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Leveraging Blockchain Technology for the Empowerment of Women Micro-Entrepreneurs

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Abstract: Despite the fact that scholars have identified blockchain technology as a powerful tool that can facilitate financial inclusion and empower marginalized people, there is a lack of research regarding its use amongst women, specifically women micro-entrepreneurs. This criticism lends itself to the issue of gender imbalances and inequality in some sections of IT/IS. This study aims to determine the benefits, risks and challenges associated with using blockchain technology for empowering women micro-entrepreneurs. A qualitative research strategy was adopted by using an interview approach, and data collection which focused on the perspectives of professionals employed in the blockchain sector. Using an affordance lens as a guideline, the findings and analysis from the interviews show that blockchain technology both directly and indirectly affords financial inclusion amongst women micro-entrepreneurs in particularly access to financial products and services to promote active participation. We found that many participants motivated that a blockchain solution will not be feasible in the context of a single micro-entrepreneur, but that women should form a network where they will be able to support each other and benefit from economies of scale.

Keywords: Blockchain Technology, Women Empowerment, Gender Inequality, Theory of Affordances, Financial Inclusion, Micro-Entrepreneurs, Development, Digital Connection, Challenges, Benefits, Risks, Digital Divide.

1. Introduction

Women empowerment and gender inequality are key issues which are currently being addressed globally [4]. Women empowerment is the process of improving the assets of women and enhancing their capabilities; allowing them to influence and engage with the institutions which directly and indirectly impact their livelihoods [2]. Empowering women allows them to overcome the barriers they face and increases their socio-economic status within society. Women make up 56% of the world's unbanked population, which inhibits them from participating within their countries emerging economies [26]. A major challenge women face is financial exclusion and the inability to easily transfer assets, which limits their financial opportunities [7].

Scholars have identified Information and Communications Technology (ICT) as a powerful tool which facilitates women empowerment in developing countries [9]. Blockchain technology is regarded as a disruptive technology which has the potential to contribute to socio-economic transformation within developing economies [11]. By breaking down socio-economic gender barriers, blockchain technology facilitates the empowerment of women by allowing them to participate in their nations' growing economies [3]. Blockchain has the potential to remove some of the current barriers faced by these disempowered women and can promote financial inclusion through access to financial resources, micro-lending opportunities, trade finance, supply chain finance and investment opportunities, to name a few [3, 12]. Financial inclusion refers to the availability and access to affordable financial services, for those that have not been supported by the formal agents within the traditional financial system [1]. This will enable women micro-entrepreneurs to have more financial opportunities and grow their enterprises.

We conduct an empirical study on how financial inclusion enabled by blockchain technology holds the potential for women empowerment. The study identifies barriers for financial inclusion and suggests blockchain technology-based solutions to overcome these barriers. The use of blockchain technology is still growing within developing countries, it is thus important to recognize its potential for the development of women and allow them to access this technology, to ensure that the digital divide amongst men and women is not accelerated as blockchain adoption becomes more mainstream. This criticism lends itself to the issue of gender imbalances and inequality in some sections of IT/IS which further emphasizes the issue of digital divide [20].

Thus, it is important to determine how the digital divide can be reduced and marginalized women can be included within economies. More studies are needed to critically analyze how women can overcome this digital divide and to actively participate to be part of the decision-making process in the creation of digital tools. This is to ensure that the solutions being designed to combat issues that women face are sustainable and fit women's existing skills, knowledge, and resources. If effective regulations are not put in place, the continued usage of blockchain could accelerate the relative return to sophisticated technology skills that men are more likely to have and further increase the digital divide between men and women [3]. Using an affordance lens as a backdrop to guide how financial inclusion can be realized with the use of blockchain technology and to identify the factors which enable and inhibit this affordance's realization. We consider affordances as a "concept that enabled a middle ground between technological determinism and social constructivism" [14]. To understand how a blockchain technology could empower women, the following research questions were formulated:

Primary Research Question:

RQ: In what ways does blockchain technology afford financial inclusion for women empowerment?

Secondary Research Questions:

SRQ-1: What are the potential benefits and risks of blockchain for women?

SRQ-2: What are the challenges faced when trying to empower women through blockchain technology?

Research Contribution:

This research aims to contribute to the limited body of knowledge and discourse on blockchain technology for the empowerment of women and serve as a foundational understanding for the application of blockchain technology as a sustainable solution for women micro-entrepreneurs. It aims to explore blockchain as a phenomenon beyond its applications in current research.

2. Literature Review

Methods

We performed an in-depth systematic literature review of existing literature to determine the current state of literature regarding the use of blockchain technology to empower women. This was followed by a quality selection assessment and finally, analysis of data in keeping with the hermeneutic cycle [15]. These steps were not performed in a rigorous, sequential fashion; but rather steps were reiterated as determined by the researcher's interpretation and analysis [15]. In the following section, some of the key claims from the synthesis will be explained.

