DEPARTMENT OF CIVIL & ENVIRONMENTAL ENGINEERING

Plastic waste is an ever-growing global threat, with an average of 430 million metric tons produced yearly, two-thirds of which becoming waste after a single use². In highly populated areas such as Kampala, Uganda, plastic pollution is a prominent issue. Without innovation to the current practices, the abundance of waste puts a strain on the waste management system, leading to both minor and catastrophic issues. In 2023, within the Greater Kampala Metropolitan Area (GKMA), it was reported that 135,804 tons of plastic waste was generated. Of the plastic waste, 42% is not collected and only 15% is used within value chain activities². Additionally, the current housing deficiency in Uganda stants at 2.4 million units⁴, creating a substantial demand to utilize lower-cost building materials, such as plastic waste. Kubik, an Ethiopian startup company, has developed the technology to turn plastic into low-carbon buildings. With the implementation of Kubik in Ethiopia, the company has been able to remove 45,000 kilograms of plastic waste daily, which without intervention would have been placed within landfills¹. Their products have also been shown to offset carbon emissions due to their low carbon qualities, product is 40% cheaper than conventional building materials and more than 100 times more durable because of the long lifespan of the plastic materials¹. This project aims to determine if implementing facility in Kampala, Uganda would serve to resolve the plastic waste and housing crisis simultaneously.



Kiteezi Landfill in Kampala, Uganda (2020)

Establishment of Baseline

To establish the baseline conditions in Uganda as a starting point for the project execution, the following areas were researched and defined:

- > Environmental conditions in Uganda and Ethiopia (temperature, precipitation, wind speeds, and natural disaster frequencies)
- > Current condition of waste and waste management practices
- > Existing legislature regarding waste and plans for mitigation
- > Onsite landfill conditions through interviews and in-person site visits

The purpose of the research was to analyze the feasibility of implementing Kubik's products.



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Environmental Compatibility			
Parameter	Result		
Temperature	Significant Difference, but the highest recorded temper Kampala is within Kubik's tolerance range		
Rainfall	No Significant Difference		
Wind Speed	Significant Difference, but higher wind speeds in Addi		
Fires	Significant Difference, but more fires in Ethiopi		
Floods	Significant Difference, but more floods in Ethiop		
Earthquakes	No Significant Difference		

C1 - UPlastic1 Capstone Team Value Chain: Converting Plastic Waste into Building Materials in Uganda Rita Booth, Cody Cerron, Caroline Kahl, Emily Liu

Project Background

Map of Uganda Population Density

Map of Proposed Plastic Waste Collection Points and Transportation Routes

Environmental Compatibility Analysis

An independent two-sample T-test was conducted on environmental parameters to test the compatibility between Uganda and Ethiopia's climate, weather, and natural disasters.







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Final Recommendations

Based on our assessment, Kubik's product can be considered valuable to implement within Kampala, Uganda. Both ASTM testing records and statistical analysis proved Kubik's compatibility with Uganda's environment. In order to consider Kubik's implementation in Kampala, a manufacturing facility location as well as collection points were proposed based on current land zoning. These collection points were determined by their proximity to the proposed manufacturing facility, accessibility to arterial roads, and distance from official dump sites that are currently serviced.



Kubik's Interlocking Brick Wall

Household Plastic Waste Items usable in Kubik Bricks			
Plastic Type	Item	Туре	Approxi Amount for e
HDPE	Milk Jug	Rigid	4
LDPE	Plastic Bag	Flexible	150
PP	Bottle Cap	Rigid	83
PS	Egg Carton	Rigid	13

Conclusion

The project will expand beyond the involvement of the Uplastic1 Capstone Team. Our deliverables will provide the groundwork for the implementation phase of the project. In future years, our project will be the strong foundation for Kubik and Impact Africa's collaboration to implement Kubik's product successfully, alleviating the current strain on the waste management infrastructure, creating a safer environment, and providing a sustainable solution.

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