, stakeholder consultations, data collection, and analysis of environmental, economic, and social factors influencing BSF operations. Activities were strategically designed to gather insights on regulatory environments, substrate availability, operational management, and market dynamics, ensuring a holistic evaluation of the technology's viability.

3.1 Inception workshops

An inception workshop was conducted to initiate stakeholder engagement and outline the project objectives, methodologies, and expected outcomes. The workshop brought together key stakeholders, including government representatives, private sector players, non-governmental organisations, and academic institutions.
The interactive sessions facilitated knowledge exchange, gathered valuable stakeholder inputs, and fostered partnerships crucial for the project success. Discussions focused on identifying potential sites, understanding local contexts, and aligning the project goals with national waste management and sustainability strategies. As part of the workshop, Entebbe and Jinja were identified as strategic locations for BSF implementation. Entebbe, situated on a peninsula by Lake Victoria, is home to Uganda's international airport and has an estimated population of 80,000 (UBOS, 2021). This location was selected based on stakeholder input and its potential for sustainable BSF operations, supported by logistical advantages. Jinja, located in the Eastern Region of Uganda, where Lake Victoria discharges into the River Nile, has a population of approximately 75,000. Its selection was influenced by its robust organic waste generation and favourable conditions for BSF activities (NEMA, 2020).

3.2 Interviews

Interviews were a critical component of the assessment, providing qualitative insights from diverse stakeholders involved in waste management, agriculture, and BSF technology. Structured and semi-structured interviews were conducted with government officials, waste management companies, BSF practitioners, researchers, and community leaders. These interviews explored practical experiences, challenges, and opportunities related to BSF operations. The data gathered helped validate field observations, enriched the analysis with real-world perspectives, and informed the development of tailored recommendations for scaling up BSF technology in Uganda.

3.3 Methodology for feasibility assessment of setting up BSF facility

The methodology used for this feasibility assessment was based on the procedure developed by Eawag, in collaboration with Eclose, which combined secondary data analysis with primary data collection. This mixed-methods approach involved reviewing existing resources and conducting interviews with key stakeholders to gather insights on the feasibility of BSF waste processing in Uganda.

1. Spatial Area Delineation

The first step involved delineating the spatial area for the feasibility study. A smaller, well-defined area enabled the collection of precise data within 1-2 weeks. As the area size expands, complexity increases, necessitating additional time and resources to maintain a comparable level of accuracy.

2. Data Collection: Primary and Secondary Sources

- Secondary Data: The feasibility assessment began by studying available literature, reports, and data to gain background information on the regulatory environment, market demand, substrate availability, and past BSF waste processing experiences. This information provided a foundational understanding of the conditions in Uganda and helped to identify key issues that may influence the success of BSF facilities.

The key areas explored in these interviews included:

- Legislation and institutional barriers: A thorough examination of Uganda's regulatory landscape was done to identify policies that facilitate or hinder BSF adoption. Key areas of analysis included waste management regulations, food safety laws, and biosecurity policies governing the use of insects in animal feed.

- Substrate quality, availability and accessibility: The feasibility of using various organic waste streams as feed for BSF larvae was assessed. Factors such as nutrient content, availability, cost, and logistical considerations were analysed to determine the most viable substrates.

- Management and operational conditions: Uganda's climatic suitability for BSF farming was evaluated, alongside the potential need for climate-controlled facilities. Land availability and previous BSF-related initiatives were also reviewed to inform facility setup, operational efficiency, and cost considerations.

- Market demand and customer perception: The demand for BSF products, including larvae, larvae meal, and frass, was assessed based on market size, consumer acceptance, and willingness to adopt BSF-based alternatives. The role of government incentives and consumer education in market development was also explored.

Primary Data: Interviews were conducted with relevant stakeholders, including government officials, industry experts, and business owners to collect qualitative insights. These interviews allowed for a deeper understanding of the challenges and opportunities surrounding BSF technology and its adoption in Uganda. The interviews were used to validate findings and fill identified gaps regarding the key areas introduced above.

3. Assessment of Feasibility

The collected data were used to assess the overall feasibility of establishing BSF operations in the selected areas. The assessment included both qualitative and quantitative analysis, focusing on:

- Market demand and customer perception: The demand for BSF products, including larvae, larvae meal, and frass, was assessed based on market size, consumer acceptance, and willingness to adopt BSF-based alternatives. The role of government incentives and consumer education in market development was also explored.

- Financial feasibility: The sustainability of the business model was assessed, considering local costs such as substrate procurement, infrastructure development, and operational expenses.

- Market feasibility: The potential market demand for BSF products was analysed, along with existing barriers to market entry.

4 Results

Through different project activities, the project team derived several findings relevant both to nationwide conditions for BSF development and to the selected locations.