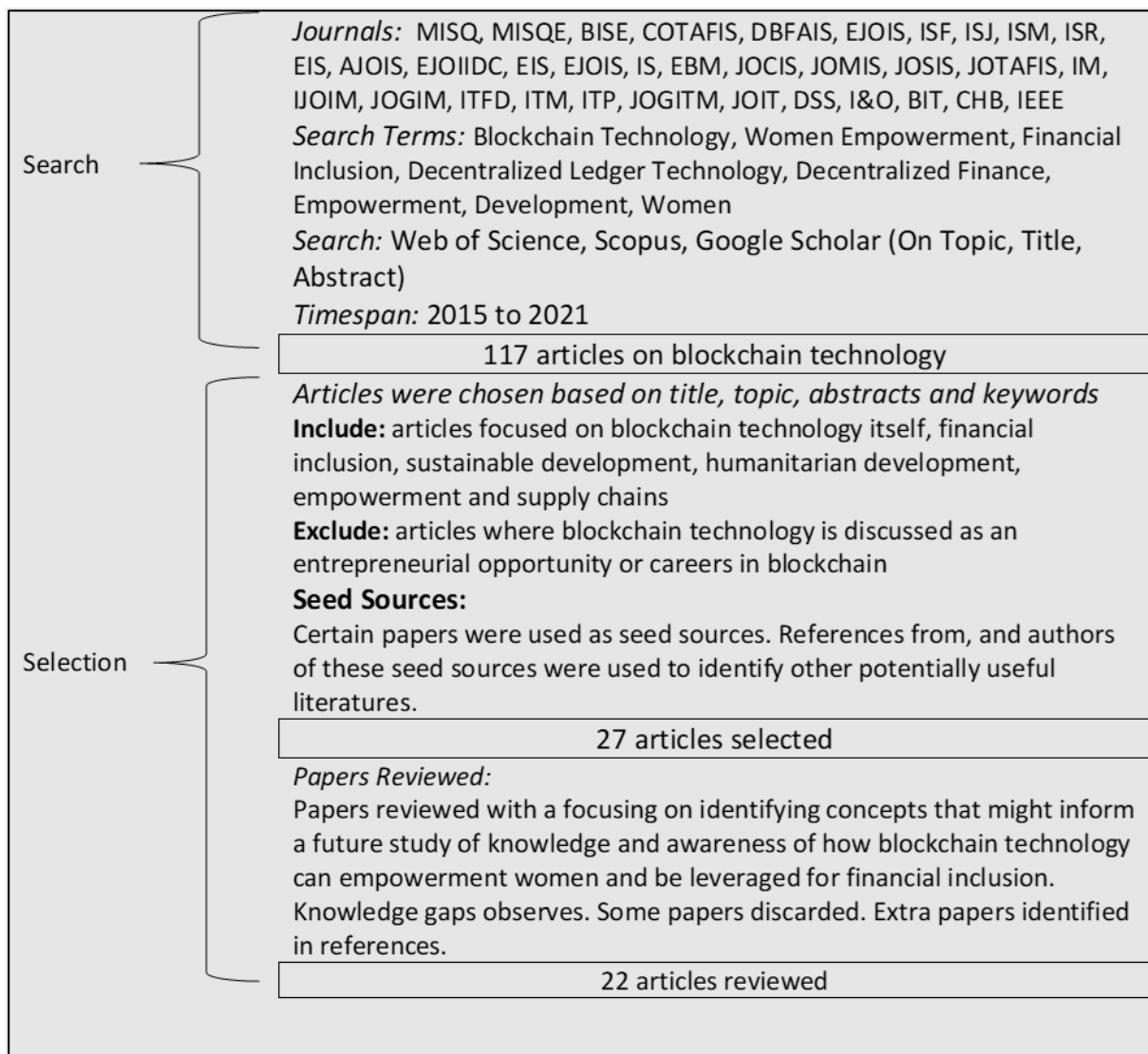


Figure 1. Search and selection process (after the fashion of [16])

2.1. Challenges faced by Women Micro-Entrepreneurs

A major challenge faced by women micro-entrepreneurs is the lack of access to financial products and services [7, 27]. This hinders their ability to grow and invest in their businesses. Considering these challenges, it is important to understand the benefits financial inclusion holds for women. When women have access to adequate and affordable financial products and services, it does not only benefit themselves but their families and communities as well [26, 27].

By leveraging ICT, women can transform their social, political, and economic lives. ICT enables opportunities for growth and development, with the potential to bridge the gaps in socio-economic development [9, 22].

2.2. Blockchain Technology

Blockchain is an emerging technology which continues to attract significant interest from scholars. It is seen as a revolutionary and potentially disruptive technology [13]. Blockchain is a decentralized, digital ledger that facilitates peer-to-peer transactions without the need for third party intervention and enables a range of digital interactions [25, 29]. By eliminating the need for third parties, blockchain technology lowers uncertainty when exchanging value.

