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## A Framework for Stability in Cryptocurrencies: Fiat Integration for E-Commerce Applications

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### Abstract

Access to financial services and efficient cross-border payments are vital for fostering global economic inclusion. However, the traditional bank-based ecosystem is hindered by centralized control, slow transaction speeds, and high costs for both local and international payments. The emergence of cryptocurrencies, such as Bitcoin, was intended to address these challenges by providing decentralized alternatives. Despite their potential, cryptocurrencies have failed to serve as reliable means of payment or stores of value due to issues such as price volatility, limited scalability, complex user interfaces, and regulatory uncertainties. This paper proposes a novel model for creating a stable cryptocurrency backed by fiat currency to overcome these limitations and support global electronic commerce. The study explores the integration of stability mechanisms, scalability, and regulatory compliance, providing a framework for a cryptocurrency that balances innovation with practical usability.

**Keywords:** *Novel model, Stable cryptocurrency, Fiat currency, E-commerce*

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## 1. Introduction

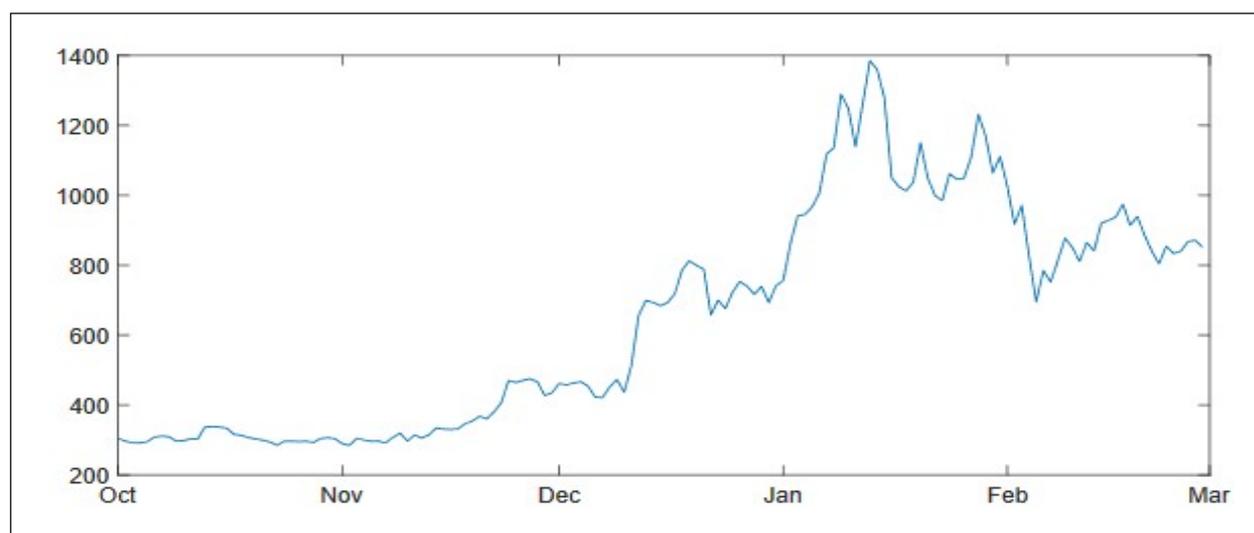
The rapid growth of the Internet and the digitization of enterprises have significantly affected economies worldwide. The financial sector, in particular, has been directly influenced by technological advancements, driven by the striking growth of e-commerce and electronic payments. Traditional bank-based ecosystems are being disrupted by the digitization of financial services and the emergence of cryptocurrencies. A recent survey conducted by Sitienei *et al.* (2020) identified banks and financial services as the most impacted sector by rapid technological advancements and projected this trend to persist for at least five years.

Despite these advancements, research by Bayram (2020) on the globalization of financial services and cross-border banking performance reveals two critical deficiencies in current payment systems: (1) the lack of

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universal access to financial services for a significant portion of the global population, and (2) inefficiencies in cross-border retail payments. Cryptocurrencies and crypto tokens were originally envisioned to address these issues due to the groundbreaking potential of blockchain technology and Distributed Ledger Technology (DLT) (Bayram, 2020).

However, cryptocurrency prices are highly volatile, reacting strongly to global events and speculative market concerns. As illustrated in Figure 1, the price of Ether (ETH) relative to the U.S. dollar from October 2017 to February 2018 demonstrated substantial volatility. During this period, ETH experienced an annualized return volatility of 120% against the USD. Such extreme fluctuations render cryptocurrencies unreliable as a stable medium of exchange or store of value. Consequently, cryptocurrencies have become highly risky assets for investors and a tool for illicit activities, rather than a practical payment method.



**Figure 1: ETH/USD Price from 1 Oct 2017 to 28 Feb 2018**

Source: Baillon (2019)

According to research by Moin *et al.* (2020) on financial cryptography, for a token to function effectively as a currency, its purchasing power must remain stable in the short to medium term. Therefore, a framework is needed to minimize cryptocurrency market volatility while preserving the benefits of blockchain technology. A proposed solution is the development of a stable cryptocurrency—a crypto asset with consistent and predictable value. This model leverages advancements in business and information technology to address the strategic implementation gap, enabling stable and universal access to financial services and efficient cross-border retail payments, both online and offline.

### 1.1. Problem Statement

The traditional banking ecosystem faces significant challenges in providing universal access to financial services and ensuring efficient cross-border payment systems. Despite advancements in digitization and the rise of cryptocurrencies, these technologies have not adequately addressed these issues. Cryptocurrencies, such as Bitcoin and Ether, were envisioned as decentralized solutions to overcome the limitations of traditional financial systems. However, their inherent price volatility, scalability issues, and regulatory uncertainties have hindered their effectiveness as reliable mediums of exchange or stores of value (Khan, 2023).

Current payment systems remain inefficient, particularly for cross-border retail transactions, and a large portion of the global population still lacks access to affordable financial services (Aysan *et al.*, 2024). Research highlights the need for stable financial instruments that can bridge these gaps while leveraging the disruptive potential of blockchain technology. Existing cryptocurrencies fail to meet these criteria due to their susceptibility to speculative market dynamics and inconsistent purchasing power.