- BSF technology has strong potential to manage organic waste in Uganda, especially in areas where organic waste generation is high, such as in Entebbe and Jinja.
- It can contribute to climate goals by reducing greenhouse gas emissions in comparison to landfilling, aligning with national waste reduction strategies.
- Regulatory gaps for BSF-based products (e.g., insect-based animal feed and fertilisers) pose a major barrier to wider adoption.
- Market demand exists, but awareness among farmers and retailers remains low, highlighting the need for targeted outreach and demonstration.
- Infrastructure limitations, such as waste sorting and temperature control, need addressing, especially in regions with less favourable conditions.
- Strategic siting near industrial or peri-urban zones could enhance feasibility and impact.

4.1 Findings at the identified locations

As indicated above, the assessment of BSF technology's potential in Uganda focused on two key regions: Entebbe and Jinja. Both regions demonstrated strong potential for BSF operations, defined by factors such as climate suitability, waste availability, infrastructure, and market demand (Smith et al., 2021; FAO, 2020). The evaluation encompassed critical areas, including regulatory environments, substrate availability, management and operational aspects, and market barriers and opportunities (Jones & Brown, 2019). The findings highlighted the feasibility of BSF technology in addressing organic waste management challenges while providing significant economic and environmental benefits (UNEP, 2022).

The assessment showed that **Entebbe** offers several advantages for BSF operations. Its proximity to Uganda's international airport facilitates efficient logistics, particularly for potential export purposes (Uganda Civil Aviation Authority, 2021), which is considered an opportunity within the East Africa market coupled with the continental free trade. The high demand from the poultry sector in the Kampala metropolitan area, with an estimated protein requirement of 420 tonnes per day, and the proximity to the Livestock Experimental Station (LES) in Wakiso create a strong market for BSF products (Poultry Association of Uganda, 2019). Easy accessibility in this region facilitates the movement of substrates and products. Additionally, Entebbe has adequate climate conditions, with an average temperature of 22.2°C and relative humidity of 79.7 %, which are conducive to BSF growth (Uganda Meteorological Authority, 2020). However, challenges include limited space availability due to urban densification, higher land costs, potential odour pollution issues, and costly waste transport exacerbated by traffic congestion (World Bank, 2021).

Jinja presents distinct advantages, making it an attractive option in particular for large-scale BSF operations. It generates a higher volume of organic waste, approximately 132 tonnes daily, supporting expansive BSF activities (Jinja Municipality, 2021). The less congested environment allows for easier establishment of facilities, complemented by good access to distribution networks. Jinja's favourable climate, with an average temperature of 21.8°C and relative humidity of 84.4 %, supports BSF development (Uganda Meteorological Authority, 2020). Nevertheless, the slightly cooler climate may necessitate enhanced ventilation to prevent mould growth, and its less direct access to international logistics poses a logistical challenge compared to Entebbe (Logistics Performance Index, 2020). The key characteristics of the two pilot locations are summarised in the following table.

Characteristics	Entebbe	Jinja
Advantages	Proximity to Uganda's international airport facilitates efficient logistics.	Little congested environment allowing for easy establishment of facilities, and good access to distribution networks. The area also produces a high amount of organic waste of approximately 132 tonnes per day.
Market demand	High: demand from the poultry sector in the Kampala metropolitan area, with an estimated protein requirement of 420 tonnes per day.	High: Abundant organic waste from households and markets, and a strong demand for sustainable animal feed in the livestock and aquaculture sectors. Ease of industrial symbiosis, enabling efficient resource sharing such as organic waste from food processors and breweries and creating linkages with animal feed manufacturers.
Climate conditions for BSF	Adequate: average temperature of 22.2°C; and relative humidity of 79.7 %	Adequate: average temperature of 21.8°C; and relative humidity of 84.4 %
Challenges	Limited space availability due to urban densification, higher land costs, potential odour pollution issues, and costly waste transport exacerbated by traffic congestion.	Slightly cooler climate may necessitate enhanced ventilation to prevent mould growth. The lack of direct access to international logistics might cause logistical challenges.

Table 4-1 Comparison of key characteristics of identified pilot locations

4.2 Summary: results of the assessment

The assessment indicates that both Entebbe and Jinja are viable for BSF technology deployment, each offering unique advantages and facing specific challenges. Entebbe's strengths lie in its logistical connectivity and high market demand, making it suitable for mid-sized or specialized BSF operations. Jinja offers abundant organic waste, lower land costs, and a less congested environment, ideal for large-scale BSF facilities.

To optimize BSF implementation in Uganda nation-wide, it is recommended to develop regulatory standards, enhance stakeholder networks, improve waste segregation practices, and support market development for BSF products (FAO, 2020; UNEP, 2022). It is also recommended to raise awareness among farmers and retailers who often remain unfamiliar with the benefits of BSF technology.

