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# **PESTEL Analysis of the Ugandan Refinery Project and Challenges of Crude Oil Refining in Sub-Saharan Africa**

Jacob Dut Chol Riak, Ph.D.

Senior Researcher and Associate Professor, Department of Political Science & Director (Dean), Institute of Japanese Studies, University of Juba, South Sudan

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\*Corresponding author: Jacob Dut Chol Riak, Ph.D. | ORCID ID: 000900340178612

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#### Abstract

**Original Research Article** 

The study examines the political, economic, social, technological, environmental and legal (PESTEL) analysis of Uganda refinery project. It does so by defining refinery, classifying refineries into simple or hydro skimming, complex or cat cracking and very complex or coking. The study also discusses refinery conversion processes which include cracking, alkylation & polymerization and reforming & isomerization. While evaluating the Ugandan refinery project, the PESTEL analysis demonstrates the readiness of the project in advancing prosperity to Ugandans. The findings indicate that the Ugandan refinery project is economically viable and safe and thus shall reap great opportunities for Ugandans if its construction is completed by 2026. Great attention should placed to the people who will be displaced at Kabaale so that they are adequately compensated. 2026 is the estimated time Uganda will have its first crude oil from its Kingfisher and Tilenga fields and it is critical that the refinery construction is completed and handover for operation on or before 2026.

Besides, the study investigates the challenges of refining in South Sudan and noted that storage and transportation of the refined product from Unity refinery continues to effect the operation of the refinery. The storage tanks are yet to be installed to store the refined products before transportation. One route of transportation of the refined products is through Lake No via barges and another route is through Mayom, Ajakuac through Wau via road. These routes need to be prepared by the Government of South Sudan through Ministry of Petroleum and Nile Petroleum Corporation (NILEPET).

Moreover, the study evaluates the state of crude oil refining in Sub-Saharan Africa and found out only 43 refineries majorly located in Nigeria, South Africa, Egypt, Algeria, Libya, and Sudan with a total capacity of 3,391,600 barrels per day (bpd). The shortage for domestic fuels in the continental Africa indicates that more refining is required. The study concludes that the future of crude oil in Africa is in refining and petrochemicals and African governments must prioritize refining for purpose of value addition.

**Keywords:** PESTEL, Analysis, Refinery, Uganda, South Sudan, Sub-Saharan Africa, Governments, Challenges, Crude Oil, Refining

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### 1. INTRODUCTION

General petrochemicals processing and particularly, refining, is a very important component of the entire valuechain of oil and gas industry. While this has been a mutely and highly neglected area, it is the heart of value-addition to the crude oil. Globally, there are 874 refineries in 2024 (Gruhn, 2025). Of these statistics, United States takes lead in the refining industry. East Africa region, which include Kenya, Tanzania, Rwanda, Burundi, South Sudan and Uganda, does not have a refinery. While South Sudan has matured oil and gas industry, it is yet to operationalize its Bentiu (Unity) refinery, which is a modular in design. Uganda has recently discovered hydrocarbons resources and it planning to produce its first crude oil by 2026.

Indeed, Uganda is endowed with hydrocarbon resources of a proven crude oil reserves of 6.5 billion barrels, of which about 2.2 billion is recoverable (Langer, 2020). The International Monetary Fund noted in 2024 that these

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reserves are the fourth largest in Sub-Saharan Africa, after Nigeria, Angola, and South Sudan. Some field projects of oil exploration in Uganda are Kingfisher and Tilenga located at Lake Albert region of the country.

The Government of Uganda plans to develop a refinery of 60,000 barrels of crude oil per day at Kabaale, Buseruka Sub-County in Hoima District. This refinery project is yet to take off after first oil, probably, by 2026. On 31st March 2025, the Uganda government entered into an agreement with UAE-based Alpha MBM Investments LLC to advance development and construction of the country's long-planned but delayed first crude oil refinery. Uganda and other countries from Sub-Saharan Africa are constrained by lack of refining capabilities. Why is the case? What is refinery anyway? Why has Ugandan refinery project delayed to commence? What analyses are required to understand this refinery? Shall PESTEL be useful tool in analyzing the refinery project? What are the challenges facing refining in South Sudan? What is the state of crude oil refining in Sub-Saharan Africa? These pertinent questions shall be attempted in this study. The study is outlined as follows: Section one introduces the study. Section two discusses the concept of a refinery. Section three discusses types of refinery conversion processes. Section four understands the PESTEL tool of analysis. Section five uses PESTEL tool to analyse Uganda refinery project. Section six discusses challenges of refining in South Sudan. Section seven evaluates the state of crude oil refining in Sub-Saharan Africa and section eight concludes.