2.2.1. Blockchain Technology Risks, Issues and Limitations. Considering that blockchain technology is relatively new; ergo the risks of blockchain have not been extensively tested and it is slightly complex for non-IT specialists to fully understand [27]. This lack of understanding, or rather lack of knowledge on how to use the technology, could be harmful [3]. There are certain challenges which could cause reluctance for the use of blockchain and make it too expensive to deploy. There is no clarity as to whether the costs will be low enough to make it affordable in developing economies and whether there are ways in which these costs can be contained [8]. Affordability of the technology therefore needs to be considered. Blockchain technology also consumes a high amount of energy [11]. There are currently existing attempts to minimize the energy costs but blockchain will always need servers and computers for the processing of transactions – which means it will always have a high-energy consumption. Most of the blockchain

processes need access to the internet [3]. As a result, countries with unreliable internet access and poor energy infrastructure have more limitations for the use of blockchain [19].

Blockchain can aid in overcoming some of the barriers faced in accessing trade and commerce by women. However, it can also further aggravate gender inequality due to the type of skills required for operating the technology [3, 29]. It requires highly specialized skills. Lack of these skills on how to operate blockchain-based applications might create even higher barriers to trade for women [3]. Blockchain technologies potential benefits are recognized amongst scholars; however, it is noted that there is an evident risk due to the lack of regulations and legislation regarding the use of the technology [27]. If not regulated correctly, blockchain could increase the digital divide between men and women, resulting in more gender inequality [3].

2.2.2. Governance. Blockchain successfully removes the need for a third party, as it does not require any authentication or verification [27]. Blockchain technology can be considered “trust less”, as there is no need to trust an intermediate organization in performing a transaction [10]. Instead, trust is spread across the peer-to-peer network. However, there is currently an absence of a central authority which authorizes and regulates blockchain. There is also a lack of legislation and no effective regulatory frameworks in place [3, 27]. Blockchain is regulated differently in different parts of the world [3]. Without a globally accepted regulatory framework or legislation, marginalized players in trade, such as women micro-entrepreneurs, could be marginalized even further [3]. An internationally accepted global standard or regulatory framework is required to ensure that this does not happen.

2.3. Blockchain Technology for Empowerment and Development

Research on blockchain is starting to enter the fields of humanitarian action, development aid, and economic and social development [29]. The technology is currently being used in areas of land titling, financial inclusion, sending remittances, providing identity services, improving the transparency of donations, reducing fraud and corruption, transforming governance systems, micro-insurance, micro-loans, cross-border transfers, cash programming, grant management, along with organisational governance [18].

The following table is a collection of projects and companies which are currently using blockchain technology for development:

Table 1. Use cases of blockchain technology for development

Project/Company Name	Use Case
Building Blocks – Piloting blockchain with refugee women in Jordan	The UN Women and the World Food Programme have launched Building Blocks for Syrian refugee women who are seeking asylum in Jordan. Building Blocks is a blockchain application which uses a private, permissioned blockchain, to shift from traditional cash transfers. The application enables them to have an online account without the need for any financial intermediaries [3]. Many refugees struggle with access to finance because they do not have documentation to confirm their identity. The application removes this barrier by allowing women to access their accounts via an eye-scan at supermarkets and receive cash [3, 27].
Spenn	Spenn is a start-up which is reviewing ways to make instant financial transfers through SMS. The company aims to create a service that doesn’t need an internet-backed smartphone. This allows women who live in villages, far from bank branches to have access to finance and purchasing power by allowing them to transact and apply for loans [3].
EtherLoan and WeiFund	EtherLoan and WeiFund are platforms which enables women entrepreneurs to build up creditworthiness. Monetary transactions are recorded in their individual blockchain-based identity. These platforms can help women in developing countries secure loans without having to go through lengthy bank procedures [3].

Buy from Women – A UN blockchain based initiative	Buy from Women aims to provide female farmers in developing countries with important information on the overall size of their cultivable land, production and weather forecasts, and market prices of their products via SMS. This will enable female farmers to connect to global value chains, thus increasing their market access and ability to negotiate better deals. It could enable them to track the journey their produce undertakes before it reaches the final consumer [3].
Alice	Alice creates a series of incentives for social organizations to report on their impact reliably and in a transparent way. It incentivizes social organizations to run projects transparently. Donors can track their donations as well as the performance of each project they donated to. The company aims to restore trust in charities and make it easier to identify and help scale projects [10].
BanQu	BanQu was founded in 2015. The company’s goal is to solve extreme poverty, by providing the poor with a verifiable identity. They believe it will give the poor greater access to participate in the economy and global supply chains, providing them with greater opportunities, thus improving their livelihoods [10].
Building Blocks – Piloting blockchain with refugee women in Jordan	The UN Women and the World Food Programme have launched Building Blocks for Syrian refugee women who are seeking asylum in Jordan. Building Blocks is a blockchain application which uses a private, permissioned blockchain, to shift from traditional cash transfers. The application enables them to have an online account without the need for any financial intermediaries [3]. Many refugees struggle with access to finance because they do not have documentation to confirm their identity. The application removes this barrier by allowing women to access their accounts via an eye-scan at supermarkets and receive cash [3, 27].