To address these limitations, there is a critical need for a stable cryptocurrency model that combines the technological advantages of blockchain with price stability, scalability, and regulatory compliance. Such a

model would enable seamless cross-border transactions, enhance financial inclusion, and provide a reliable alternative to traditional banking systems for global electronic commerce.

## 2. Methods

### 2.1. Focus Group Discussion

A Focus Group Discussion (FGD) involves gathering people from similar backgrounds or experiences together to discuss a specific topic of interest (Nyumba et al., 2018). It is a structured discussion used to obtain in-depth information from a group of people about a particular topic. In this study, this method aimed to obtain data from a purposely-selected group of individuals with blockchain and cryptocurrency experience. According to Van and Angehrn (2017), natural groups and expert groups are two types of focus groups. Natural groups consist of multiple participants who belong to a pre-existing informal or formal group (e.g., family or kin, co-workers) before the study. While expert groups consist of several people who have particularly good and broad expert knowledge and experience of the research topic(s). They also added that such groups tend to be smaller than typical FGDs and are used to solicit large amounts of highly specific information, although participant statements may vary.

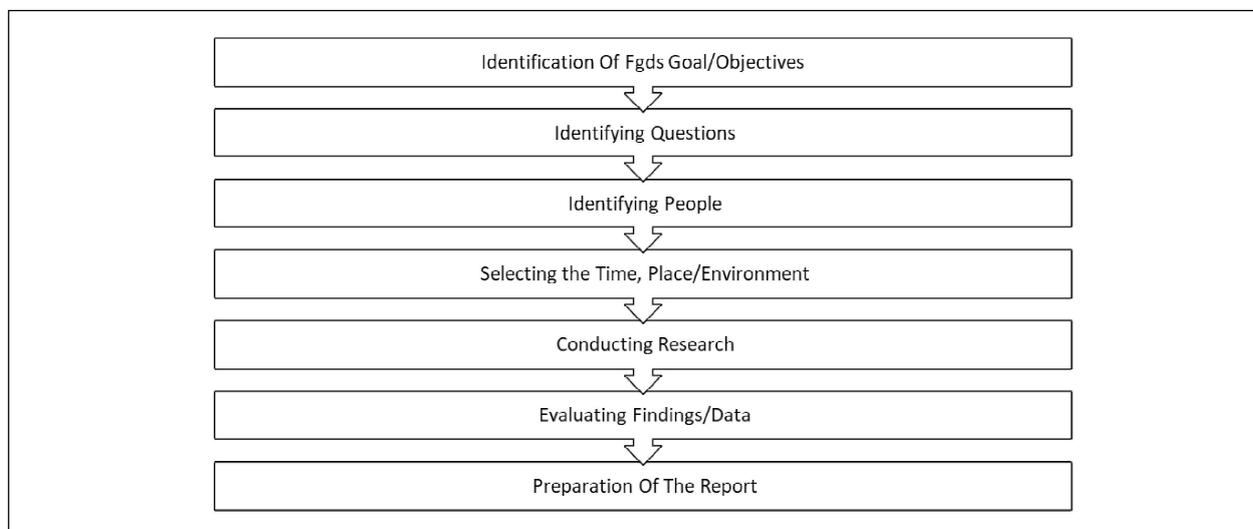
With respect to Van and Angehrn’s (2017) classification of focus group discussions, this research used expert groups. The focus group discussion participants consisted of blockchain and cryptocurrency experts as shown by the participant inclusion criteria. The Expert Focus Group Discussion (EFGDs) was used to investigate the model requirements for design purposes. This helped in gathering deeper information about the model’s functional requirement and its components. At the end of the focus group discussion, a description of model functional requirement, model inputs, outputs, and the expected behavior was realized.

#### 2.1.1. The Focus Group Discussion Operational Planning

Before the FGDs, some operational planning for the exercise was undertaken. These include: preparing and developing informed consent forms and a comprehension list in line with research ethics best practices. The research team also obtained official approval from Kabarak University Research Ethics Committee and Kenya National Commission for Science, Technology and Innovation (NACOSTI). Time and place planning for the interviews were also organized. The interview place selection considered venues that would allow for a relaxed, safe, and comfortable interaction. The recording tools and equipment were also arranged.

#### 2.1.2. Glynn et al. (2015) Framework for Conducting a Focus Group

To conduct the focus group discussions successfully, a framework recommended by Glynn et al. (2015) was used. It involves the identification of FGDs goal/objectives, identifying questions, identifying people, selecting



**Figure 2: The Process of FGD**  
 Source: Glynn et al. (2015)

the time, place/environment, conducting research, evaluating findings/data, and preparation of the report. To enhance the readability of this research work, the researcher summarised these phases into major and sub-phases while acknowledging the source (Figure 2).

### **Step 1: The Focus Group Discussion Purpose**

The purpose of the focus group discussion was to identify the model's requirements and its components for design. Through the FGDs, the categories of users' and stakeholders' different perspectives and requirement needs were elicited and prioritized.

### **Step 2: Focus Group Discussion Discussion Prompts/Questions Identification**

Before the focus group discussion, a list of questions and discussion prompts that would help gather information were created. The questions were formulated in two dimensions: (i) those that aided in the dependency and best platform identification, and (ii) those that would aid to gather information about the potential model users and their requirements.

### **Step 3: Selecting the Participants and Leader**

The focus group discussion participants targeted blockchain experts who had experience in dealing with blockchain. The research identified four blockchain-based companies which the participants would be sampled from. A letter was written to seek formal permission to carry out the research in the identified institutions or a phone call. For the organization that had a policy about research activities, the research team read the policy and determined the appropriate process to gain access to the people. The research team also presented the obtained official approval of an ethical committee (from KUREC), ethically approved data collection tools and procedures, and the NACOSTI clearance.

