A Proposed Unified Distributed Computing System Model Utilised by Emerging Technology Firms in Kenya

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Abstract: - Blockchain technology has the potential to revolutionize the financial services industry, providing secure and efficient ways for parties to conduct transactions without the need for intermediaries. However, the implementation of blockchain systems in practice can be complex and challenging. This is especially true for fintech firms in developing countries like Kenya, where infrastructure and regulatory challenges can make it difficult to implement and scale blockchain solutions. In this term paper, we propose a model and explore the use of unified distributed systems as a solution for implementing and scaling blockchain systems in the Kenyan fintech industry. A unified distributed system model which is a combination of multiple distributed systems that work together to provide a seamless and cohesive experience for users. By utilizing unified distributed systems, fintech firms in Kenya can overcome infrastructure and regulatory challenges, allowing them to fully leverage the benefits of blockchain technology.

Key Words: ***Artificial Neural network, Unified distributed computing model, fuzzy logic inference.***

I. INTRODUCTION

Blockchain technology has the potential to revolutionize the financial services industry, providing secure and efficient ways for parties to conduct transactions without the need for intermediaries. However, the implementation of blockchain systems in practice can be complex and challenging. This is especially true for fintech firms in developing countries like Kenya, where infrastructure and regulatory challenges can make it difficult to implement and scale blockchain solutions. One way to overcome these challenges is through the use of unified distributed systems. A unified distributed system is a combination of multiple distributed systems that work together to provide a seamless and cohesive experience for users. By utilizing unified distributed systems, fintech firms in Kenya can overcome infrastructure and regulatory challenges, allowing them to fully leverage the benefits of blockchain technology.

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Researchers and practitioners alike have identified Information and Communication Technologies (ICTs) as a critical catalyst for accelerating development in the developing countries of Africa (Chapman, Tom 2002). This paper provides a novel contribution to this end; a proposed home-grown Unified distributed computing prototype solution build around emerging disruptive ICTs: block chain technologies, Artificial Intelligent neural networks agents (AINNAs) and Big data analytics (android mobile phones as IoTs) to be utilized by emerging techfirms in Kenya.

The proposed model architecture is simulated in a unified distributed Blockchain framework that is integrated with AI and Big data to provide Internet, software, computation, storage resources, networking and data access to these emerging tech firms in Kenya. Ultimately these emerging firms will benefit from the architecture framework of the UDCS in three categories: software as a service (SaaS), platform as a service (PaaS), and infrastructure as a service (IaaS).

We critique on how if disruptive technologies that hold the greatest potential for driving inclusive economic growth and, in particular, the Big Four Agenda in the Kenyan tech space in that the study will strive;

- To identify distinct value propositions of these emerging disruptive technologies, and where can they create value.

- To determine current and expected future applications and use cases for these emerging disruptive technologies.
- To investigate and review the underlying factors that hinder the implementation of such prototype unified distributed models

Our study in this paper is grounded on this philosophical space that though having generated promising results, integrated/unified system models and prototypes still face the challenges of scaling up beyond small tech-firms. Innovative use of the readily available (IoTs) such as mobile phones and the versatile artificial neural networks technology riding on blockchain environment can be used to accelerate large scale success stories. Further, adoption of selected emerging technologies within the UDCs' algorithms could ease the process of unified computing. The switch from single computing platform to unified computing system has the potential to improve the trajectory of economic value proposition in Kenya and other emerging sectors of the economy. However, these benefits do not seem to be realized as of yet due to the gaps towards the design and implementation of a working unified computing model. Thus, a need to undertake a study on proposing a unified computing system model, fully converged with the block chain- Ai and big data analytics that can be adopted by emerging tech firms in Kenya.

II. Literature Review

2.1 Introduction This section describes the literature review on theoretical groundings for the dissertation.

First, we discuss the literature for theoretical framework, conceptual framework and empirical framework on software development approaches and their applicability towards development of novel information system software applications. We then review literature on the value proposition of block chain, Ai and Big data analytics all converged within UDCS framework. Emerging technologies can support and develop all of the Big Four Agenda in Kenya, and none have the potential to be as disruptive and transformative as UDCS with Blockchain technologies, Big Data and Artificial Intelligence (AI) all unified in one platform. These emerging technologies can converge and complement each other rather than compete, and are expected to be extremely beneficial to the Government and to have tremendous positive impact to spur economic growth for citizens (R. Aitken, 2018).

Kenya, like many developing countries, are on the verge of economic trajectory. This can be achieved with the uptake of emerging technologies as Blockchain, big data analytics (IoT) and AI that have been heralded as game changers to spur economic growth. Several governments across the world have embraced the use of such technologies for improved governance and within the fintech sector (Bankykoom,2018).