2.4. Blockchain Technology for Financial Inclusion

Financial inclusion is a crucial component of women empowerment. Under the UN’s Sustainable Development Goals, increased financial inclusion is a major goal as it increases resilience and captures economic opportunities amongst poorer households and informal economies [21]. Financial inclusion can be viewed as a catalyst to lift women out of poverty by giving them a safe place to save money, build assets, and make their daily lives easier [1]. Financial inclusion is not a means to an end, but it is universally recognized as a critical component to reducing the current high levels of poverty and achieving inclusive and sustainable economic growth.

An inclusive financial system has the possibilities for a greater volume of resources for investment purposes and for the promotion and development of women micro-entrepreneurs [18]. Blockchain technology has the potential to foster greater financial inclusion, encourage economic participation and democratize and decentralize financial services in a new disruptive way.

Blockchain technology can be leveraged to create a more accessible and open financial system. It enables decentralized financial services, which have the potential to broaden financial inclusion, promote permissionless innovation, and create new opportunities for entrepreneurs [6, 24]. It can decrease information asymmetries, increase transparency and reliability in the system. The removal of the need for financial intermediaries significantly reduces costs [17]. Thus, due to these reduced costs, previously excluded participants will now be able to participate.

Blockchain technology can remove the barrier women currently face in the economy, and make foreign trade more inclusive, by including unbanked women in the formal financial system, reducing the credit gap which women micro-entrepreneurs face, enhancing transparency and the decentralized creation of records, and reducing transaction costs and time involved in doing business [3]. There is great potential to increase women’s participation within the economy. Blockchain can help women micro-entrepreneurs overcome the costs associated with exporting and importing, and allow these women to interact easily with consumers, other businesses engaged in the supply chain, customs officers, and regulatory bodies [3, 8]. Blockchain technology allows for the automation of credit checks and verification measures throughout the entire supply chain process, which impacts the costs of the financial sector and the shipping industry.

These reduced costs encourage women micro-entrepreneurs to participate in their economies [3, 28]. Reduced costs across the supply chain and for financial services allows women micro-entrepreneurs gain competitiveness in foreign markets at higher profitability. This can increase their overall market access within the economy.

3. Research Methodology

The aim of the research was to create new, richer interpretations of how blockchain technology can facilitate women empowerment. The study was guided by an interpretivist, inductive approach, focusing on the narratives and interpretations of participants in order to create these new understandings [23]. This study began by analyzing existing literature on blockchain technology for development and the empowerment of women to identify current use cases of blockchain for empowerment and development. The study did not examine the data collected in terms of theory-derived presumptions; theories have thus been developed based on the themes present within the data after it has been analyzed and interpreted. The study did, however, make use of the theoretical framework of affordances to guide the interpretation of the empirical findings.

Qualitative methods were used to collect data through semi-structured interviews in order to learn and report on participants perceptions and emotions of how blockchain technology can facilitate financial inclusion among women micro-entrepreneurs. Thematic analysis using NVivo software was used to analyse the data. The sample comprised of only blockchain professionals, as opposed to women micro-entrepreneurs. This is because these experts understand blockchain and its potential for empowerment. Blockchain companies are likely to facilitate more empowerment impact as they know the capacity of the technology. The participants selected work on solutions that have potential for women empowerment. There was a preference for female participants to gain first-hand perspectives on women empowerment issues. However, due to the limited number of females in the blockchain industry, it was not possible to only have females in the study. Male participants were included in order to bring a different perspective to the study and avoid any biases.

A total of 12 interviews were conducted, of which only 10 interviews were considered to have valuable data. To comply with the ethical considerations of this study, participants were given a code to ensure that they remained anonymous.

4. Data Analysis, Findings and Discussion

The table below presents the participants demographic characteristics.

Table 2. Participant Demographics and Professional Experience

Participant Code	Gender	Professional Position	Professional Experience with Blockchain
F#01	Female	Freelance Blockchain Developer	4 years
F#02	Female	CCO of Blockchain Product Development Company	4 years
F#03	Male	CTO of Blockchain Based Food Supply Chain	2.5 years
F#04	Male	CEO of AI and Blockchain Company	7 years
F#05	Female	CEO of Blockchain Product Development Company	6 years
F#06	Male	CEO of Mobile Payment Company	2 years
F#07	P1: Male, P2: Female	P1: Blockchain Consultant, P2: CEO of micro-finance institutions	P1: Research: 10 years Corporate: 1 year, P2: 0
F#08	Female	COO of Blockchain B2B2C Marketplace	3 years
F#09	Female	Project Manager at Blockchain Product Development Company	Research: 1 year Corporate: 3 months
F#10	Male	Identity Research Engineer	4.5 years

All participants have at least one year of experience with blockchain technologies. Many of the participants have high ranking job roles; and were thus able to provide valuable insights due to their levels of experience and a deeper understanding of blockchain technology.

4.1. Empirical Findings

The findings consist of themes which aid in building further context as well as answering the research questions.

4.1.1. Challenges faced by Women Micro-Entrepreneurs. As identified in the initial literature review, women micro-entrepreneurs face many challenges which offset their economic growth. These being: no proof of record, lack of formal identity, financial exclusion, and limited access to information.

4.1.1.1. No Proof of Record

Currently, many of these women micro-entrepreneurs are not leveraging their existing business data. Without this proof or record, they are unable to prove that they are running sustainable and successful businesses. Thus, they cannot get access to financial services which rely on this proven track record.