Upon receiving approvals from the institutions to carry out the research, the research sampled between 4-7 members per group as guided by Krueger and Casey (2002). To ensure compliance with research ethics and best practices, the researchers obtained informed consent from the potential focus group participant through the approved informed consent form. The process of obtaining consent from the participants was also guided by ethically approved procedures. Before the focus group discussion, all the participants were asked to complete a comprehension checklist questions survey that explored the participant's familiarity with the focus group discussion objective, their expectation during the discussion, and their perception of the value of the entire research objective. The survey consisted of open-ended questions. The information was used to help gauge the participants' familiarity with the discussion topics.

The research also selected one focus group leader who is outside of the organization to ensure participants aren't fearful of backlash or lead to bias and skewness. The research also ensured that the leader is familiar with the research topic since it followed the other participant's recruitment criteria. The leader or facilitator selection was also based on his/her ability to build rapport by creating a warm, supportive and comfortable environment to foster open and honest dialogue among the individuals. At the end of the selection process, each focus group discussion consisted of at least four members and the largest group had six members

### **Step 4: Selecting Time, Place/Environment**

This research identified the time and place of the discussion based on the participants' convenience. It considered participants' comfort, access to the venue, and levels of distraction. A normal and familiar setting with sufficient space for different activities within the focus group discussion, such as note-taking, evaluation of comprehension, and internet access was considered. Before the focus group discussion, the research team ensured that there was enough seating that enabled participants with a clear view of each other and the facilitator/the focus group leader. The researcher also communicated the agenda, location, and time to the focus group participants ten days earlier.

### **Step 5: Conducting Research**

Each focus group discussion started with an introduction of the research team and the selected leader. The purpose of the focus group discussion, focus group discussion rules, how to ensure confidentiality, and the participant's role was also explained. Nyumba *et al.* (2018) recommended a minimum of three to four group

meetings for simple research topics. To ensure that the focus group discussions yield maximum impact on the research and the theoretical saturation realized, this research carried out four different focus group discussions.

Before the discussion, the participants agreed on the way of documenting the FGD findings. A minute/note-taker was enlisted to write down the most important points made by participants, along with any other ideas or analytical thoughts that come to mind during or right after the discussion. To ensure that no important point was left out, each focus group participant was given a notebook and a pen to record what they found important during the discussion to complement the note-taker.

In two of the carried focus groups, a group exercise to search for some content online and the projected model user role play was incorporated into the course of the discussion to formulate scenarios for design. The scenarios created during the focus group discussion are presented in section 3.3.1 below. At the end of the discussion, the notetaker read out the recorded findings for the participants to ascertain and add if there was an important point left out. The final focus group findings were labeled with a unique focus group id and stored for further analysis in the next phase.

#### **Step 6: Evaluating Findings/Data**

This stage coalesced the focus group discussion into a manageable form for report development. This phase began immediately after focus group closure. The Comprehensive note-taking and summarization of the discussion with the participants during the focus group session facilitated more efficiency in this phase. For each focus group question, the findings were summarized into a functional requirement or design consideration. Data reduction was the key to this stage; the discussion was summarized into manageable concepts that will facilitate report development or model users and their possible functional requirements.

#### **Step 7: Focus Group Discussion Report**

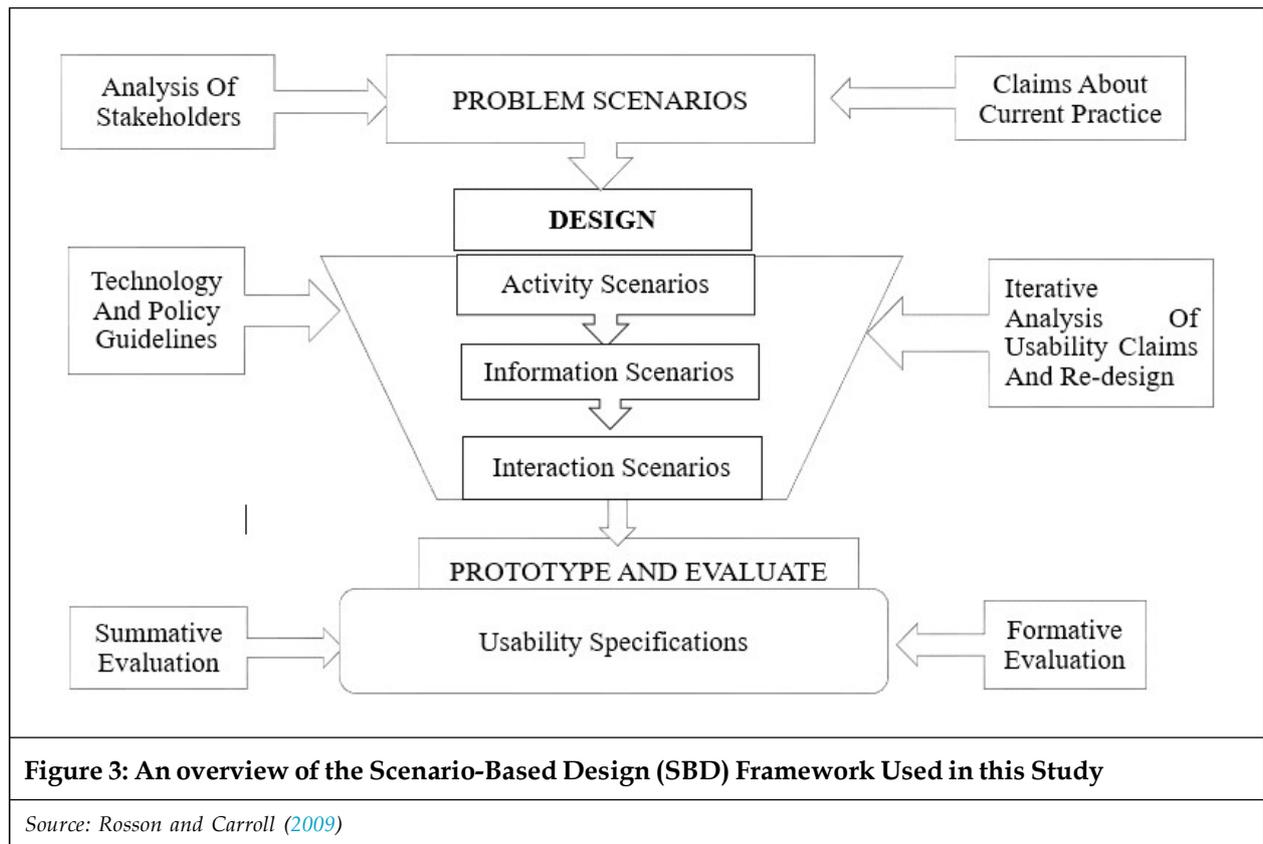
This phase summarized the key findings of the focus group discussion conducted with the blockchain and cryptocurrency experts. The focus group discussions revelation is presented in form of the model objectives and design principles that would inform the model design and implementation.

