SoK : Can NFTs Solve The Economic Problems of Countries with Ancient Heritage? Egypt as a Case Study

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Abstract. The pros & cons of replacing a problematic country fiat currency with a cryptocurrency has been tackled many times before with a lot of existing real-world examples to analyze; the impact of trading cryptocurrencies and the reaction of different governments around the world is not less studied either. In this paper, we do not aim at such straight forward implications of Decentralized Finance; we look from a different angle at NFTs. We believe that NFTs, especially in the MetaVerse evolving age, came as a bless to nations with ancient heritage that attract tourists; a bless that can provide a real lift-up to their economy. A lot of previous studies addressed the economic impact of VR/AR/XR museum tours on Egypt and similar ancient civilization countries especially with COVID-19 travelling restrictions. In this paper we try to study and analyze the merit of adding the NFT component to this recipe; NFTs of museum pieces can be made and sold alone as a source of income, also NFT games can be made based on historical stories or famous characters. Then we analyze in more detail the use of NFTs in the MetaVerse whether by selling country original NFTs on existing MetaVerse like brands do and more important by building MetaVerses of the country ancient ages, historic places, and whatever special GOD gifted places are their like coral reefs in a Red Sea MetaVerse for example. We do not neglect the impact of security risks involved in the MetaVerse world and discuss available solutions solutions, we believe it may add an advantage to governmental made historical MetaVerses to be cryptographically trusted than anonymous ones. This paper aims to promote the discussion on how feasible is these proposed solutions to implement in Egypt and similar countries; we discuss different challenges and design decisions involved in the process like blockchain choice, security risks, auction and pricing mechanisms, and finally to what limit can the proposed uses of NFTs solve the debt problems; is the cost worth the effort?

Keywords: NFT, MetaVerse, Blockchains, tourism economics,

cryptocurrency, security & privacy.

1 Introdution

With the emergence of cryptocurrencies, especially at the prices rise up time of Bitcoin and Ethereum, a lot of developing countries thought that mining crypto can provide them with an economic boost like it enriched some people [1]; many voices inside developing countries see crypto as a gate to escape poverty and connect equally with the developed world [2] and thus encourage governments to do so [3,4,5][1]. As for developed countries the USA, which was the origin of Bitcoin & Ethereum, there are more than 8000 Bitcoin ATM by the end of 2020 [6]; the government of Fort Worth in Texas did started mining recently [7]. Other countries created their own digital currency [8]; from the middle east Tunisia created eDinar, according to [9], Egypt, UAE, and Israel had some thoughts. Then with the popularity of individuals usage of cryptocurrencies, where there are no law regulations along with the anonymity nature of blockchains could hide a lot of money laundering, criminal, or against-government activities, a lot of governments became repulsive and took a defensive position for their fiat currency [10,11,12]. Other countries took a conceptual risk by adopting Bitcoin as their main currency which led to dramatic losses [13,14]. In fact, most of the described experiment failure reasons contradicts with the *Financial Inclusion* incentives described in[2]; dealing with digital wallets is not easier than holding bank accounts, and doesn't necessarily measured by possessing smart phones. All those economic factors on developing countries have been studied extensively in the literature [2,6,15,16]; a side note in [17] about "*currency inconvertibility problems*" between African countries that plagued trading for long times and could be solved by using a cryptocurrency, is worth mentioning. We here clarify that all the above is not the scope of this paper, we avoid those controversy risk and return crypto usages, and concentrate on different {cultural and entertainment} uses of ***NFTs*** that will be detailed in what follows.

Existing governmental and institutional uses of NFTs include holding health or educational records. Ethiopia 5 million child educational NFT records on the Cardano Blockchain is an example [17], [18,19] list different universities and professors in USA, China, and South Korea that use NFTs to

[1] We even believe the electricity needed for crypto mining in Ethiopia may have changed the valuation of different cards in the Game Theory model of the Nile Basin conflict of interests towards GERD at some moments; agriculture water was the most important in (https://www.academia.edu/15471274/A_Game_Theory_Approach_to_Understanding_the_Nile_River_Basin_Conflict) introduction, while electricity is the dominant factor in recent statements (https://twitter.com/FdreService/status/1557674864454078464)

hold students results; the first DeFi MOOC course offered by Berkeley University in Aug 2021 has just offered students success NFT badges [20].

The use of NFTs to collect donations money has been widely adopted by NGOs and universities [21,22,23], and even countries recently [24]. There were some rejecting voices from environmental activists earlier [25] due to the carbon inflation environmental harm from the very high energy consumption in ***Proof of Work (POW)*** blockchains, however this has not become a problem anymore. Lately, a ***Crypto Climate Accord*** has been signed which seeks to decarbonizing the cryptocurrency and blockchain industry and achieve net-zero greenhouse gas emissions by 2040 through different solutions [26]. ***Proof of Stack (POS)*** blockchains with their low energy consumption is the current dominant solution; in 2021 [27] conducted a comperative study of energy consumption between POW blockchains, different POS systems and more. As for now in 3rd quarter of 2022, Cardano[28] and Solana[29] are well known of their low energy consumption, also Ethereum, the first Blockchain to deploy NFTs, will soon (15th Sep) perform ETH 2.0 POS merge phase that is said to consume 99% less energy [30]; a longer list of the 10 most Eco-Friendly blockchains can be found in [31]. So we go forward on our proposed variety of applications, with a clear conscious towards environment and climate change.