2.1.1 Theoretical framework

The theoretical basis for this dissertation comes from two research streams: Information systems software platforms and software development approaches. Literature from the software platform research stream is used to identify key challenges which are different from the challenges studied in prior work in software development for developing novel information system software applications on digital innovations. These approach stem from the apache cordova architecture and governance mechanisms of the platform ecosystem and require the software development approach to proactively shape and evolve the product to be relevant in the future. We will also explore the underlying logic of existing software development approaches using the framework of control and prediction (Wiltbank et al. 2006). The framework shows that existing software development approaches focus on positioning the software product in an exogenous environment so that it is relevant and profitable in the future

2.2 Information system software platforms; Apache Cordova

2.2.1 Information system software platforms; Apache Cordova

Following the mantra of Apache Software Foundation (ASF), the Cordova application framework is used by numerous application developers to develop applications and provides tools and interfaces that can be readily used. Apache Cordova provides all the interfaces and plugins that the information system software developers need to develop an application which can then be published across multiple platforms. Cordova supports seven platforms—Android, iOS, Windows, Ubuntu, Blackberry 10, WP8, and OS X. Web View provides user friendly interface capabilities (Casino, F et al., 2019).Web App provides configurational settings for the application, and Cordova Plugin allow seamless communication within application components and the platform. The Mobile OS platform provides standardized plugins, which are regularly updated by the platform administrator.

All Apache projects are required to store and host programming activities, decisions, and status of the project. Projects adhere to these requirements using mailing lists, project management and version control tools, and/or messaging platforms (Casino, F. et al., 2019) In our study, we will extract data from the UDCS project management tool. Specifically, we focus on this dataset because (a) all data are available, (b) the dataset consists of issues raised by active contributors, and (c) the dataset includes requests for information, bug fixes, feature requests, suggestions, and discussions. We will focus on completed smart contract that describe a specific feature request and/or issue with the application and/or platform. Completed user smart contracts are suitable for this research since they provide the issue and its description addressed in the transaction, and a solution that is provided and implemented using the block chain iOS within the application as shown in fig 2.1 below.

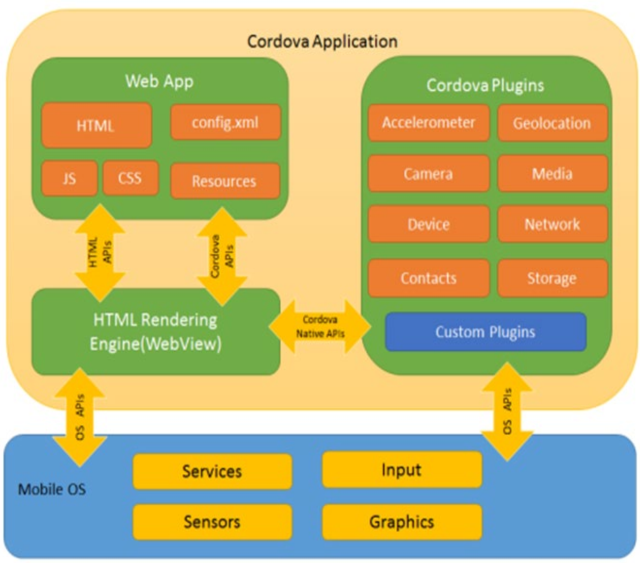


Fig.2.1 Information system software platforms the Apache Cordova architecture.

2.2.2 Framework of control and prediction

These theoretical framework approach stem from the architecture and governance mechanisms of the platform ecosystem and require the system software development approach to proactively shape and evolve the product to be relevant in the future (Wiltbank et al., 2006). To address these, we explore the underlying logic of existing software development approaches using the framework of control and prediction (Wiltbank et al., 2006). The framework shows that existing software development approaches focus on positioning the software product in an exogenous environment so that it is relevant, usable, profitable and provides utility in future.

2.3 Blockchain Definition and Value Proposition

Blockchain Attributes to UDCS Blockchain, as with any new and emerging technology, is little understood and has many definitions. Fundamental to any definition, however, is the concept of chain of transactions linked by cryptographical signatures that are unchangeable across networks and that are decentralised in terms of ownership and control (D. Chandrasekhar, 2018). Thus, Blockchain is a distributed ledger or a decentralised database that permanently records transactions between users without requiring a third-party. In such a ledger, transactions are cryptographically chained such that they cannot be tampered with and are shared with the linked users. Verified transactions in the ledger cannot be modified without obtaining a consensus from users. Although Blockchain's most commonly known app is Bitcoin, Blockchain's utilisation has grown and has rapidly diversified in recent years and its market is expected to grow (A. Mbogo et al.,2018). Blockchain as an expanding list of cryptographically signed, irrevocable transactional records shared by all network's participants. Each record contains a time stamp and reference links to previous transactions. With this information, anyone with access rights can trace back a transactional event, at any point in its history, belonging to any participant. The capabilities of Blockchain as D. Chandrasekhar, 2018 opines include: represent assets digitally, enable new forms of value exchanges, interact/transact without a central authority or a middleman. It also ensures distributed copies of identical records that are immutable and traceable are captured. Finally, it enables management, governance and execution of partnerships and smart contracts across a varacity of data entities (Manav Gupta, 2018).

2.4 Conceptual Framework

The conceptual framework is the set of broad ideas used to explain the relationship between the independent variables (factors) and the dependent variables (outcomes). The independent variables also known as exploratory variables and which are presumed cause of changes in the dependent variable which the researcher wishes to explain (Wray,2011). A conceptual framework is a diagrammatic representation of how variables interact. It provides a clear concept of the areas in which meaningful relationship are likely to exist (Stables,2014).