5 Estimation of GHG emissions reduction

One key advantage of BSF larvae is their efficiency in quickly consuming and converting organic waste, preventing it from ending up in landfills. When landfilled, organic waste decomposes anaerobically, releasing methane (CH_4), a powerful greenhouse gas (GHG). In the wet tropics, each tonne of food waste sent to a landfill generates methane emissions equivalent to approximately 930 kg of CO_2 (Scharff et. al, 2023, The impact of landfill management approaches on methane emissions). In contrast, BSF technology emits only 50 to 300 kg of CO_2 equivalent per tonne of organic waste treated, varying with the degree of technology and the origin of the energy used in the facility (Mertenat et. al, 2019; Spykeman et. al, 2021). Based on demographic data, scientific publications, and interviews with local stakeholders, the table below shows the GHG reduction potential if all organic waste in the Jinja and Entebbe regions would be treated with BSF rather than left to decompose uncontrolled in streets or at landfill sites.

	Total amount of waste generated/year	Organic fraction	GHG emission reduction potential
Jinja	112,000 tonnes	43 %	36,400 tonnes CO2eq/year
Entebbe	45,000 tonnes	38 %	13,000 tonnes CO2eq/year

Table 5-1 BSF GHG reduction potential in pilot locations compared to landfilling

6 Recommendations for larger BSF roll out in Uganda

To facilitate the successful scaling up of BSF technology across Uganda, a strategic approach to address regulatory, infrastructural, and market-related aspects is essential. The following recommendations are based on the findings from Entebbe and Jinja, aiming to leverage existing opportunities while mitigating identified challenges. The following measures are proposed to support the widespread adoption and sustainability of BSF technology in Uganda:

1. **Development of a national robust regulatory framework:**

- Formulate and enforce national standards and guidelines for BSF production and processing aligned with existing or upcoming regulations, such as the national livestock policy, the animal feed bill and standards for dried insect products for animal feed. BSF-related policies should also be harmonised with existing waste management and agricultural regulations to foster a supportive legal environment. Thereby, compliance with health, safety, and environmental regulations should be ensured.

- Cooperate with public stakeholders affected by the topic, including NEMA and UNBS.

2. **Capacity building and technical training:**

- Implement training programmes targeting key stakeholders to enhance technical expertise in BSF rearing and processing. Key stakeholders could include farmers, waste managers, entrepreneurs, and government officials, such as representatives from MAAIF, the Ministry of Health, Ministry of Science, Innovation, and Technology, NEMA and UNBS; and academia, like Makerere University or NARO. Women, youth and other marginalised and vulnerable groups, should also be included.

- Establish a demonstration site in the region of Kampala and/or circular economy centres of excellence for practical learning and knowledge dissemination.

3. **Enhancement of waste management systems:**

- Strengthen municipal waste collection and segregation practices to ensure a consistent supply of high-quality organic waste for BSF operations.
- Promote household and community-level waste sorting initiatives to improve substrate quality at the source.

4. **Market development and consumer awareness:**

- Launch targeted marketing campaigns to raise awareness about the benefits of BSF products, such as protein-rich animal feed and organic fertilisers, among potential users in agriculture and aquaculture sectors in Uganda.
- Facilitate the creation of BSF producer associations in Uganda to enhance market access, advocacy, and collective bargaining power.

5. **Infrastructure and logistics support:**

- Invest in essential infrastructure, including BSF processing facilities, and efficient transportation networks and vehicles.
- Develop localised hubs for BSF activities to reduce transportation costs and enhance supply chain efficiency.

6. **Promotion of R&D and innovation:**

- Support research institutions such as Makerere University in conducting studies to optimise BSF breeding techniques, improve substrate formulations, expand product applications, and promote regional and international partnerships for BSF research.
- Encourage innovations in BSF technology, such as semi-automated rearing systems and climate-resilient production methods, as well as new products such as bio-stimulants using frass.

7. **Financial incentives and investment facilitation:**

- Provide financial incentives, including grants, subsidies, and tax breaks, to attract private sector investment in BSF ventures.
- Improve access to affordable credit and microfinancing options for small and medium-sized enterprises (SMEs) engaged in BSF activities.

8. **Strengthening Public-Private Partnerships (PPPs):**

- Foster collaborations between government agencies, private sector players, non-governmental organizations, and development partners to pool resources, share expertise, and promote the scalability of BSF technology.
- Encourage joint ventures and partnerships to enhance technology transfer and capacity building across regions.

6.1 Suggested business models

Several business models can be applied, each tailored to local market needs in the selected location and based on available resources.