### 2. THE CONCEPT OF A REFINERY

A refinery is conceptualized as a production facility consisting of dozens of chemical engineering units processes and units of operations that refine given materials by converting raw materials into finished products or products of value (Colombano, 2017). While the processing and operations may be the same, the technology and products may be different. A typical refinery may produce diesel, kerosene, jet fuel oils and heavy fuel oils. Other refineries may produce petrol while others can convert liquidity gas into diesel and petrol. Refineries can range from small 'topping plant' that produces a few thousand barrels per day to large-scale refineries that produce a few hundred thousand of barrels per day. These 'topping plant' refineries are also called 'teapot' in China and 'jerry-pot' in Russia (Parkash, 2003). Refineries are classified into the following groups:

• **Simple or hydro skimming refineries.** These types of refineries provide very modicum upgrading and usually modest distil crude oil into

its individual cuts or group of products (Leffler, 2008). These refineries based on their designs can process light sweet crude oils and they can have sulphur removal units.

- Complex or Cat Cracking Refineries. These types of refineries often have the same units as modest refineries in addition to Fluid Catalytic Cracking (FCC) units that can upgrade dense gas oils and other mediums to dense hydrocarbons into gasoline and petrochemical feedstocks. These refineries may also have other typologies of cracking such as hydrocracking units, alkylation plants and gas processing plant units (Elkanel and Khalid, 2010).
- Very Complex or Coking Refineries. These types of refineries have all units in complex shape together with a coker that removes remaining fuel oils, including sour, heavy and extra heavy that tend to be high in remaining fuel molecules and usually produce petroleum coke as byproduct (Meyers, 2003).

### 3. TYPES OF REFINERY CONVERSION PROCESSES

- **Cracking.** This refers to the process of transforming or some extent breaking of large molecules into smaller more important molecules. The aim of cracking is to turn the larger or long chain molecules that are not needed by the market (Favennec, 2001). These long chain molecules need to be converted into more desirable smaller or shorter chain molecules or other intervening feedstocks. Cracking often involves using a combination of heat, catalysts and pressure to accelerate the breaking of the molecules.
- Alkylation and Polymerization. The primary role of alkylation is to re-constitute some of the smaller molecules such as olefins, alkenes like propylene generated by the cracking processes (Gruhn, 2025). One of the key advantages of producing alkylate is that the re-constituted molecules have a higher octane rating (Data, 2019).
- **Reforming and Isomerization.** The overall objective of reforming and isomerization is to transform the chemical structure of the molecules going through theses processes in order to improve the octane rating and other qualities of the products being reformed (Data, 2019). Once the molecules are transformed, the chemical structure changed and octane rating goes higher thus producing the required products.

#### **Example of Crude oil Refinery**



Figure 1: Schematic flow of a typical crude oil refinery

### 4. UNDERSTANDING PESTEL ANALYSIS TOOL

PESTEL is a tool of analysis of projects in business and management science. It is a framework use to analyse the environment business operates in or plans to launch new operations or monitor the macro-environmental (external) factors that have any result on that environment (Yudha, et al, 2018). While PESTEL is an acronym, it stands on specific analytical issues. For instance, **P** stands for Political, **E** for Economic, **S** for Social-cultural, **T** for Technological, E stands for Environmental and L for Legal.

**Political:** This factor refers to the analysis of political will of the leadership of the country that include drafting of policies, laws and regulations and importantly implementation of these policies, laws and regulations. This also refers to the analysis of the institutions and various stakeholders running these institutions. Besides, it refers to the analysis of political stability of the country and the democratization processes.

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**Economic:** This refers to direct or indirect impact of the economic performance of a market, organization, industry sector or even a country, and has resonating long-term effects. For example, an increased inflation rate would affect the way organizations change the pricing structure of their products, influencing the purchasing power of consumers, and eventually modifying the level of demand and supply for that economy. Economic factors typically include interest rates, inflation rate, economic growth patterns and foreign exchange rates.

**Social-cultural:** This refers to the analysis of cultural trends, demographic influences and populations analytic.

**Technological:** This refers to the analysis of technological innovations that may affect the operations of the market, organization and the industry. This should also demonstrate how the organization adopts to the technological revolution.