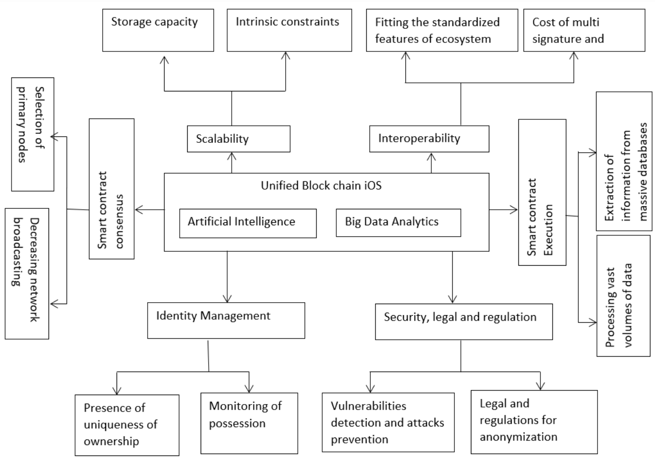


Fig.2.2 shows scalability, interoperability, security, legal and regulations, smart contract consensus and execution and identity management as the independent variable in this study.

Blockchain ios fully converged or unified with Big data analytics (IoT) and AI as the depended variable. The constraining and intervening variables are also addressed alongside the independent variables. 2.3.1 Interoperability Decentralization is one of the critical components of blockchain technologies. Blockchain system do not rely on centralized third party to keep transactions and smart contracts safe. Due to decentralized nature of blockchain, the data can be recorded, stored and updated distributedly. As Gartner (2018) opines in hype circle of emerging technologies, the blockchain could be a game changer for data security and has the potential to improve the reliability, transparency and trust in unified distributed system. The blockchain technology is a mixture of Cryptography, Peer-to-Peer networks and Mathematics. It solves the synchronization problem in traditional distributed databases by combining P2P networking and distributed consensus algorithms. This then will reduce the cost of multi-signature and transparency. By fitting the standardized features of Blockchain's ecosystem into our UDCS model then it can generate a great opportunity to use blockchain internet operating system technologies in many fields and services such as finance, IoT, sustainable supply chain, voting, cloud storage, and healthcare.

Scalability The main motto of blockchain is to change the trust from one centralized server to the whole system without interfering. This specific property of blockchain is extremely useful for databases storage capacity to handle large volumes of data. By proofing its intrinsic value constrains it can be used in financial transactions since the records are reserved forever and no one can alter the transaction unless an intruder takes control more than 51% accessibility of the network. The chain is linked to the complicated procedures of products and services known as cryto blocks which are being created and distributed. This chain, depending on the transaction, can include many stages, various geographic places, various accounts and payments, various people and institutions (N. Bore,2017). 2.3.3 Identity Management Blockchain is an all-crypto verified transactions digitized, decentralized, and public ledger. As such these documents are chronologically documented, helping participants to keep track of digital transactions without keeping central records. Distributed database is one of blockchains key. With such there is that presence of uniqueness of ownership. The blockchain identity and accessibility are associated to monitoring of possession having the three main principles such as public or permissionless, private or permissioned, and consortium. A public blockchain is designed to cut the intermediary from transactions to maintain the security whereas a private blockchain restricts the users from having the authority to validate the actual transactions and create the smart contracts. On the other hand, consortium blockchain is actually partly private and permits some predetermined selective nodes to have full control. Such presence of uniqueness of ownership will validate the transactions within the iOS-blockchain UDCS (Bancor,2018).

2.4.1 Smart contract consensus

In blockchain, anyone can access and audit the transactions because it is an open file. Furthermore, blockchain system is open to everyone, due to this; anyone can validate and audit the transaction. Inviduals use blockchain technologies to build any applications they really want. In many copies, this type of database exists across different computer systems forming a peer-to-peer network, denoting that there is no single, centralized database or server. This then tends to increase network broadcasting. To limit this then selections of primary nodes is quite essential. This will initialize the use of digital signatures with a public key cryptographically. Consensus models: A key aspect of blockchain technology is determining which users publish the next blocks (Aitzhan, N. 2016). This is solved by implementing any one of the consensus models. Whenever the consensus algorithms fail, it leads to several issues such as forks problem, dominance issues, and deficient performance of the blockchain network. Based on applicability and efficiency the consensus algorithms have the following properties. A consensus protocol has to be safe and consistent. Fault tolerance will be affected by the consensus protocol recovery to pre-selected primary node a property used to solve the blockchain trust problem between nodes to node.

Two different anonymity sets exist in a communication system namely sender sets and the recipient sets. The UDCS blockchain system will use as Proof of Bandwidth (PoB) consensus mechanisms.

2.4.2 Smart contract execution

Alice is asking for a smart contract transaction to be executed from a Blockchain UDCS. In such a case the vast volumes of information will have to be extracted and processed from volumes of databases. Cryptocurrency, agreements, documents or other data could be engaged in the such a scenario. Using nodes, the desired transaction is transmitted to a P2P network. Through a recognized algorithm, the node network validates the transaction and user status. On completion the transaction a fresh block will be added to the current blockchain. Blockchain owes its name to the way it stores transactions of data in blocks that are linked together to form a chain. Each block encloses a hash (a digital fingerprint or unique identifier), verified proof of valid transactions with timestamp, and the hash of the previous block (Arslan, S. 2020). The previous block used to prevent the block from being altered or a block being inserted between two existing blocks as in figure 2.3. In this way, each subsequent block strengthens the verification of the previous block and hence the entire blockchain. Smart Contracts that are executed based on certain conditions can be written into the platform. UDCS Blockchain internetwork operating system can evolve in pace with the extraction of massive volumes and processing of information from vast volumes of databases for a given smart transaction consensus initiated.