4.1.1.2. Lack of Formal Identity

The lack of formal identity was another challenge mentioned in interviews. Participant **F#04** noted that “[*there are still a lot of women who do not have identity and that’s a big challenge, because men don’t really struggle with that problem.*” This lack of identity restricts them from registering their businesses, entering into contracts, opening bank accounts and being able to access financial services [3].

4.1.1.3. Financial Exclusion

The lack of banking history, not having access to financial services and lack of funding can be grouped into one larger theme and described as financial exclusion. Financial exclusion was the most common challenge mentioned amongst the participants. Women micro-entrepreneurs have difficulties accessing traditional financial services; “[*they have no banking history, and they have no access to financial services.*” (**F#03; F#04; F#05**).

4.1.1.4. Limited access to information

Because these women have limited access to information, they are not able to empower themselves with an understanding of how the value chains they are operating within work and do not have the resources to better position themselves for opportunities available, “[*women entrepreneurs don’t necessarily have access to or full understanding of the supply chains.*” (**F#04**). This lack of access to information creates information asymmetries within their value chains [3].

4.1.2. Benefits. The potential benefits for women if they were to adopt blockchain technology are that its accessible and has less barriers to entry than traditional systems. Participants noted that blockchain allows women to grow their businesses, it is censorship resistant, reduces costs, increases credibility, promotes financial inclusions, reduces discrimination, and allows women to create a track record of their operations.

4.1.2.1. Reduced Barriers to Entry

Participants noted that one of the main benefits of blockchain is because within the traditional systems there was a “[*need to be able to lower barriers to entry*” (**F#08**). Unlike traditional financial services and other traditional products, blockchain allows for fewer barriers to entry as there are not as many requirements to participate. Many participants described blockchain based solutions as “[*more accessible*” (**F#01; F#02, F#05, F#08**). And participant **F#10** said that “[*the barriers of entry are lower or almost like non-existent in comparison [to traditional systems]*.” It was also noted that you would not need a bank account of credit history.

4.1.2.2. Business Growth and Job Creation

Another benefit identified was the ability for these women to grow their businesses exponentially. Participant **F#01** noted that “[*data is very empowering*”. Having access to data allows women to leverage this data to make informed business decisions and ultimately grow their businesses, by gaining competitive advantage, allowing them access to markets, and increasing their market share. As these women’s businesses grow; it will lead to job creation. With business growth and increased demand, there will always be a need for more labour as businesses start to expand. As these women’s business start to scale up, there will be “[*job creation*” (**F#08**).

Blockchain can increase women’s access to information, thus improving their bargaining position [3]. The access to information about other contracts will allow these women to better position themselves to “[*negotiate with suppliers as they know the contracts other businesses are getting*” (**F#08**). Decreasing information asymmetries and allowing women access to important information will enable women micro-entrepreneurs to be connected to global value chains, thus increasing their market access and knowledge to be able to negotiate better deals [3, 6].

Blockchain technology “[*helps [women] have access to markets*” (**F#08**). Because blockchain removes barriers to entry and removes the obstacles of cross border purchases and sales, it holds considerable promise to boost women’s participation in international trade [3]. This allows women to access foreign markets. Blockchain also lowers the cost of cross-border payments, which in turn make these markets more accessible to these women [3]. Women can “[*use it as a as a method to make international payments as a way to store money specifically if [they] don’t have access to traditional financial mechanisms*” (**F#05**).

Another way these women can grow their businesses is by increasing their market share.

Participant **F#05** gave an example in the African context. *“Because, if we look at marginalized women in certain sectors, sorry, of certain countries, right. So, you would basically increase the market share of that woman in a country where women are probably not perceived to be valuable in the market space, right? Women don’t have equal and fair opportunities to participate in that specific country. Right. So, the moment you put a platform like ours, you put it on the block, and this woman now has access instead of saying for instance, her country has 10 million people, right, of which her market share is so low or so small, that she can’t really make a better business in that market.*

Now, the moment she goes on to the block, for instance, and it's spread throughout the whole of Africa. Now, she's got a billion population, the size of a market [share] now is about a billion, you know, on a macro scale, but obviously, you segment the market now, maybe her market is now 100 million, as an example, you know, so which is 10 times more than then her country or entire country.

So, then she can then build her business, she can export products to countries where whatever she produces is actually valued, you know, and it's not because she's a woman, not because she's not a woman. You know, it becomes irrelevant, you know, the agenda. Then becomes irrelevant, because now people are not buying from a person anymore, are they buying from a brand.

You know, they're buying a product, you know, from a brand. So, so I think there's a, there's a whole bunch of value.

So, firstly, increase my market [share]. And then also, obviously, by way of increasing the market [share], I would be scaling my business, right so this is an opportunity for them to scale the business and scale themselves out of just being a micro entrepreneur into really starting to set up a proper business at the end of the day. The advantage that you have with a with engaging or subscribing to or joining some sort of blockchain based solution is the cryptocurrency advantage that comes along with that you say, because the moment you do that, you open yourself to the possibilities of not just receiving Fiat payments and pay payments in fiat currency, but also in cryptocurrency”.