**Environmental:** This refers to the analyses that are induced or are unwavering by the surrounding environment. Environmental factors are certainly critical for the energy sector. Environmental factors include policies on weather, geographical location, climate, global changes in environmental offsets and climate.

**Legal:** This refers to the analysis of procedures, laws and regulations that affect the market, industry, organization from these viewpoints and then thrust out the strategies in light of the legal matters. These include labour laws, safety standards, consumer protection laws, etc., that affect the business performance due to maintaining certain laws or adhering to certain principles.

#### 5. PESTEL ANALYSIS OF UGANDAN REFINERY PROJECT 5.1. Political

### 5.1.1. Policies Related to Refining in Uganda

The Government of Uganda has drafted and passed a policy related to refining in Uganda. This policy is called the National Oil and Gas Policy for Uganda, February 2008. This policy has detailed the governing of the entire oil and gas sector, focusing on the complete value-chain of the industry: downstream, midstream and the upstream activities. In this policy, refining through oil refineries is discussed and the policy objective centers on quality refining and effective management of refineries. However, the conundrum is that application of this policy will be realized once the 60,000 barrels refinery is built in Uganda.

### 5.1.2. Government of Uganda Commitment for the Refinery Project

The Government of Uganda through top leadership is committed to the realization of the Uganda refinery project. Although the Final Investment Decision (FID) has been rolled out, the commitment of the government has not been realized in having 60,000 barrels refinery. While Uganda Refinery Holding Company Limited, which is a subsidiary of Uganda National Oil Company (UNOC) has been created, the construction of the refinery is yet to be seen from UAE based Alpha MBM Investments LLC. The refinery holding company is training Ugandans in preparation of the launch of the refinery project when the construction is completed.

### 5.1.3. Citizens Interest in Harnessing Petroleum Products

The Ugandans are quite interested in realizing the refinery project in Uganda. The Uganda people tweak this interest on harnessing all the petroleum products. This is due to the expectations that come with the discovery of natural resources in a country.

### 5.1.4. Emergence/Participation of Civil Society

Most of the civil society organizations, ranging from rights groups, charities, religious groups, academics and environmental are participating in every step in the refinery project. They advocate and represent the voice of the voiceless. However, this has not been quite smooth for these activists as the government continues to interfere, intimate, hunt and arrest the vocal members of civil society.

#### 5.1.5. Electoral Violence

As part of threats to the refinery project of Uganda, electoral violence continues to cause havoc and discourage more investors into the oil and gas industry and above all, the investment of the entire country.

### 5.1.6. Weak institutions and culture of bad governance

Weak institutions and culture of corruption continue to torment Uganda, like any other African country. This practice has continued to discourage investors in investing their money given that institutions are weak and are easily compromised.

### 5.2. Economic

## 5.2.1. Economic Blueprint Related to Uganda Refinery Project

The Government of Uganda has rolled out an economic blueprint that is focusing on enhancing prosperous economy for all Ugandans. This is noted in the Uganda Vision 2040 that has clearly spelt out the Uganda Green Growth Development Strategy stressing green jobs, green financing and green oil and gas sector. Moreover, the Government of Uganda has rolled out the Country Economic Strategy 2021-2025. This strategy berates Uganda as the destination for investments for all the sectors of the economy including the oil and gas sector. Although these economic blueprints don't directly address

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the Uganda refinery project, they point towards the economic prosperity for all Ugandans and the international investments including hydrocarbon resources exploitation.

## 5.2.2. Improvement of Balance of Payment of Uganda Government

It is important to note that being a strategic investment for the country and the region, establishing a refinery in Uganda will improve the country's balance of payments by lessening the petroleum products import bills (Wasaga, 2021). This shall help the ordinary Ugandans to access the products of the refinery cheaply. Refined products such as diesel, petrol, heavy fuel oils (HFO), Kerosene, Jet Fuel and Liquid Purified Gas (LPG) could easily be evacuated from Kabaale, Hoima to the other parts of Uganda via 211km pipeline to a storage and distribution terminal at Namwabula in Mpigi District. Given that Uganda is a landlocked country, transportation of the refinery products would have been via barges, which is quite cheaper than a pipeline. However, the cost estimate of 4 billion USD for completing the refinery project is very high. It will be treated as recovery cost, particularly, to the Uganda National Oil Company (UNOC) in the future, which has equity shares of 40% through Uganda Refinery Holding Company Limited. While the Albertine Graben Refinery Consortium (AGRC) was awarded the bit to finance the construction of the refinery, the Government of Uganda in March 2025 awarded UAE-based Alpha MBM Investments LLC to finance the construction of the refinery. Reasons for change from Albertine Graben Refinery Consortium to Alpha MBM Investments are very scanty. Nonetheless, Uganda's refinery project will not enjoy the associated benefits of economies of scale accruing from produced barrels of oil due high cost recovery.