2.4.3 Security, legal and regulations

When publishing new node on blockchain networks, users should prove their identities are validated. This is applicable only to permissioned blockchain with high level of trust. After the proof of work (PoW) puzzle is solved, the block is broadcast to other nodes. By such initialization then vulnerabilities are detected while attacks are virtually prevented from intruding the UDCS. Bitcoin, Kovan testnet, Ethereum are examples of Proof of work (PoW). The main goal here is to develop a less computational model than PoW with good security guarantees. The publishing of the new node depends on random waiting time from a secure hardware shell. When it comes to legal and regulation for anoymizations of which the Hyperledger Sawtooth an example for PoET (R. Aitken, 2016). Anonymization of the Public Blockchain with no access restriction everyone connected to the internet can participate the reading or writing or auditing of the transactions. Private Blockchain which is permissioned, the participant can join only after getting the legal and regulated invitation from network administrators as in a Bankchain type. For a Consortium or Federated Blockchain which is semi decentralized the selected members of the consortium can run the entire node, make the transaction and review or audit the transaction as in the case for the Hyperledger as consortium blockchains (Agora et al., 2018). From the conceptual framework we intend to link the operationalization of the model to the studied depended variables for execution of smart contracts within the UDCS prototype model.

Proposed Empirical framework for the UDCS Prototype Model

Empirical research is based on experimentation, observation and measurement of phenomena, as directly experienced by the researcher. The data gathered may be compared against a theory and or hypothesis presented, but the results are still based on real life experience as opines D. Yaga, 2018. In the case of this study, we model a unified distributed computing system blockchain iOS fully converged with Ai-Big data analytics (IoT). We implement this with an empirical execution of a smart contract from consensus to execution within the UDCS.

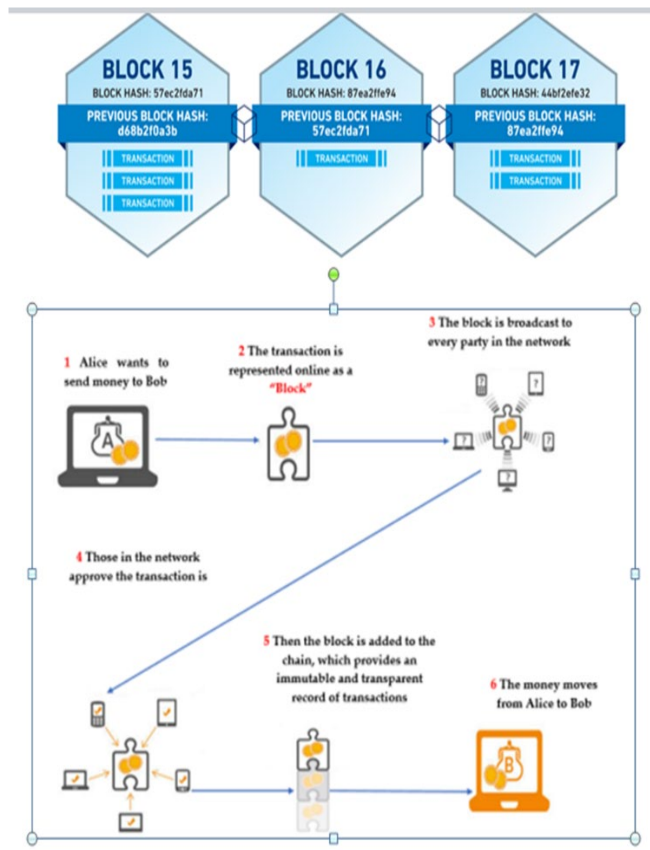


Fig 2.3 UDCS bock chain consensus –execution structure of transactional model

In fig 2.3 within our UDCS we model UDCS bock chain consensus –execution structure of transactional model where a hash function that takes input data of any length messages and output the data as distinct fixed length message. If there is any modification in the input, then the output is entirely different. In our study the UDCS blockchain, the hash functions are utilized ubiquitously. Each block containing data is hashed and the modification could be output as large or small sets. We consider in figure 2.3 as presented in our study a user named Alice tries to modify the data stored in a block during initialization of a smart transaction. Once modification is done then the modified block will have an entirely different hash value, assuring that every node or miner in the network would have the knowledge of the modification made by updating the ledger copy of the all users.

For these reasons, the blockchain's trustworthiness of the data stored. The UDCS also incorporates the Merkle Tree or hash tree where every node is represented as a leaf and is labelled with a block. This Merkle tree allows the user in our study Alice, to store large data structures in a secure and efficient way. With the timestamp element then we can track the creation or modification time of smart contract documentation in a secure way.