4.1.2.3. Cost Reduction

Another significant benefit is the reduction in costs. Traditional services generally have many fees and middleman costs. The removal of the need for financial intermediaries significantly reduces costs [8, 17]. With blockchain *“you don't need to pay ridiculous service fees”, “you don't need to pay all those middleman fees.” (F#01; F#07), “there's fewer intermediaries. Right. And this results in cost savings that are significant that can be passed on to, to the participants, or to the consumers.” (F#03).* Due to these reduced costs, previously excluded participants will now be able to participate [6].

Blockchain also *“reduces the costs of operations” (F#04).* It can also allow these women to *“save on costs for travel, because [you are able to] buy on [your] phone.” (F#08).* These women would generally travel to buy their products.

4.1.2.4. Financial inclusion

The main benefit identified in the analysis, and the main benefit which this study aimed to uncover, is the financial inclusivity of blockchain. This was the most common theme present amongst participants' responses. Participants noted that blockchain enables access to decentralized loan platforms, alternative credit scoring platforms, grant funding, alternative payment, and transaction mechanisms, and has the potential to unlock traditional financial services through digital identities and documented business records.

Participant **F#04** stated that *“being able to give them access to funding”* is the first step towards financial inclusion as it allows women to invest in their businesses.

Participant **F#03** and **F#06** shared similar sentiments of using digital identities as the first step for financial inclusion.

Participant **F#03** shared *“I think I think whenever I look at financial inclusion in the unbanked space, I think that the ideas around this are like, initially, how can you give somebody a means to transact? Right to transact, in a digital manner. And then beyond that, how they do they give them access to a savings product or to loan and so but like, at the core, they need first level to transact, just send and receive.*

So, with blockchain, because the requirements to participate are not as rigid as traditional finance, you can onboard someone with minimal identification, or with alternative identification, right? The infrastructure at least allows for this. Once they've been given an identity, they can then suddenly, instantly receive send and receive value via digital assets. Right. So, this is like the very first step in the financial inclusion. So, I think the fact that you can create the fact that you can create an identity and use that identity to send and receive and have minimal regulatory hurdles. I think those are the building blocks to accelerate financial inclusion. So, once you have identity, and you can send and receive, I think this is like, you know, like you've already done the heavy lifting in terms of financial inclusion, any other product you add on top of that is a bonus.”

Another perspective offered by participant **F#06** was that it *“leaves room for blockchain development, you know, where we will be pushing payments on the block to allow for decentralized finance mechanisms on this on the blockchain, you know, and then from there is, there's a whole bunch of things that that you can do, you know, on the blockchain.*

So firstly, that would be number one, you know, so that everyone in the informal sector, in the SME or micro entrepreneur space can benefit from that.

Because that's the biggest stumbling block. So what I would, what I would do, I would, if I would then like I would push to have my identity digitized, and go to the financial institutions and present this to them as an alternative or if I were the university, I would engage with the financial institutions and open the pathway for informal traders, for SMEs for an identifiable individuals at this stage, to be included through some sort of mechanism of digital identification. So that's, that's One."

Both participant **F#03** and **F#08** emphasized the importance of using business records to enable financial inclusion. "I think blockchain potentially can help to, to, in complementing the digitization of these day-to-day operations of some of these women, which in turn helps to unlock financial services." (**F#03**).

Participant **F#08** explained how it helps to unlock access to insurance policies. "Definitely, definitely. Remember blockchain technology how it started from the word go was because there was a financial crisis. That happened because a small group of people have created a system that only they can control and created barriers to entry for many people making financial services to be exclusive to a certain calibre of people. So, the people that discovered or invented blockchain, [identified] a need a system that will be decentralized, meaning that you won't have somebody controlling the entire supply chain or the entire system.

That's why they have to use it for financial inclusion, because at record keeping you needed to submit it to the banker, you submit to the insurance company." The participant then goes on to discuss a practical example of how this can be done, "for example, when a company wanted us to talk them [about] hair, we had to have insurance because if you want to have products at 200 stores, that product has to be insured, but it could not because insurance companies said that there's no records here that proves that this hair is what you say it is. They asked how do we ensure this thing just based on your word that you say this is what it is? Then again, it was not insurable.

Insurance is a part of financial inclusion. For businesses, you need that insurance. But insurance [companies] don't insure anything that is not documented, they won't even show a car that doesn't have papers. Therefore, they won't ensure any asset that doesn't have papers and a proof of where it came from. If it's a laptop, they want a serial number, they want all those kinds of things that actually prove the existence and the creation of the product itself. So that's [how blockchain will] help them with that, [access to insurance].

So, when it comes to that financial inclusion aspect, being able to prove that you are running a sustainable business [is important]."