### 5.2.3. Uganda Refinery will create jobs for Ugandans

It is envisaged that the refinery project will contribute to economic benefits for Ugandans as the construction of the refinery alone is estimated to create 6,000 to 8,000 short-term jobs (Kisenyi, 2024). Once inaugurated, the refinery operations are expected to generate more than 1000 permanent jobs in the Uganda economy, particularly for the youth (Chambiso, 2024). The growth of infant industries such as the petrochemicals and manufacturing industries will also generate jobs for Ugandans and guarantee the transfer of technology in the refining and related industries.

### 5.2.4. Promotion of Regional Market

The refinery will help to avail the products to the region. Landlocked countries such as Burundi, Rwanda and South Sudan will find it cheaper to buy diesel, petrol, HFO and LPG from Uganda instead of buying it from Kenya, which is very expensive. Base on the Front End Engineering and Design (FEED), the refinery is expected to market 232 bpd to the region for the first year of its operation (Langer, 2020).

### 5.3. Social-cultural5.3.1. Socio-Cultural Issues Related to Uganda Refinery Project

The refinery will have socio-cultural implications to the Bunyoro-Kitara people of Hoima District. Although 545 acres of land was acquired in Kyakabooga Parish, Buseruka Sub-County for resettlement of the Project Affected Persons (PAPs) who opted for relocation, the compensation for the land fell short of 3% (Kagara, 2020). Failure to fully compensate the lands of the locals at Hoima can lead to conflicts and social arrest. When ready and commission, the refinery shall change the demographics of the Bunyoro-Kitara people, as many people will have to leave the area and settle elsewhere due to pollution. Moreover, the youth around Hoima could be a catalyst of change when they are engaged. However, they could be a catalyst of destruction once they are not engaged and employed.

#### 5.4. Technological

## 5.4.1. Technological Revolution Related to Uganda Refinery Project

Uganda as a country has embraced technological innovations. While it is a developing country, Uganda has continued to adapt to the new technologies including the ones of oil and gas sector. 55% of Ugandans use different technologies ranging from communication, advertisement, transport, land, housing, health, education and most importantly oil and gas sector, particularly, the downstream division. The processing technology of the refinery shall be residue fluid catalytic cracker (RFCC) configuration, which will enhance products such as diesel, petrol, HFO, kerosene, Jet fuel oil and LPG. Though the crude oil diet is waxy with an estimated API of 16-21, there is an opportunity for the Government of Uganda to deploy blending technology so that high sulphur content is removed. This technology is called crude oil blending technics. We have two types of blending technology: inline blending and in-tank blending. While in-line blending is expensive than in-tank blending, it is the preferred technology for finely mixing of different crude oils to accurately provide the needed crude diet with low sulphur and with an API between 30-45.

### 5.5. Environmental5.5.1. Environmental Policies Related to Uganda Refinery Project

The Government of Uganda has rolled out numerous environmental policies to protect the natural world. Likened to other countries, Uganda ranks high in her number of commitments regarding climate change mitigation and environmental protection. The country has National Environment Management Policy that has tools such as Environmental Impact Assessment (EIA) and above all, Environment and Social Safeguards Policy

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(ESSP). Uganda has declared its National Climate Change Policy 2015, and it has forwarded its nationally determined contributions to the United Nations Framework Convention on Climate Change in 2018, and it has Green Growth Strategy in place. It has signed up to meet the Bonn Challenge. National Environmental Management Agency (NEMA) as an agency has a role in implementing all related environmental protection policies including the one related to oil and gas sector. The Environmental Social Impact Assessment (ESIA) on the refinery has progressed up 80% complete. This is a great achievement for the realization of the refinery project.