The nonce which is a value of basically 4-bytes starting with 0 and increments each time, whenever hash calculation is performed-solved and distributed within our UDCS blockchain model. Cisco Unified Computing System technology has redefined the enterprise computing environment. By breaking the traditional data center model and redefining data center infrastructure as pools of virtualized server, storage, and network resources, the Cisco Unified Computing System has delivered a new computing model with advantages in capital and operational cost, improving flexibility and availability, and reducing the amount of time needed for IT to respond to business changes. A key element in the power of Cisco Unified Computing System is the service profile, the fundamental mechanism by which the Cisco Unified Computing System models the necessary abstractions of server, storage, and networking (D. Chandrasekhar, 2018).

In our study of the UDCS we borrow some of the unique elements of a unified computing system then we model our UDCS blockchain internetwork operating system as we explore the various capabilities and the benefits that accrue from this model after implementation especially in regard to realization of the big 4 agenda in Kenya.

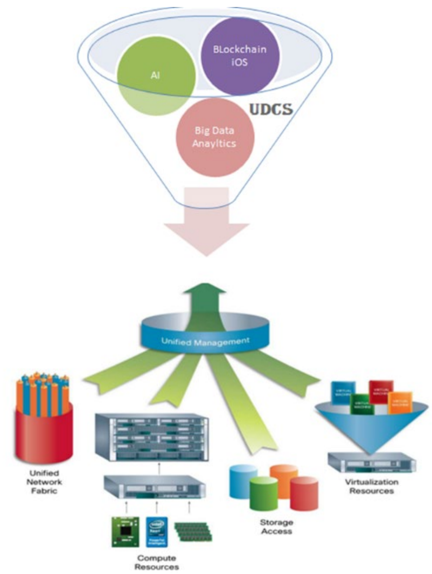


Fig.2.4 UDCS blockchain –Ai-Big data analytic which integrates network compute, storage, virtualization resources into a converged cohesive system.

In this model of Unified Computing Distributed Systems Integrated with blockchain iOS-Ai and Big analytics(IoT) as presented in fig 2.4 we have the layer of Unified Computing System Manager with the service that provides for the creation of an interoperability interface between the unified computing platform and third-party management tools, using the available application programming interface (API) for ease of provisioning, monitoring, troubleshooting, and adaptability of the unified distributed computing platform. With the API of the UDCS it will fully integrate with another network, storage, server, and provisioning management systems for a seamless smart contract initialization or consensus.

Unified Computing Migration and Transition Service will assist to accelerate the adoption and optimal implementation for a transaction business application on our UDCS blockchain platform. The service can help smoothly migrate existing block applications, modernize them to a new version, and automate them using features of the Unified Computing System block chain platform and other management applications (N. Charania,2018). The layer will have three components:

Unified Computing Server Virtualization Mobility and Management Service which will provide in depth planning and design for an end-to-end data center virtualization and enhance provisioning and management of virtual machines. This component helps to eliminate common problems associated with virtual machine deployments during initialization processing and execution of a smart contract consensus. The service provides an exhaustive evaluation of your current environment and processes and documents requirements across the existing block assets to achieve virtualization smart contract objectives.

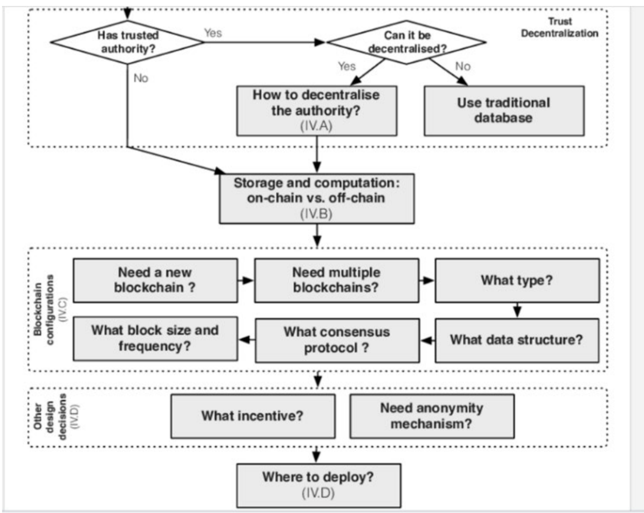


Fig.2.5. Design algorithm process for our UDCS blockchain-based systems

In figure 2.5 a design algorithm process for our UDCS blockchain-based systems is presented. Throughout this design process, our taxonomy will assist the decision making through enabling a systematic comparison among the capabilities of different design options. The taxonomy also links the impact of different design options on the quality attributes. The trade-off analysis of quality attributes provides a foundation for the comparison. Blockchain is an emerging technology for decentralized and transactional data sharing across a large network of participant who do not need to trust each other. It enables new forms of distributed software architectures, where components can find agreement on their shared states without trusting a central integration point or any particular participating components (Manav Gupta, 2018). Blockchain, as a software connector with a complex internal structure, has various configurations and different variants. Using blockchain in different scenarios requires the comparison of blockchain options and products with different implementations and configurations as opines D. Yaga et.al., (2018). In this we then evaluate an algorithmic taxonomy of UDCS blockchain-based systems. The taxonomy can be used when comparing and computing blockchains and assist in the design and evaluation of software architectures using blockchain technology. Our taxonomy captures the major architectural attributes of blockchains, and the impact of different decisions implemented within UDCS. This taxonomy is intended to help with important architectural considerations about the performance and quality attributes (e.g., availability, security and performance) of UDCS blockchain based systems. We also present a mechanism to classify and organize the existing solutions from solving the blocks algorithms.