4.1.2.5. No Discrimination

It was clear amongst participants responses that women face discrimination when applying for loans or credit. Blockchain is able to reduce these levels of discrimination as the technology allows you to only share certain credentials and "it is kind of like pseudo anonymous to a degree." (**F#01**); "if I just have your wallet address, I can't tell if you're a woman or a man. So, I can't actively discriminate against you." (**F#01**; **F#02**)

4.1.3. Risks. Three risks of using blockchain were identified amongst participants responses. There was a concern that the lack of regulation could pose a risk to already marginalized people [3]. Participants offered different perspectives within their responses. Some participants stated that "the nice thing about blockchain is that it allows for self-regulation" (**F#08**), while others were worried the lack of regulation could pose as a risk, and one participant stated they were unsure of whether it would have any negative effects.

Participant **F#03** and **F#04** felt that the "lack of regulation can put these women at risk". Participant **F#03** stated that "because there is no regulation, it opens things up to counterparty risk, which is the risk that you're like, the other person in a transaction won't fulfill the end of the transaction."

Participant **F#05** stated that they did not know whether this would pose a risk, sharing that they were unsure. "I'm not sure. Possibly" (**F#05**), however, they also mentioned that within the blockchain space, people would not accept a solution which actively discriminates against a certain group of people.

The lack of private key management was the most common risk present within the responses. Blockchain does not have any ways to recover your keys; "if you lose your key. That's it, it's gone." (**F#01**; **F#02**; **F#04**; **F#06**; **F#10**). This is not an ideal situation, especially in the case that this would be their entire investment and poses a great risk. For marginalized people who are already struggling with their finances, these women cannot even afford to lose access to their money with no way of recovering it.

Similarly, as with not being able to afford losing your keys, "these women will not be able to take the hit should the cryptocurrency they are using or invested in had to massively drop." (**F#01**; **F#04**). Thus, the volatility of cryptocurrencies is another major risk; in the case that women should accept cryptocurrency as a payment method or investment opportunity.

Although there are many benefits associated with the use of blockchain technology, the risks of using blockchain cannot be ignored and need to be explored before considering whether to adopt blockchain.

4.1.4. Challenges

Although blockchain technology has been described as disruptive and revolutionary, it is not a panacea to all these ‘women’s problems’ and is not without its limitations. There are several concerns that are important to consider. This theme addresses the challenges which come with the use of blockchain technology.

4.1.4.1. Lack of awareness and understanding

Participants stated that many women micro-entrepreneurs would not even know that blockchain is an option for them. Other participants noted that *“blockchain is a complex technology”* (F#08), and many people do not understand it. This would negatively influence the adoption of a blockchain solution, as without awareness and understanding, one would not know how it could benefit you. The lack of understanding should not be overlooked, as it is important to understand how new technologies can be used, to reduce the risk of more harm being done than good [3, 27].

4.1.4.2. High Costs

The operational costs and cost of adopting a blockchain solution can be extremely high. Majority of participants noted that the high costs was the biggest challenge, especially because these women do not have excess finances available. Many participants stated that *“it needs to be more affordable”* (F#01; F#02; F#09). Participant F#07 and F#08 shared similar sentiments, stating that it will not be a feasible for a single woman micro-entrepreneur to adopt or develop a blockchain solution, as the costs would be far too high. Participant F#07 stated that *“it can be [too] costly”*, while participant F#08 offered a solution to overcoming this problem.

F#08 *“Firstly, blockchain, it works a lot with macro-economics. So, with micro-economics, if I was a small business by myself, I wanted somebody to build me a blockchain solution for myself, it will be too expensive. So, you have to know that before you build a blockchain [solution], you are building it for a community of more than 1000 business users that are going to use it otherwise cannot be an expensive exercise that will not be able to be sustainable.”*

4.1.5. Potential Use Cases for Financial Inclusion

The majority of participants focused on the direct financial aspects. Alternative perspectives included use cases which indirectly focus on financial inclusion, which were using blockchain to digitize business operations, digital identities, create a consistent track record to prove their sustainability and build credibility, proving authenticity and supply chain management.

4.1.5.1. Credit Scoring

Blockchain has the potential to create an effective “credit scoring system” (F#02, F#03, F#05). It can track payment histories [3, 18]. Participant F#02 stated they *“believe credit score systems can be very biased”*, a blockchain enabled solution will provide a transparent way of calculating credit scores.

4.1.5.2. Cryptocurrency

Using cryptocurrency will allow women to participate in foreign trade [3, 17]. Transacting with cryptocurrency gives women access to global markets, because when transacting *“with fiat currency’s, women are restricted to their local markets.”* (F#06). Using cryptocurrencies also *“removes the need for financial intermediaries, which results in savings which are directly felt by the user.”* (F#03)

4.1.5.3. Digital Identity

A blockchain enabled digital identity was a common use case mentioned for financial inclusion. Participant F#09 offered a perspective which ties into some of the previous themes discussed. *“So digital credentialing, I feel like would be a very good alternative because it allows the person to also to provide information they wish to provide. You could exclude your name which may or may not reveal your gender and also your gender but as all of the rest of the information has been verified and backed, then this will not influence and this your application.”*

4.1.5.4. Supply Chain

Using blockchain technology within supply chains was mentioned to indirectly contribute to financial inclusion; as it lowers costs by removing middlemen, having access to information gives women bargaining power, and having a deeper understanding of their supply chains allows them to make informed financial decisions. Blockchain technology allows for the automation of credit checks and verification measures throughout the entire supply chain process, which impacts the costs of the financial sector and the shipping industry. These reduced costs encourage women micro-entrepreneurs to participate in their economies [28]. Reduced costs across the supply chain and for financial services allows women micro-entrepreneurs gain competitiveness in foreign markets at higher profitability.