### **2.2. Scenario-Based Design for the Model Design**

According to Hanington and Martin (2019), Scenario-based design is a family of techniques in which the use of a future system is concretely described at an early point in the development process. Narrative descriptions of envisioned usage episodes are employed in a variety of ways to guide the development of the system. As Rosson and Carroll (2009) put it "a scenario describes a specific target user trying to achieve a specific goal or perform a specific task in a specific context." In other words, scenario-based design is a relatively lightweight method for envisioning future use possibilities. Concisely: scenario = user + task + context. Scenarios evoke reflection in the content of design work, helping developers coordinate design action and reflection. These qualities, the concrete and work-oriented nature of scenarios make them effective for the envisioned model design activities.

During the focus group discussions, the scenario-based design was employed to present a concrete and flexible design. Scenarios gave multiple views of interaction and diversity helping the researcher manage the model design. It helped to recognize, capture, and reuse generalizations in the model design.

To employ scenarios-based design in this study, a framework presented by Rosson and Carroll (2009) in his book entitled *Orchestrating human-centered design* was used. This framework incorporates scenario-based analysis and design into all phases of system development, from requirements analysis through usability evaluation and iterative development. The overall process in this study aimed at improving usability, where the scenarios supported the identification of model requirements and elaboration of the model's usefulness. The aim was to develop a rich understanding of model elements, platform specification, model functionalities, and how to implement them. It also helped to use this understanding as a basis for activity transformation while observing the model design philosophies. Figure 3 provides an overview of the scenario-based design framework used in this study.



In SBD, scenarios serve as a central representation throughout the model design and development. Firstly, a description of the model goals and concerns of current use, and then being successively transformed and refined through an iterative design and evaluation process. The problem scenarios were transformed and elaborated through several phases of iterative design as suggested by Rosson and Carroll (2009). The definition of scenarios utilized focus group discussions where blockchain and cryptocurrency expert members describe the potential user, task, and context.

### 3. The Model Design

The model design begins with defining the design philosophies and objectives that guided the design process. The model functional and system requirements are also presented.

#### 3.1. The Design Philosophy and Objectives

The principal objective of the Central Bank of Kenya is the formulation and implementation of monetary policy directed toward achieving and maintaining stability in the general level of prices (The Central Bank of Kenya, 2022). This aims to achieve stable prices measured by low and stable inflation and to sustain the value of the Kenya shilling. In driving this core objective, the design principle for the stable cryptocurrency in this research also delivers on key economic objectives of the Central Bank of Kenya to positively affect overall economic growth and to generate significant social and economic benefits for all. The design aimed to realize a cryptocurrency that would enable households and businesses to make fast, efficient, and reliable payments while benefiting from a resilient, advanced, inclusive, and competitive payment system.

#### 3.2. Design Philosophies

The design philosophies encapsulate the overall objectives of the envisioned model. The philosophies outline the model’s purpose to act as a medium of exchange and as a payment system. The model design was also based on three mutual principles advocated by the Bank for International Settlements (BIS); do no harm, co-existence, and Innovation and Efficiency (Westermeyer, 2018). With respect to the first principle, the envisioned cryptocurrency should in no way impede or interfere in the ability of financial institutions to carry out their pursuit or affect the present mechanisms to ensure monetary and financial stability. Secondly, the envisioned

cryptocurrency should be able to coexist with different forms of money already in use. The existing forms of money such as cash, reserves, and settlement accounts should complement each other and coexist. Lastly, the cryptocurrency design should be open to innovation and efficiency (Table 1).

Based on these principles from the Bank for International Settlements and the principal objective of the Central Bank of Kenya, this study developed six philosophies that guided the model design. These are Inclusivity, Innovation, Efficiency, Resilience, Scalability and Coexistence.

<b>Table 1: Model Design Philosophies</b>	
<b>Philosophy</b>	<b>Description</b>
Inclusivity	The envisioned cryptocurrency should foster the inclusion of all in the financial system and enable access to financial services.
Innovation	The envisioned cryptocurrency will provide a platform that fosters continuous innovation and collaboration across different sectors of the economy.
Resilience	The envisioned cryptocurrency will strengthen the existing payment system by serving as a key alternative means for digital transactions in the country and across the border.
Coexistence	The envisioned cryptocurrency should be able to coexist with different forms of money already in use.
Efficiency	The envisioned cryptocurrency will enable fast and efficient payments, reduce transaction and setup costs, and widen direct participation in the payments value chain.
Scalability	The model should be scalable and accommodate future trends and financial ecosystem needs.
<i>Source: Author</i>	

### 3.3. Design Dimensions

The model design adopted two dimensions: (i) Analysis of potential model business environment to realize services necessary for users. The deliverable is the model functional requirements (the potential processes that the system has to perform as a part of supporting a user task ). (ii) Analysis of the model functional requirements to define system requirements necessary to build a model that can deliver the required user needs.

#### 3.3.1. Model Functional Requirements

The model functional requirement describes what functionality should exist in the system to support an activity that the user would like to achieve. It communicates the model’s expectation from an end user’s perspective. To achieve the functional requirements, the focus groups and scenario-based design methodologies described in the methodology section were used.