2.5 Nature of Application

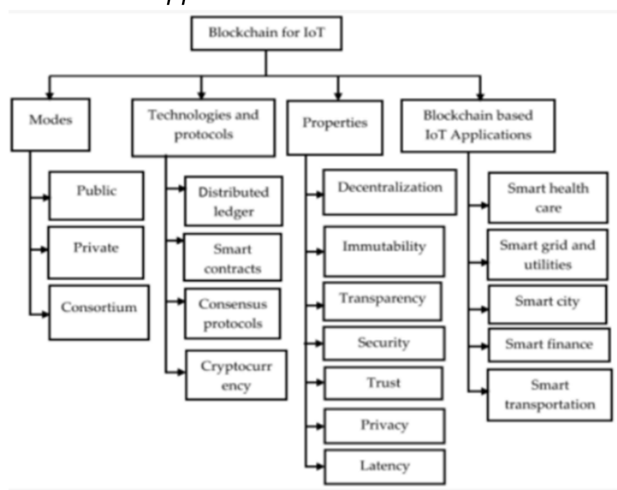
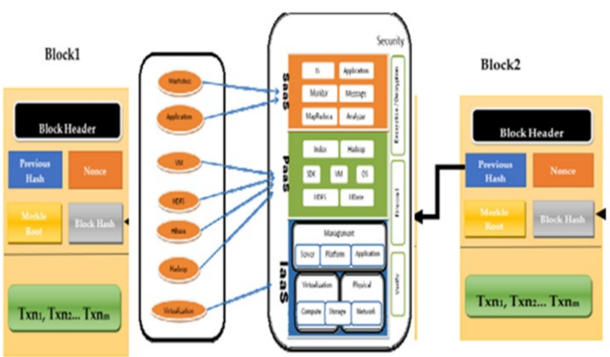


Fig.2.6. Thematic taxonomy of the UDCS

The Internet of Things (IoT) utilization with Big data analytics has become a popular computing technology paradigm. It is increasingly being utilized to facilitate human life processes through a variety of applications, including smart healthcare, smart grids, smart finance, and smart cities (Manav Gupta,2018). Scalability, interoperability, security, and privacy, as well as trustworthiness, are all issues that Big data analytics (IoT) applications face. Blockchain solutions have recently been created to help overcome these difficulties a unified distributed computing system framework is proposed, which comprises of MapReduce, a virtual machine, Hadoop distributed file system (HDFS), Hbase, Hadoop, and virtualization as presented in fig 2.6 (Ruddick, W. 2011).

Empirical Research Gaps Infrastructure Challenges One of the main infrastructure challenges facing fintech firms in Kenya is the lack of reliable and fast internet connectivity. This makes it difficult to implement and scale blockchain systems, as the decentralized nature of blockchain technology requires a high degree of connectivity between nodes. A unified distributed system can help overcome this challenge by utilizing a combination of different distributed systems, such as cloud-based systems, edge computing, and peer-to-peer networks. This allows for a more resilient and flexible system, as nodes can continue to operate and process transactions even in the event of internet connectivity issues. Regulatory Challenges Another major challenge facing fintech firms in Kenya is the lack of clear and consistent regulations for blockchain systems. This makes it difficult for firms to know how to comply with laws and regulations, and can also create uncertainty for users and investors. A unified distributed system can help overcome this challenge by providing a clear and consistent framework for compliance. This can include measures such as regular security audits, incident response plans, and community-based decision-making processes. By implementing these systems, organizations can proactively identify and address potential regulatory issues before they can cause significant harm. Case Study: M-PESA One example of a Kenyan fintech firm that has successfully leveraged the benefits of blockchain technology is M-PESA. M-PESA is a mobile money transfer service that allows users to send and receive money via their mobile phones. By utilizing a unified distributed system, M-PESA is able to overcome infrastructure and regulatory challenges, allowing them to fully leverage the benefits of blockchain technology. M-PESA uses a combination of cloud-based systems, edge computing, and peer-to-peer networks to provide a resilient and flexible system. This allows for a high degree of connectivity between nodes, even in the event of internet connectivity issues. In addition, M-PESA has implemented robust governance and risk management systems to ensure compliance with laws and regulations.



III. Research Methodology

We propose the following approaches: i. Applied-descriptive-structured research carried to analyse the elements, modules and characteristics of unified computing systems; ii. Applied-exploratory-unstructured is used for all other aspects of the research presented here. This is informed by the fact that the block chain inter-net-working operating system unified with artificial neural networks and big data analytics are relatively emerging technologies. This design will be applied in investigating the suitability, applicability and evaluating the effectiveness of ICTs emergent disruptive technologies: Artificial Intelligence (Artificial Neural Networks, and intelligent agents, IoTs (mobile phones), in qualifying/quantifying through computation algorithms within the UDCS architecture. Finally, this approach will investigate the suitability of fuzzy logic in capturing and representing the holistic nature of smart contracts business knowledge.