5. Conclusion

This study was conducted to determine the ways blockchain technology can be leveraged to empower women micro-entrepreneurs through financial inclusion. The study focused on answering the main research question; ‘in what ways does blockchain technology facilitate financial inclusion for women empowerment?’.

It is evident that the way blockchain technology can empower women is manifold. Blockchain is able to assist in overcoming many of the current challenges women micro-entrepreneurs are facing regarding financial inclusion. The findings reveal that blockchain technology both directly and indirectly affords financial inclusion amongst these women. The proposed model below summarises the key findings using an affordance lens.

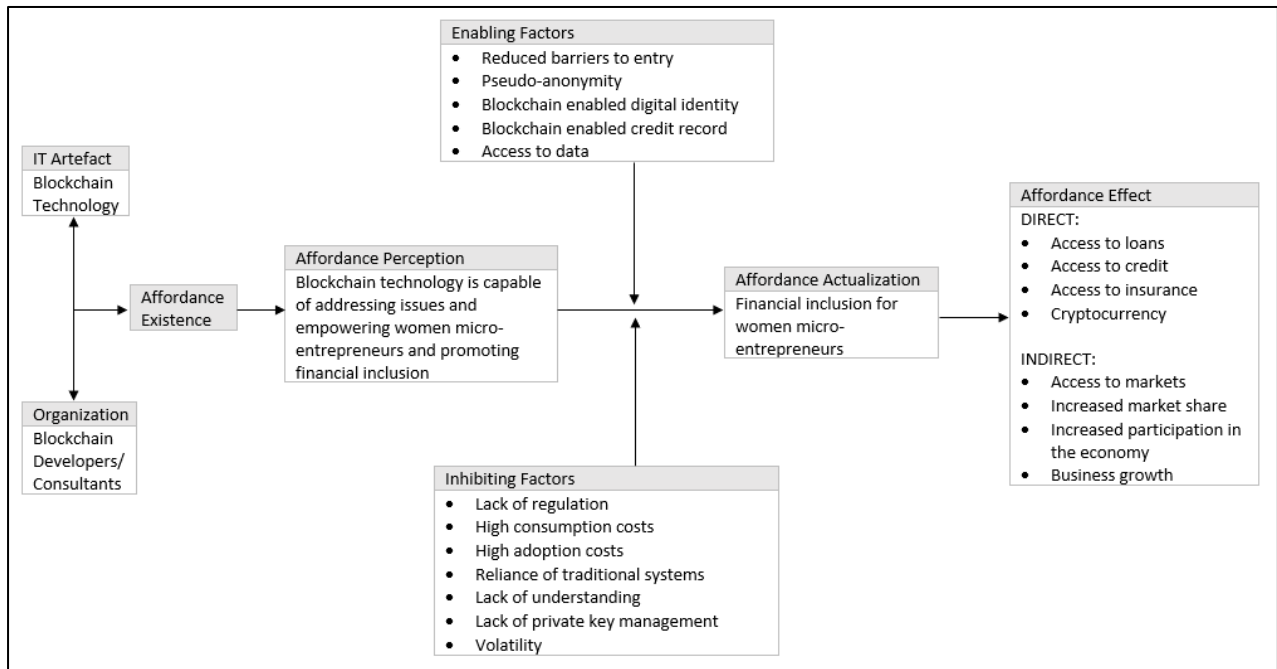


Figure 2. Summary of the key findings using an affordance lens

The use of blockchain technology allows women micro-entrepreneurs to grow their business and affords them the opportunity to access both local and foreign markets, increase their market share and increase their participation within the economy. As their business grows, their revenues will increase, and they will be able to scale their businesses. Being financially included does not only mean having access to financial products and services, but rather being able to financially participate as well. It is, however, important to note that a blockchain solution will not be feasible in the context of a single micro-entrepreneur, and that these women should rather form a network where they will be able to support each other and benefit from economies of scale.

5.1. Limitations

There were certain factors which limited this study, the first one being the limited research on blockchain technology for women empowerment. In certain instances, the paper relied on blog posts to explore how blockchain is currently being used to empower women. However, the researchers ensured that these were from reputable websites and that the author of the blog had knowledge and experience with blockchain technology. Secondly, the most evident limitation was that this study does not have the perspectives of women micro-entrepreneurs. It was, however, decided that the study would have more grounding coming from the organizational context and by analysing the perspectives of blockchain experts who understand the technologies potential.

5.2. Future Research

Considering that this study did not include the perspectives of women micro-entrepreneurs; future research can be conducted which analyses factors which influence adoption amongst these women and aid in the development of an adoption framework. Alternatively, future research can aid in the development of a conceptual model to guide organizations on how to apply strategies in blockchain for women empowerment.

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