#### 5.6. Legal

### 5.6.1. Laws and Regulations Related to Refining in Uganda

The Government of Uganda enacted Petroleum (Refining, Conversion, Transmission and Midstream Storage) Act 2013. In this Act, the government has provided a framework for the establishment and running of refineries in Uganda. Moreover, the Government of Uganda enacted Petroleum (Refining, Conversion, Transmission and Midstream Storage) (Health, Safety and Environment) Regulations, 2016. These regulations are responsible for the establishment and effective management of midstream and particularly, refineries. With present of laws and regulations, then the control and management of the Uganda refinery project will be successful. It is important to note that a regulated environment is always critical for the success of the project. On the environment, the Government of Uganda enacted National Environmental Law, 1995 and Environmental Social Impact Assessment (ESIA) Regulations, 1998. These pieces of legislations regulate environment and any large-scale projects carried out in Uganda.

### 6. CHALLENGES OF REFINING IN SOUTH SUDAN

As mentioned in the introduction, South Sudan faces significant refinery shortages. Currently, the country relies on a single refinery with a processing capacity of 10,000 barrels per day. Although operational, it is producing only 3,000 liters of diesel of which 65% is diesel, 33% heavy fuel oil (HFO), 2% of naphtha and Kerosene. Located in blocks 1, 2, and 4, the refinery is modular in design, allowing for future expansion. A major challenge is the storage and transportation of refinery products to the market. Lack of terminal tanks hinders the storage capacity of the refinery. However, evacuation of the refined products has remained a daunting task. One potential route for evacuation is via the Nile River through Lake No; however, this route is hindered by the growth of papyrus, reefs, debris, and discarded materials. In response, the Government of South Sudan through Nile Petroleum Corporation (NILEPET agreed to clean and clear Lake No to facilitate better water flow and allow barges to navigate freely.

Another option of evacuation of refined products involves construction of asphalt roads from Bentiu to Juba through Mayom, Ajakuac, and Wau. This effort began with the construction of muram roads in 2019, but these roads have since been washed away by heavy rains, necessitating a return to the drawing board. Once constructed, the asphalt roads will facilitate the transportation of refinery products to Juba and the East African region. According to the plan, the Ministry of Petroleum and Nile Petroleum Corporation (NILEPET) aims to build five refineries namely: Paloch, Thiangrial, Pagak, Akon, and Unity. However, feasibility studies for each of these refineries is yet to be conducted.

Currently, the Ministry of Petroleum and NILEPET have not agreed on which refineries should be prioritized, as there is competition and rivalry between the two over the Ministry's role as the government's commercial arm. This lack of consensus, coupled with insufficient refining and petrochemical processing capacity, poses a significant challenge and exacerbates the lack of industrialization in South Sudan.

The study argues that a refinery is meant to solve energy security of any country and therefore South Sudan government should urgently build with asphalt leading roads to the refinery in Unity so that refinery products are evacuated from refinery sites and used cross South Sudan to solve the energy security and energy poverty and not for export only.

### 7. EVALUATION OF THE STATE OF OIL REFINING IN SUB-SAHARAN AFRICA

43 Sub-Saharan Africa has refineries (Prezeworski, 2023). Majority of these refineries are located in Nigeria, South Africa, Egypt, Algeria, Libya, and Sudan with a total capacity of 3,391,600 barrels per day (bpd) (Gruhn, 2025). Although the total capacity output of barrels per day is high, particularly, diesel products; these quantities have never been adequate for Sub-Saharan Africa. The shortage for domestic fuels in the continental Africa indicates that more refining is required. While Sub-Saharan Africa has enormous hydrocarbon resources of the global average of 11% in 2024, lack of project financing and modern technology continues to leg the region behind on refining and petrochemicals.

### 8. CONCLUSIONS

The study has used PESTEL analysis to evaluate the Uganda refinery project. Looking at this at political, economic, socio-cultural, technological, environmental and legal lenses, the study found out that the Uganda refinery project is important for the government and people of Uganda. However, the study noted that politically Uganda is quite volatile, particularly, during general elections and this could shun away the investors. While the economy of Uganda is steady, it is proven to shocks by external forces such as pandemics and global wars such as Russia-Ukraine debacle. Socially, the refinery will displace the ordinary

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Ugandans who would require compensation. Uganda has abundant technologies, only that it needs to embrace modern refinery-related technologies. While environmentally, the Government of Uganda has great policies to protect the natural world, it is required to implement these policies. The Government of Uganda has enormous legislation to regulate the construction and operation of the refinery. Challenges of refining in South Sudan are very enormous as the country has only 1 refinery in Unity region where its operation is affected. This is the same challenge for Sub-Saharan Africa which has only 43 refineries. The future of crude oil in Africa is in refining and petrochemicals and African governments must prioritize refining for purpose of value addition.

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