3.1 Research Design

Research design is the conceptual structure within which research would be conducted; its function is to ensure that the evidence obtained enables the researcher to answer the research question(s) as unambiguously as possible (Vaus, 2001). Guided by the objectives, Experimental research design approaches will be selected. The following aspects of the research will be evaluated before deciding on the research design approach: (1) The number of elements within the design; (2) Number of pre-tests and/or post-tests computation phases;

3.1.1 Experimental Design

Experimental Design will be applied in the testing of the UDCS model readiness in accepting input, processing and computing the harsh blocks then running the output on block chain iOS; Unifying the selected emergent disruptive technologies modules within the UDCS and testing the versatility and coherency within the unified environment. Surveys and experiments are the prime examples of quantitative research. For our research, we choose experiments as the suitable design. Novel experiment types called Recursive Participatory Experiments (RPE) will be used. Our experiments model will entail running a series of Pilot, Exploratory and Confirmatory Experiments (PiECEs) recursively. After every cycle, the stakeholders (business firms, tech firms/hubs' representatives) will then be given a chance to evaluate the solution (Participatory) before other cycles of PiECEs are executed. Pilot Experiments are small, usually short-term, experiments, which are used to test the logistics of a proposed study with the aim of gaining preliminary information. Pilot experiments are common approaches to computational fields and are used to test novel technologies (Billé 2010). In the current work, before output of harsh blocks nodes, pilot experiments will first be carried out in order to give an indication of how the various elements components behave. Exploratory Experiments will be used to study the patterns of response to some parameter variations or intervention, without necessarily being based on a formal hypothesis, and may be used to generate hypotheses for more formal testing in confirmatory experiments. Confirmatory Experiments will be carried out to clearly test the hypothesis that was set prior to the commencement of the all the experiments. During our experiments, the Participatory Phase (Evaluation by Stakeholders) will be carried out soon after the Pilot and Exploratory Experiments in some cases. In the figure below This is represented by path 1b and 2b respectively in the figure. This is to avoid running the full cycle of experiments (PiECEs) without involving the stakeholders. The path 4b allows the return to normal 'PiECEs' cycle; that is resume Exploratory Experiments interrupted by path 2b. (Franklin 2005; Festing 2012).

Artificial intelligence techniques, especially Fuzzy Logic, Intelligent Agents and Artificial Neural Networks (ANNs) is our proposed methodological approach in design of the propsed UDCS. Agents have been known to perform well in conquering systems complexity in autonomous mission- critical systems. The ability of ANNs to use a black-box's approach to tackle very complex mathematical equations/formulas, like those found in prediction, has made them find applications in hundreds of computing modelling applications. Fuzzy Logic, on the other hand, has the power to represent and manipulate information that has imprecise categorisation and generalisation, such as is the case with business and economic knowledge

Fuzzy Logic is based on fuzzy sets in that, unlike classical sets, their membership is not a true-false 'but not-quite-true-or-false 'answer. A fuzzy set A is made up of ordered pairs and is defined as follows: A={x| mA x) | x Î X} where X is the universe of discourse whose elements are denoted by x and mA(x) is the Fuzzy Membership Function of x in A. This is a value in the unit interval [0,1], where 0 means that an attribute has complete non-membership in a fuzzy set; 1 means that an attribute has complete membership in a fuzzy set, and grades between 0 and 1 mean partial membership in a fuzzy set. This value (grade) is associated with a certain proposition in the domain being modelled. Fuzzy Modelling Stages There are three stages of fuzzy modelling (Mathworks 2005; Sicat, Emmanuel, John, Carranza et al. 2005): i. Fuzzification of the inputs; generation of FMFs for input to a degree of membership between 0 and 1 ii. Logical Inference procedures – that is fuzzy set operations that combine fuzzy sets into a synthesised fuzzy set. This entails resolving the antecedent the IF x) part(s) to a single number between 0 and 1 iii. Defuzzyfication – transformation of synthesised fuzzy set back to a crisp set. It involves assigning an entire fuzzy set to the output based on the consequence of a fuzzy rule.

In real-life, multiple fuzzy rules are used; output of each rule is a fuzzy set. All these sets are aggregated into a single output fuzzy set which is then defuzzified into a single number. This mapping (input to output) process is called fuzzy inference (Mathworks 2005). MATLAB Fuzzy Logic Toolkit MATLAB Fuzzy Logic Toolkit will be adopted and used to model business knowledge for the execution of the smart contract within our UDCS model(protoptype): Step 1: Fuzzify Inputs – for each of the inputs, the degree to which they belong to each of the appropriate fuzzy sets (via membership functions) is determined. Step 2: Apply Fuzzy Operator – these are used when the antecedent part of a rule has more than one part: fuzzy operators (AND-min, OR-max, etc.) are applied to resolve it into a single rule. Step 3: Apply Implication Method – this is the shaping of the consequent (a fuzzy set) based on the antecedent (a single number). This is determined by the rule's weight (relative to other rules in the rule set). This could be done using min (minimum), which truncates the output fuzzy set, and prod (product), which scales the output fuzzy set. Step 4: Aggregate All Outputs –unify the outputs of each rule by joining the parallel block threads. This is achieved via three in-built methods; max (maximum), probor4 (probabilistic or), and sum (simply the sum of each rule's output set). Step 5: Defuzzify – that ensures that the final output for each variable is a single crisp value. This is achieved by applying any of the following five in-built methods supported: centroid, bisector, middle of maximum (the average of the maximum value of the output set), largest of maximum, and smallest of the maximum.

