BUILDING A COMPUTER TO MINE CRYPTOCURRENCY AS EFFICIENTLY AS POSSIBLE

AN ANALYSIS OF THE ADOPTION OF BITCOIN AS LEGAL TENDER IN EL SALVADOR

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By
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On my honor as a University student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments.

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General Research Problem: Analyzing the Uses of Cryptocurrency Through a Case Study of El Salvador

How, if at all, can a cryptocurrency such as Bitcoin be implemented to improve the financial lives of millions around the world?

With the world's current financial technology, sending money between different countries can be a daunting task. Also, billions of people live without property rights and use currencies that lose a quarter, half, or more of their value each year due to hyperinflation (*Dubrovsky, 2018*). How can cryptocurrency, a new technology, improve people's lives financially where it is implemented, or should it be stayed away from entirely? By looking into how El Salvador has reacted to making Bitcoin their official currency, strides can be made to determine if it is beneficial and practical to experiment with cryptocurrencies in other countries. As for now, the promises of cryptocurrencies are often overshadowed by the crypto community's over-enthusiasm in the technology, so the goal for my STS research is to filter through the extreme proponents and opponents of Bitcoin.

My technical topic covers my journey mining cryptocurrency for the past two years: a process that uses a large amount of energy to secure cryptocurrency networks. This process is a requirement of the current largest cryptocurrency, Bitcoin. It took many months of planning and researching cryptocurrencies and hardware to create a working, efficient, and profitable computer to mine cryptocurrency, so I will use this knowledge to aid in my research on El Salvador. In this paper, I will be discussing Bitcoin's infrastructure in El Salvador and whether or not it has been a successful launch over the past two years.

Building a Computer to Mine Cryptocurrency as Efficiently as Possible

How can a computer be designed to mine cryptocurrency using the least amount of electricity as possible to maximize profits and reduce mining's carbon footprint?

My technical project is about my journey mining cryptocurrencies the past two years. In order for cryptocurrencies to survive, they need to be "mined" through the use of large amounts of computer processing unit (CPU) power. "Mining" in cryptocurrency is a process where computers around the world solve complicated math problems (simplified) to get rewarded cryptocurrency and allow the network to run. Cryptographic coins that function based off of Proof of Work (PoW) specifically require this CPU power to secure their network, so I built a computer specifically meant for mining to contribute my own computing resources to those coins. For the design of this computer I had three goals in mind: to make it as fast, energy efficient, and cheap (for the performance) as possible. This project took weeks of planning, and in the end I decided to build a computer that had eight powerful graphics cards to mine, a very low end processing unit, and an open frame design to allow for easy repairs. The reason I chose a low end processing unit was because it does not do any of the mining. If instead I chose a higher end processing unit, the cost would be higher and it would use more power while idling. There were many times I have needed to fix issues where the open design saved time. For example, one of my power supply units failed, and instead of opening the case, taking out some of the graphics cards, and installing a new one, I was able to swap the power supply without opening the case at all. This is an ongoing project since changes need to be consistently made to improve its efficiency. Overall, the goal is to make the most efficient mining computer possible since cryptocurrency mining alone contributes to about 0.5% of the world's total carbon footprint (*Jones, 2022*). By doing this, it provides both a benefit to the environment and my own profitability. Electricity takes away from roughly 30% of my profits, so my goal is to make it

closer to 10% by stripping away unnecessary components from the computer and in the future relocating to areas with cheaper electricity.

Adoption of Bitcoin as Legal Tender in El Salvador

Has President Bukele's insistence on incorporating Bitcoin into everyday life in El Salvador been accepted by citizens, institutions, and corporations, or does their society seem to be reluctant around using such new technology?

Bitcoin is a new technology (2009) that has many promising uses but also large drawbacks. The non confiscatable nature of Bitcoin allows those with weak or non-existent property rights to be able to own an asset of value without fear of any entity taking it away. It is also resistant to inflation in the same way that gold is since new coins cannot be printed at the government's will like fiat dollars (*Böhme, 2015*). In places like Argentina where hyperinflation is rampant, these properties along with its accessibility are persuading some to store their wealth in it. Like any technology, it does have its drawbacks. Due to its anonymous nature, a criminal's first choice for transferring or laundering money is Bitcoin (*IMF, 2021*). It is also a highly speculative asset as it is in its infancy, so large price swings of 10-30% happen frequently. Could this technology be an effective solution for giving people property rights and an inflation resistant currency despite these drawbacks?

The only full-scale experiment of Bitcoin so far is President Bukele's enthusiastic launch of it in El Salvador. His launch consisted of him giving 30 dollars worth of Bitcoin to every citizen of El Salvador through the Chivo wallet and requiring every company to accept Bitcoin as a form of payment. This paper will attempt to evaluate the success of his plan both through the reception from Salvadorians and its impact on their economy thus far. As a metric to decide this, I think a fair evaluation is that if 10% of citizens use Bitcoin consistently for payments, then it

has been effectively incorporated within El Salvador. 10% is a small number, far from the majority, but would be substantial considering that Bitcoin became legal tender just over a year ago (September of 2021). An example of a payment technology that gets roughly that amount of usage is checks in America. In 2019, 8.3% of all non-cash payments were made with checks. Thus, if Bitcoin's usage in El Salvador matches or exceeds the usage of checks in America by percent, then there is a strong enough infrastructure with enough people using it to consider it "incorporated" in society.