##### 3.3.1.1. Framework for Scenario-Based Design

The model design was inspired by metaphors and technology options to realize a minimum viable product to demonstrate the viability of the overall research idea. As indicated earlier, at the center of the overall design were scenarios created through FGDs. The scenario was to describe a specific target user trying to achieve a specific goal or perform a specific task in a specific context. Each set of scenarios had a claim and a narrative. A claim analyzed the possible positive and negative consequences of the key design features. This reflected the usage implications of the design ideas during and after development. While the narrative served as a test case for analytic evaluation and claims hypothesized usability outcomes for one or more test cases.

##### 3.3.1.2. Functional Requirements Analysis

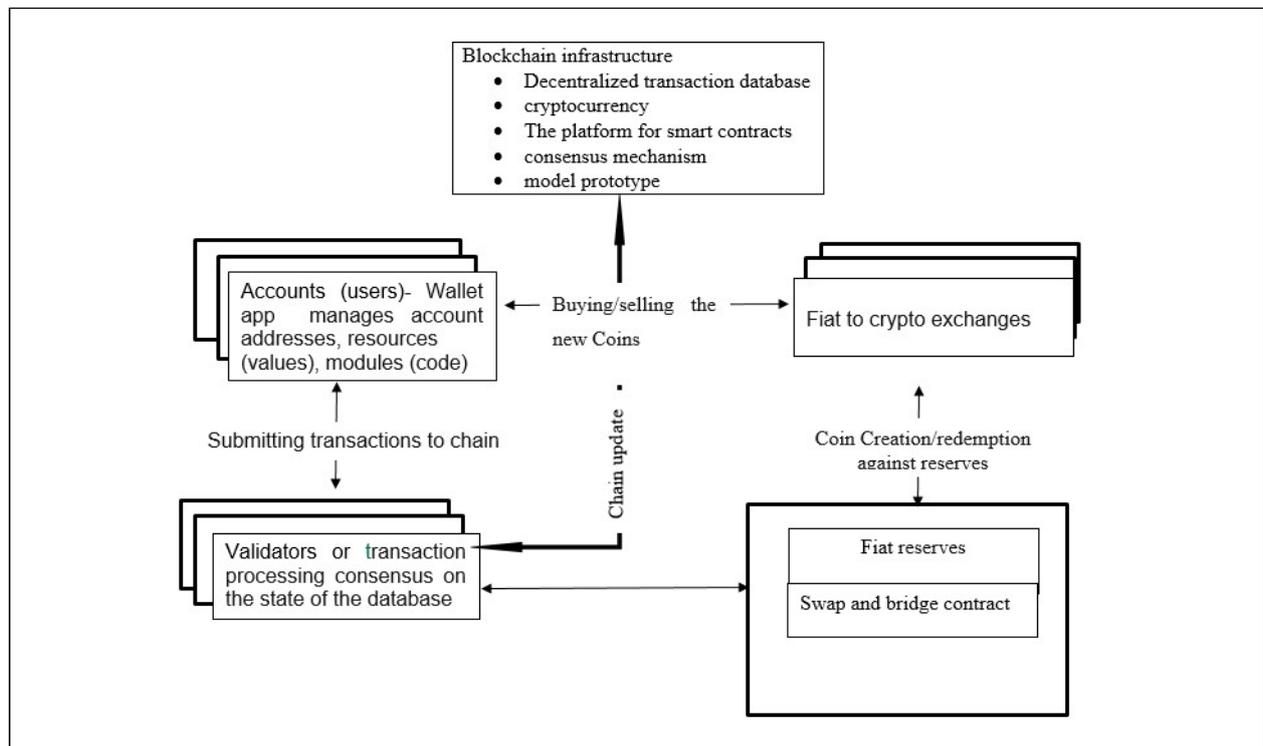
Requirement analysis, also known as Requirement Engineering, is the process of defining user expectations for a new software under development (Jayatilleke and Lai, 2018). The primary concern of the study was to design a model for creating stable cryptocurrency using fiat currency to enhance global electronic commerce. In the SBD, this research expressed an initial analysis of requirements as a root concept (Table 2). The root concept enumerated key aspects of the model’s starting vision. This served as a primary guide for further analysis and elaboration of the model’s functional requirements.

<b>Table 2: The Root Concept</b>	
<b>Component</b>	<b>Contributions to the Root Concept</b>
High-Level Vision	The model users to access the stable cryptocurrency.
Basic Rationale	The stable cryptocurrency overcomes volatility challenge exhibited by the previous cryptocurrencies.
Stakeholder	Convenient access to expected services for users and stakeholders with minimal latency while achieving the model's expected functionality and design philosophy.
Starting Assumption	Open-ended participatory design process.
<i>Source: Author</i>	

The root concept laid the groundwork for analyzing the model user activities and consequently deriving the model user and system requirements. Although the scenarios were through the expert focus groups, from here henceforth this document will be focusing on analyzing and developing model requirements using the SBD technique. The SBD through the focus group discussions expanded the root concept based on the problem scenarios and claims to realize comprehensive model requirements. A problem scenario is a narrative of current practice that synthesizes actors, themes, relationships, and artifacts Rosson and Carroll (2009)

The generation of problem scenarios started with a description of a set of realistic hypothetical model users, their tasks, and context. This formed the basis for describing and later transforming current activities into system and user requirements. A more systematic evaluation of the scenarios was obtained by asking questions about the scenario that are guided by cognitive and design philosophies. The analysis was also extended through “what if” reasoning that explored other possible requirements.

During the design process the model design was expected to contribute to the credibility of the new cryptocurrency as a unit of account, a stable medium of exchange, and finally as a store of value. Hence, the new cryptocurrency design fulfilled the basic functions of money. Users have to purchase and sell the stable



**Figure 4: Abstract Model Features**  
*Source: Author*

cryptocurrency through the model. The model is linked to fiat reserves and supports the exchange of the cryptocurrency from one form to another. Various forms of fiat currencies shall be accepted (mobile money, electronic exchanges, and mobile banking for the current POC). The future model advancement will however accept more interaction as indicated in the design philosophies. The blockchain infrastructure will allow quickly and securely transactions executions. This will be possible through cryptographic technologies and algorithms that ensure consensus among the network nodes. It will maintain the model integrity by preventing double spending of monetary units while ensuring that other DLT features are enjoyed within the model operation. The Figure 4 above describes the model features.