For the actual smart contract execution on the harsh blocks within the UDCS, three Artificial Intelligence techniques (Agents, Artificial Neural Networks and Fuzzy Logic) will be adopted. Systematic approach to the design of the integrated tool will be followed; this ensures that the tool is generic and can be ported. In order to test the model framework, an integrated system prototype will be developed and deployed for accessibility via a user-friendly web portal.

This will be achieved through the novel middleware MobiGrid, that allows a pool of phones to operate in a grid version (Masinde, Bagula et al. 2010). To further improve the use of this grid, a service-oriented interface that allows applications to run on MobiGrid as a service will be developed (MobiSOC, Masinde, Zebal et al. 2012). At prototyping stages, these will offer unique contributions to the world of unified distributed computing.

At the final stage we expect that an elaborate system prototype will be our major deliverable of this research. This UDCS will be a comprehensive system made up of several sub-systems that are linked up together by intelligent agents that will be implemented using the Java-based multi-agent systems 'development framework called JADE (Java Agent Development). The sub-systems are: (1) Data Sensor-Based computing system prototype; (2) The EDI Monitor which is a FORTRAN program; (3) ANNs logic Tool; (4) UDC Fuzzy Sub- System that stores business model knowledge; (5) Block chain -android mobile application to input and output processed harsh blocks; (6) a user-friendly web portal used for both system administration as well for displaying detailed information.

IV. Findings

We will use Atlas.ti qualitative data analysis software for our model analysis. To aid our coding procedure, we will develop a qualitative codebook that identifies sub-codes and operational definitions for each construct in our model. Coding Analysis for the Unified blockchain-Ai Model will then be presented in tabular form.

The sub-codes are identified from the research objective, questions, the research context, theoretical constructs and conceptual framework. Operational definitions are identified based on the research context and empirical framework studies (Chandler et al. 2011, Perry et al. 2012). Further, the coding scheme is flexible to add new sub-codes blocks as they emerge from the input data and update the operational definitions. The codebook will guide our first-order coding. Using descriptive coding technique (Miles et al. 2013), sub-codes from the code-test results will be applied to each block where applicable. To address construct validity, multiple sources of data—smart contract, documentation, harsh blocks, board reports are tapped to ensure that the findings converge. Reliability of the study will be addressed with (a) programmatically retrieving and storing analysed transactional stages distributively locally from our UDCS block chain-Ai project management tool, (b) maintaining the qualitative codebook of codes and (c) developing matrices from the labelled data block sets.

The results will then be presented in the form of graphical simulation of the UDCS. A multiple regression model will used to show the relationship between the independent variables to the dependent variable as follows;

$$Y=\beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3+ \beta 4X4+ \beta 5X5+ \beta 6X6+ \beta 7X7+ \beta 8X8+ \varepsilon$$

Where;

Y = UDCS Blockchain internetwork operating system converged with Ai-Big data analytics process and output

X1 = Scalability

X2 = Interoperability

X3 = Security legal and regulation

X4 = Identity management

X5 = Smart contract consensus

X6= Smart contract execution.

X7 = Security legal and regulation

X8= Identity management

In the model, β0 = the constant term while the coefficient βii = 1….4 will be used to measure the sensitivity of the dependent variable (Y) to unit change in the predictor variables X1, X2, X3 and X4. The error (Ɛ) term captures the unexplained variations in the model. Data will be presented using charts, graphical simulation models and tables which are user interface friendly and easy to interpret.

V. Conclusion

In summary Blockchain's value proposition has the potential to help Kenya achieve its Big 4 Agenda in the following ways as opines (M. Kimenyi and D. Muthaka,2018). Health: Blockchain technology can be used to track the pharmaceutical supply chain. Such tracking capability would help tackle the issue of counterfeit medication. The MediLedger project for instance brought leading pharmaceutical manufacturers together to track prescription medicines using blockchain technology to trace medical products back to their original manufacturers and to confirm the authenticity of a drug with each transaction. In terms of Food Security blockchain technologies, agriculture could benefit from transparent and auditable supply chains. Counterfeit seeds have flooded many markets, resulting in reduced productivity in soil and compromising farmers' yields for many seasons. In 2012, it was reported that 40% of seed packets in Kenya contained counterfeit seeds and 75% of farmers had planted counterfeit seeds at some point. This is what contributed to a national food deficit in 2011. Origin Agritech, a Chinese seed provider, is using Blockchain technology to track and document the original source of seeds to eliminate the prevalence of counterfeit seeds (Fleishman, 2000). In manufacturing: Blockchain can be used to improve supply chain systems. In manufacturing industries, supply chain systems involve a wide range of activities, such as material procurement, processing, packaging, labelling, transport and payments. Typically, such systems have significant transaction costs and, where manual processes are involved, are prone to errors. Wipro, a business process services consulting company, has developed Blockchain applications for supply chains that address registration, certification and tracking of goods. Manufacturing industry could benefit from harnessing Blockchain technology (Bass L. 2015). In this study we propose a model of Blockchain as an operating system, such as Microsoft Windows or MacOS, such that other transactional contractual documents as only but many of other applications that can run on that operating system in particular to this study UDCS blockchain iOS.

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