Background

First, what exactly is Bitcoin? Bitcoin is a decentralized currency, meaning that no government, company, or individual has power over the currency like the US government does over the US dollar. This decentralized characteristic defines Bitcoin - no single entity can decide who can own bitcoin, confiscate it from someone, tamper with its protocol, or create more of it (*Nakamoto, 2008*). And all you need to buy bitcoin is a phone connected to a bank account. In many ways it is similar to gold but is a digital version of it, since gold and Bitcoin have inflation-resistant properties and use electricity proportionate to the amount of gold or Bitcoin mined. There is a max supply of 21 million bitcoin, meaning that the rate of inflation (coins added to total supply) has already been calculated for the rest of Bitcoin's history (*Nakamoto, 2008*). This is due to Bitcoin's algorithm that makes it more difficult to get a reward proportionate to the total amount of mining power on the network. When more people turn on more computers to mine, everybody gets slightly less Bitcoin in return. This algorithm is tuned so well that it is known almost exactly how much Bitcoin will be issued for the rest of its history, thus preventing hyperinflation from ever occurring.

This STS research will dive into the effects Bitcoin has had so far on the citizens of El Salvador, both those within major cities and tribes in rural areas, as well as their reception of this new technology.

Literature Review

According to research done by Argente Alvaraz within El Salvador, "less than 60% of [citizens] downloaded Chivo Wallet, and 20% continued to use the app after spending their $30 sign-up bonus. Further, 5% of citizens have paid taxes with bitcoin, and despite its legal tender status, only 20% of firms—mostly large ones—accept bitcoin" (*Alvarez, 2022*). With these stats, it is clear to see that Bitcoin is being used by some people but has not become the "norm" like President Bukele has envisioned (*Daudelin, 2022*). In fact, it seems the majority of people who live in El Salvador as well as the World Bank are against Bitcoin becoming the national currency. In a survey conducted on Salvadorians, 66% were against Bitcoin taking the place of the US dollar as the national currency (*Taylor, 2022*). Nayib Bukele's Bitcoin plan does not seem to be positively viewed by his own citizens but instead by the Bitcoin enthusiasts from outside of El Salvador. The Minister of Tourism of El Salvador, Morena Valdez, stated that due to the excitement around Bitcoin's adoption, tourism in November and December of 2022 increased by 30% *(Helms, 2022)*. But what if Bitcoin suddenly appreciates in value to the extent that President Bukele's plan takes off? Will the current infrastructure in El Salvador promote a healthier economy if that were to happen? A deeper investigation is needed.

Theoretical Framework

No matter what people's opinions are of a technology, the most important metric for its success is how the market receives it. The article, *Evaluating your innovation,* states that "The true test of whether an innovation can become a business success is when a new device, product

or service becomes accepted by the marketplace" (*Queensland, 2021*). All economies work as competitive markets. The technologies, resources, and institutions that provide the most benefits generally come out on top, which is reflected in people's use of those things. Although, because the market can be influenced by monopolies, people in power, and more, it will not be the sole metric of adoption. This research will analyze Bitcoin's success in El Salvador through statistics of its use by citizens and through primary source documents outlining the receptivity of big actors such as companies and government officials. There will also be an aspect of people's attitude towards it, but it is possible for a technology to be disliked by many (even the majority) and still be the best option. Thus, this research will emphasize the market's decision on what currency to use in El Salvador.

Methods: Evidence/Data Collection and Analysis

Government documents, newspapers, surveys, and other primary sources from El Salvador will be used in this research to determine Bitcoin's success. Those sources will be the most important, but studies conducted by other countries will be used as additional references, especially since President Bukele of El Salvador has a strong bias towards Bitcoin that is evident in many government sources (*Daudelin, 2022*). In fact, the entire cryptocurrency sphere is consumed by the excitement that it could provide solutions to many economic issues. The goal is to get a holistic view on how the market of El Salvador, without President Bukele's or the cryptocurrency community's enthusiasm, is genuinely reacting to Bitcoin's implementation. Ways to get a clearer picture are to ensure that not just a certain group of technology-savvy people are using it, research current laws in place, and gather opinions from international institutions such as the International Monetary Fund (IMF).

Conclusion

By analyzing the effects that the first large-scale experiment involving cryptocurrency has on the society of El Salvador, this new technology can be more thoughtfully analyzed to see what place it has in the world. It could be the case that there is no use for it and other forms of money can solve the issues that Bitcoin is attempting to solve. It could also be the case that it is too early to tell, and more innovation needs to happen before Bitcoin can be used. Or maybe Bitcoin, as is, can solve many issues and already has a place in the world. More research needs to be conducted.

As far as the technical research project, the goal is to learn how to contribute to these cryptocurrencies in the most efficient way possible. By reducing the carbon footprint, cryptocurrencies may have a place in a world where climate change is a prominent issue.

Both the STS research and technical project will attempt to analyze what place cryptocurrency has in the world. By understanding how cryptocurrency works in a society through the El Salvador Bitcoin experiment, conclusions can be made on its overall efficacy. By being involved in the mining process of Bitcoin through the technical project, a better understanding of cryptocurrencies' technology will aid in that analysis.

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