To describe the various functional requirements that users, user stories from the model abstract and scenarios described during the focused group were written as shown in the Table 3. The tasks and contexts thereafter

<b>As a...</b>	<b>I want to. . .</b>	<b>Traceability</b>
User	Be able to automatically generate my cryptographic identification parameters.	1.1
	Be able to create an account with model.	1.2
	Use memorable parameters for authentication.	1.3
	Be identified cryptographically.	1.4
	Be able to see my cryptographic transaction records.	1.5
	Make withdrawals from my cryptocurrency account.	1.6
	Transfer cryptocurrencies currencies from my wallet to another wallet.	1.7
	Convert my cryptocurrency to other forms of currency.	1.8
	Pay for goods and services using my cryptocurrency.	1.9
	Deposit cryptocurrency (create cryptocurrency by depositing fiat currency).	1.10
	To manage my account/wallet (check address and balance).	1.11
Admin	Be able to automatically generate my cryptographic identification parameters.	2.1
	Be able to create an account with model.	2.2
	Use a memorable parameter for authentication.	2.3
	Be identified cryptographically.	2.4
	Be able to view the model users (registered users and access the name service).	2.5
	Be able to view the model cryptographically recorded transactions	2.6
	Be able to access and view the minting records (a record of total/all generated cryptocurrency).	2.7
	Administrate (set up and maintain accounts) the system.	2.8
	Be able to view the total burned cryptocurrencies (cryptocurrencies that were permanently removed from circulation as a result of withdrawal or account dissolution).	2.9
	Be able to view the total market capitalization for the stable cryptocurrency (total cryptocurrency in circulation).	2.10

Source: Researcher (2022)

were defined in detail. An effort was made to simplify the user stories and requirements to the bare minimum, while still keeping the PoC design at a viable level of usability and security.

Summarization of the above user stories gives the following model functional overview as shown in the Table 4.

<b>Table 4: Description of the Model Functional Requirements</b>			
<b>The Model Functionality and Functionality Traceability (FT)</b>		<b>How to Realize the Target User Story (TUS)</b>	
Functionality	FT	How to Realize	T.U.S
User Registration	A.	All users are required to register with the model before accessing any of the model functionality. This is to capture the user's personal information and authentication details.	1.1, 1.2, 1.4, 2.1, 2.2, 2.3, and 2.4
User Authentication and Security	B.	The model ensured that all users registered before allowing them to access the model functions. The registered persons are required to log in using a memorable parameter of biodata.	1.3, 1.4, and 2.4
Stable Coin Creation	C.	The model created a stable cryptocurrency equivalent to the fiat currency deposit.	1.10
Cryptocurrency Account Liquidation	D.	The model allowed users to withdraw cryptocurrencies from their wallets.	1.6
Cryptocurrency Transfer	E.	The model allowed users to transfer their stable cryptocurrencies from one account to another. This assumed that users would need the transfer module to pay a debt, make a donation or pay for service.	1.7 and 1.9
Cryptocurrency Exchange	F.	The model allowed users to exchange cryptocurrency from one crypto to another within the liquidity pool.	1.8
Transaction Records Management	G.	The model allows the recording of the transaction on the blockchain.	1.5, 1.11, and 2.6,
Report Generation	H.	The model enables users to generate reports regarding transactions.	1.5, 2.7, 2.9, and 2.10

*Source: Author*

### 3.3.1.3. Interaction Design

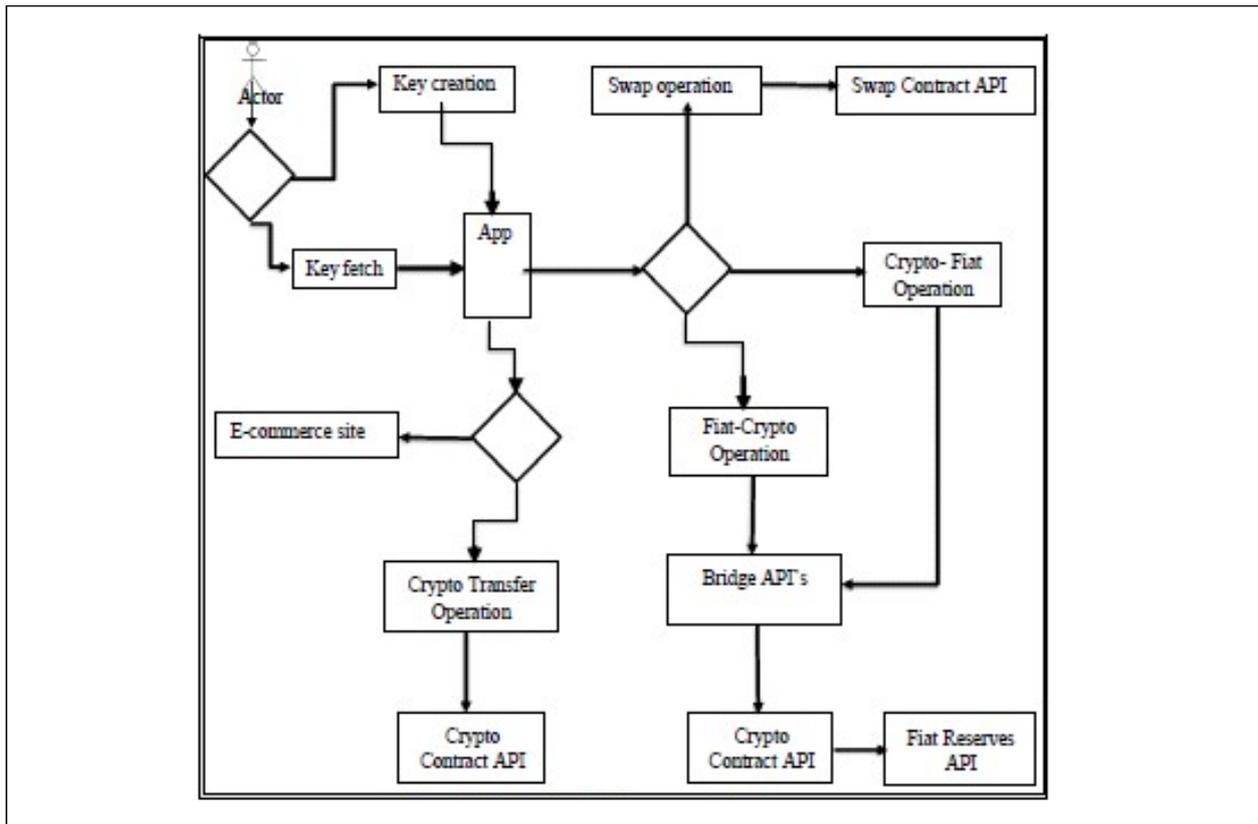
The User interaction design shows the activities and tasks that users can perform while using the model. It intends to support the identification and exploration of design alternatives to meet the requirements revealed by analyses of opportunity space and context of use (Figure 5). It also aids in realizing technical requirements and issues that need consideration to complete the model development.