1. **Waste-to-Value model**

This model focuses on collecting organic waste (food, market waste, brewery residue, etc.) and converting it into

BSF larvae for feed and frass for fertiliser.

Target partners: municipalities, food markets, restaurants, food processors, e.g. breweries Revenue streams: service fees for waste collection and processing; sale of BSF larvae (live, dried, or processed; sale of frass as organic fertiliser

Key resources needed: logistics for waste collection, BSF rearing facility and biosecurity protocols, partnerships with waste generators and regulators

Strengths: addresses Uganda's urban waste problem; promotes circular economy and climate-smart solutions; provides locally sourced natural feed ingredients and soil improver

2. Animal feed ingredient production mode

This model produces BSF larvae at scale and processes them into protein meal or oil for animal feed manufacturers.

Target market: commercial feed manufacturers; poultry, piggery, and aquaculture farms

Revenue streams: sale of dried larvae (protein meal); sale of BSF oil for pigs and poultry; sale of frass as a secondary product

Strengths: high demand for protein-rich, cost-effective feed; import substitution for fishmeal and soy

3. BSF outgrower/franchise model

This decentralized model involves setting up a network of smallholder farmers or groups who rear BSF larvae, with the main company aggregating, processing, and marketing the products.

Target market: farmer groups; cooperatives; development partners supporting livelihood programmes

Revenue streams: Sale of starter kits and training; buy-back of larvae for processing and resale; franchise fees (optional)

Strengths: scalable and inclusive; promotes rural entrepreneurship and job creation

4. On-Farm integrated production model

Overview: Farms integrate BSF rearing into their own operations to reduce feed and fertiliser costs.

Target Market: poultry, pig, and fish farms; agroecological and permaculture farms

Revenue/Benefit Streams: Internal use of BSF larvae for feed (cost saving); use of frass for soil improvement; possible sale of surplus larvae or fertiliser

Strengths: closed-loop farming system; boosts farm productivity and resilience

Adopting a hybrid model should also be considered. This can combine two or more BSF business approaches such as waste management, feed production, and training services to diversify income streams and increase operational resilience. This model may be well suited for scaling in Uganda, as it allows for flexibility to adapt to market demands while maximising the value extracted from organic waste.

7 Next steps with the CCAC part of the project

In the following steps, the CCAC-funded project component will progress with key activities aimed at embedding BSF technology into national and local waste management strategies. A comprehensive implementation guide will be developed to support public actors, including policymakers and development agencies, by further developing policy recommendations, business models, and training materials to integrate BSF into climate and waste strategies. A social media campaign will raise awareness of BSF's role in enhancing NDCs by diverting waste from landfills, reducing GHG emissions, and creating valuable by-products.

Capacity-building efforts will continue with national workshops introducing government officials and stakeholders to the BSF training kit. To strengthen local implementation, an online hub will be established to facilitate knowledge exchange among BSF operators, offering a platform for discussions, resources, and expert advice. Face-to-face training workshops will provide hands-on guidance, covering BSF facility design, operational procedures, and GHG savings calculations.

To ensure long-term sustainability, the project will assist governments in developing large-scale BSF project proposals and connecting with funding opportunities. The lessons learned will be compiled and shared across Sub-Saharan Africa to support replication, accompanied by an updated implementation guide and workshops targeting ministries, municipalities, and development agencies. The project will conclude with a publicly available final report, summarising outcomes and paving the way for future initiatives to expand BSF technology as a tool for sustainable waste management and climate action.

8 Links to other BUGS Documents

- **BUGS Project Factsheet**
  https://prevent-waste.net/wp-content/uploads/2025/07/FactSheet_BSF_2025-06.pdf
- **Country Factsheet Uganda**
  https://prevent-waste.net/wp-content/uploads/2025/08/factsheet-BUGS-Uganda_2025.pdf
- **Feasibility Guide Uganda**
  https://prevent-waste.net/wp-content/uploads/2025/07/Uganda-Guide-for-assessing-the-feasibility-for-BSF.pdf
- **Assessment Report Uganda**
  https://prevent-waste.net/wp-content/uploads/2025/07/2025-01-03-Assessment-report-Uganda.pdf
- **PREVENT Project BUGS Website** (including documents on Ethiopia and Côte d'Ivoire)
  https://prevent-waste.net/projekte/bugs-project-biomass-utilization-by-insects-for-green-solutions-in-africa-through-black-soldier-fly-technology/

Published by:

PREVENT Waste Alliance c/o
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This implementation was developed within the PREVENT Organic Waste Working Group and the and the resulting pilot project BUGS, implemented by the Africa Circular. The views and opinions of the authors do not necessarily reflect the positions of all PREVENT Waste Alliance members or official policy positions of the governments involved.

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