### 3.3.2. Model System Requirements

The model system requirement describes the technical requirements. It designs the technical system blueprint that satisfies the system’s user requirements. It also clarifies the system-implementation techniques to deliver the model’s functional requirements. In designing the model system requirements, this research has taken into consideration four key design elements based on the recommendations from the World Economic Forum and Bank of International Settlement (BIS) on digital currency implementation as they align with the overall objective of the envisioned model.

#### 3.3.2.1. The Model Design Elements

Based on the model functional requirements discussed in Section 3.3.1, the model system requirements include the following design elements; Architecture, Infrastructure, Interlinkages/ interoperability, and Access.



**Figure 5: Interaction Design**

Source: Author

3.3.2.1.1. The Model Architecture/Reference Model

The model design targeted a platform that incorporates the design philosophies. The model entailed building a technology platform as well as leveraging the existing structures and roles in the payment system to deliver additional value for users. It aimed at realizing a platform that serves as a payment platform on which the users and payment service providers can innovate and create layered payment services to enable broad use cases (Figure 6).

To realize the defined model design philosophies, four key basics were provided:

1. A service suite and human-model interaction layer to facilitate interaction between humans/users and model for service access.
2. Inter-process communication layer to facilitate communication mechanism between users and the underlying or the model components if an event has occurred or the transferring data from one component to another.
3. Contracts module to execute user requests and respond to events to accomplish specific user requirements.
4. A core ledger to serve as the model core and a platform to record transactions and payments to be processed.

As a result of the above four essentials, the model was designed to have a four-tiered/layered architecture; Application Layer, RPC/Restful/socket APIs, Contract layer, and the Core Blockchain Layers. This architecture describes four layers that the model used to realize its operations. In addition, with these four elements, the model core drives inclusiveness, innovation, coexistence, scalability, originality, and interoperability as the baseline requirements and the design philosophies.

The four layers above were represented in an abstract framework or domain-specific ontology. This forms the model’s reference model consisting of all the elements in an interlinked manner to encourage clear communication (Figure 7).

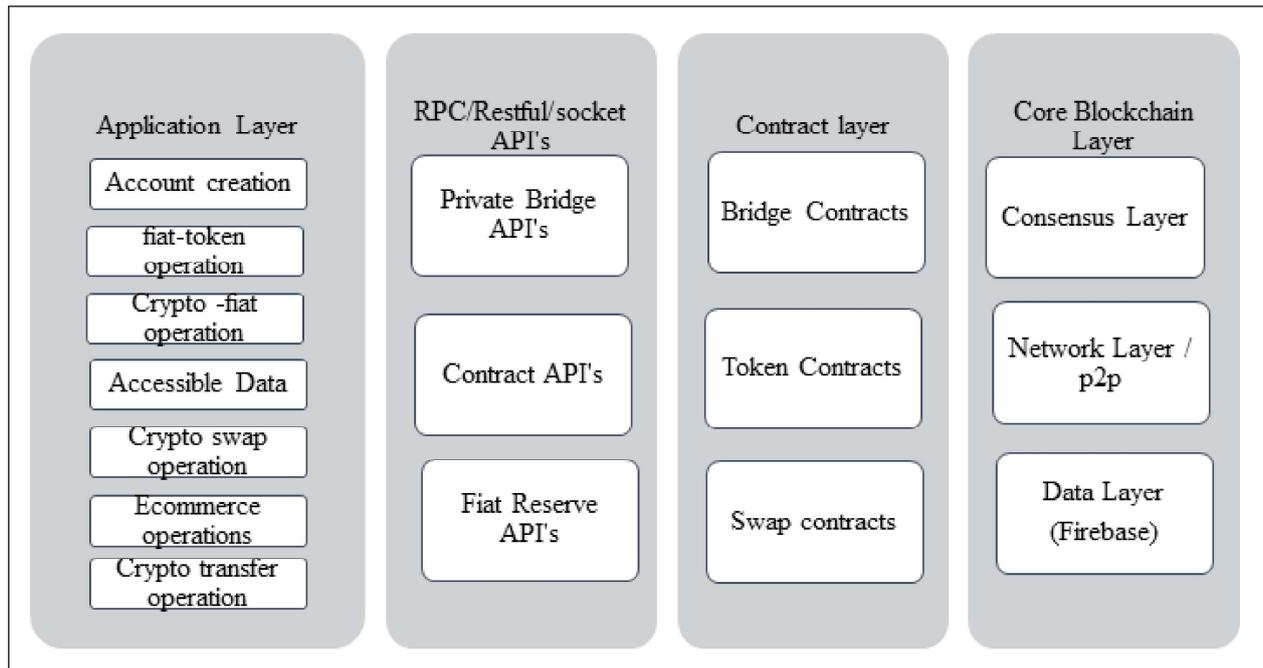


Figure 6: Model Architecture Layers

Source: Author

LAYER	OPERATIONS/ COMPONENTS
Application Layer	<ul style="list-style-type: none"> <li>• Account creation</li> <li>• fiat-token operation</li> <li>• Crypto -fiat operation</li> <li>• Accessible Data</li> <li>• Crypto swap operation</li> <li>• Ecommerce operations</li> <li>• Crypto transfer operation</li> </ul>
RPC/Restful/socket API's	<ul style="list-style-type: none"> <li>• Private Bridge API's</li> <li>• Contract API's</li> <li>• Fiat Reserve API's</li> </ul>
Contract layer	<ul style="list-style-type: none"> <li>• Bridge Contracts</li> <li>• Token Contracts</li> <li>• Swap contracts</li> </ul>
Core Blockchain Layer	<ul style="list-style-type: none"> <li>• Consensus Layer</li> <li>• Network Layer / p2p</li> <li>• Data Layer</li> </ul>

Figure 7: The Model Architecture/Reference Model

Source: Author

**Application Layer:** The application layer provides human-model interaction and user service access points. The services include and are not limited to the list provided in the table below as it leaves room for scalability, adaptability to future needs, and further innovation (Table 5).

<b>Table 5: The Application Layer of Model Architecture/Reference Model</b>	
<b>Application Layer Service</b>	<b>Description</b>
Account Creation	This service allows to register with the model prior to accessing any of the model functionality. This is to capture the user personal information and authentication details as a requirement for Knowing Your Customer (KYC).
Fat-Token Operation	This service will be facilitating conversation of fiat currency to cryptocurrency by invoking the bridge smart contracts.
Crypto-Fat Operation	This service will be facilitating crypto to fiat currency conversion or liquidation service using bridge based smart contract or Blockchain oracles.
Crypto Swap Operation	Provide cryptocurrency conversion (i.e., crypto A to crypto B) in this research, swap operation helps to convert the created cryptocurrency from Kenya shilling to other currency like USD.
Crypto Transfer Operation	This service facilitates transfer of the created cryptocurrency from one account to the another
Ecommerce Operations	This operation facilitates electronic payment for goods and services.
Accessible Data	Distributed data access by the network crews is facilitated by this service.
<i>Source: Author</i>	

**RPC/Restful/Socket API's Layer:** This layer provides a set of protocols and APIs that the clients use to interact with the blockchain network. The model users can query the blockchain-related information such as block number, blocks, or node connection and send the transaction request within this layer. Remote Procedure Call (RPC), RESTful API, and socket API used in this model operate on this layer. The following are the components that make up this layer for this model.

- **Private Bridge API:** This cross-chain private bridge enables users to transfer crypto-assets or data between different blockchain networks.
- **Contract API:** This API facilitates smart contract communication. It allows contract-to-contract communication and service-to-contract communication.
- **Fiat Reserve API:** This API facilitates the model components to communicate with the Fiat Reserve/custodian entities. Ideally, it facilitates communication with the M-Pesa business account and the GT-bank account used in the developed model to prove the overall concept.

**Contract Layer:** This layer defines the Smart contracts used in this model. To classify the contracts, “The Five Types Model” described in chapter three was used. The major smart contracts include Bridge contracts, Crypto Contracts, Swap contracts, and data contracts, Name system contracts. Bridge Contracts connect blockchain to external systems using blockchain oracles to enable smart contracts to execute based upon inputs and outputs from the real world. The Crypto Contracts facilitate the cryptocurrency transfer from one account to another. It contains a map of account addresses and their balances. The Swap contracts facilitate the cryptocurrency conversion from one form to another.

3.3.2.1.2. *Infrastructure*

The model infrastructure used was based on the Distributed Ledger Technology (DLT) that would support the adopted four-layered architecture. It also took into account the core requirements of financial systems and quality attributes which include: user identification based on underlying identity frameworks, high transaction throughput performance, low latency of transaction confirmation, and privacy and confidentiality of transactions and data about the business transactions

3.3.2.1.3. *Access*

Financial inclusion was a core objective of this study as highlighted in the design philosophies. To ensure

inclusive access while also ensuring the integrity of the financial system, the account based on the mobile money model was chosen for the envisioned cryptocurrency. This mirrors the progress made by the National Financial Inclusion Strategy (NFIS), which plays a significant role in driving financial inclusion by leveraging last-mile networks to identify users and provide banking services through channels such as USSD. With this, the model seeks to enable access by leveraging the existing identity infrastructure in such as the registered phone numbers to identify individuals. A phone number to cryptographic key mapping simplifies the identification mechanism. This identity mechanism will help ensure a robust KYC framework positioned to enable access for all users.

#### 3.3.2.1.4. Interlinkages/Interoperability

The envisioned cryptocurrency has broad use cases beyond the domestic market as it has the potential to avoid fragmentation and promote global cooperation in the long term as well as support a more connected and inclusive world. Interoperability between the envisioned and other cryptocurrencies has been factored into the overall design. This will help drive the business case for cross-border payments and could potentially address issues of dollarization of the economy, which is a key issue, in those sub-Saharan African countries.

## 4. Conclusion

The proposed platform in this study emphasizes key design principles aimed at ensuring decentralization, auditability, and transparency while fostering a high degree of trust-minimization compared to traditional off-chain systems. Additionally, the platform is designed to incorporate asset flexibility, allowing collateral to encompass various forms of digital fiat currencies, thereby enhancing its adaptability and usability.

Given the dynamic nature of the payment landscape, this study recommends that future iterations of the model explore emerging opportunities and address evolving user needs. New design features should be tailored and implemented to address unique circumstances, ensuring the platform remains responsive to changes in technology, regulatory requirements, and market demands. By adhering to these principles, the model has the potential to revolutionize financial transactions, enhance trust, and offer a scalable, inclusive solution for global payments.

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