Now let us span the NFT well known commercial uses, as the main purpose of this paper is to propose money rewarding solutions especially for Egypt. The *PWC* global entertainment and media outlook 2022-2026 [32] reports a 10.4% increase in 2021 revenue, and expects it to reach US$3tn in 2026; a section was dedicated to NFTs $55bn exchange[2] in 2021 featuring it to put more power in creators hands (what most youth love about the crypto world in general). From Blockchain specific analytical sites, *glassnode* [33] reported a $100m NFT trading in *OpenSea* in just the early days of Aug2021, also the *Axie Infinity* NFT game market cap have risen in July 2021 from $200m to $2bn. As for a celebrity NFT example the Johnny Depp NFT collection "*Never Fear Truth*" selling has made about $300-400K (an average price of 0.8 ETH each) after his famous trial [34].

Musicians, and similarly by football celebrities [35], use NFTs as a form of trading digital copys, posters, or what could be similar to baseball cards; where people, specially youth, naturally buy excessive amounts from those things in cheap to moderate prices. The business nourished at first by those

[2] [18] says that NFTs trading volume in 2021 is only $17 bn, but maybe this because PWC number may include repeated selling as they stated in in their report, also "Non Fungible" recorded a potential decrease in the 2022 NFT quarterly report (https://nonfungible.com/reports/2022/en/q2-quarterly-nft-market-report) mainly due to the noticable fall of crypto prices, we believe this will not destroy our case since we are targeting tourists and Egyptology fans not for FOMO (https://www.spiceworks.com/tech/innovation/guest-article/the-future-of-nfts-is-fomo-the-best-business-model/) ; will be explained in more detail later in the paper

who looks for everything new, for those who are nostalgic about rare old records [36]; and finally as cases mentioned in the same reference because if they didn't do it someone else will. In addition, NFTs have evolved to add more features to attract target customers like adding some bonuses or special rights to their buyers, a *royality* to give the original owner (the celebrity) a ratio of each resell,.....etc. The tactics of sometimes selling and sometimes giving free *air drops* of such NFTs, the feel of fairness, the proof of identity techniques, and more issues are summarized in Vitalik Buterin blog [37] that we will get back to later in the paper.

The popularity and profits from such uses encouraged educational (Yale University in June 2021 [38]) and cultural (Russian museum in July 2021 [39])[3] institutions to gain money through NFTs as a mean of digital copyrights. An NFT of a rare first-edition printed copy of the US Constitution was sold in November 2021 at $43.2m [40]; [41,42] consolidate and discuss different European museums NFT selling experience, while [43] is a webinar debating the subject. To our knowledge, UAE is the pioneer Arab country in the field of NFTs; since the beginning of 2022 museum NFTs have been auctioned [44], and governmental NFTs had been minted by Dubai police department twice [45]; their enthusiasm to Metaverse is no less [46].

In light of the above, we propose in this paper different NFT lines of use for Egypt, mainly in heritage-based projects, that we believe may have a considerable impact on its economy. In fact, if the government didn't do it someone else will[4]; there exists already Egyptian heritage inspired NFT games [47] done by non-Egyptians, even the egyptian women in debt donation NFTs was originally created by Horizon FCB Dubai [23]. We believe it is time due for Egypt to step in this full of magic varieties empowering creators NFT world

[3] The recent Russian Central Bank consultation paper Aug2022 which is described to be a blanket ban (https://www.cbr.ru/Content/Document/File/132241/Consultation_Paper_20012022.pdf) and this doesn't prevent or contradict with the NFTs selling, in fact the same stands for China banning mining & at the same time supporting crypto research and hosting Blockchain conferences. In addition Russia has another problem with most of the crypto community taking the Ukrainian side (https://cointelegraph.com/news/crypto-community-reacts-to-russia-s-war-in-ukraine), collecting donations for them [24], and calling to ban Russian TXs (for further analysis visit https://blog.chainalysis.com/reports/cryptocurrency-liquidity-russia-sanctions/), this naturally is expected to affect the Russian government strategy towards crypto.

[4] The webinar in[43] and the introduction of [41] discusses a real incident of minting and selling public photos from a museum gallery website and different reactions towards that (an ex.:https://mobile.twitter.com/TinaRiversRyan/status/1370533790284722189), a similar different opinions about fashion brands are discussed in a latter reference [58]

and start its own large scale projects; there are eneromus number of ancient pieces, sights, rare coral reefs, and scientifically valuable Egyptology digital images (like mummies CAT scans, and Pyramids inside angles,...) that can be sold as NFTs with different prices according to value. Historical legends and stories from different eras can be used to create tons of games; joining NFTs with Metaverse can reach even more higher domains. If virtual museum tours has gained such satisfaction [48,49,50][5], especially with recent pandemics and other factors that promote remote tourism activities [51,52,53], then different ancient eras and temple Metaverses, red sea navigation between colored fishes and rare coral reefs are expected to gain more for having more user interactivity and role varieties [54]. Hence, such Metaverses can be designed on commercial basis], not just for educational purposes as mentioned in the first few lines in [55][6]. In addition, based on the popularity of Egyptology fans real life activities [56], virtual historical clothes and jewelries from different eras can be traded as NFTs inside different Metaverses in a similar way to brands NFTs within current existing Metaverse projects [57,58,59]. Current economy volume and Future estimates of the Metaverse were discussed thoroughly in the World Economic Forum 2022 [60,61], along the debatable need and different uses of NFTs and Blockchain technology inside it [55,62,63,64]. On 28 June, the European Parliament research service (EPRS) organized a round table discussing "*The Metaverse: a unique opportunity for innovation and growth – or a dangerous 'parallel reality'?"*, a note was released followed by a more recent paper [65]. {could divide the 4 ref, on who discusses the debate, who just discusses the application s}

Naturally, these fancy financially promising projects comes with some design and implementation issues and problematic areas that remains a subject of research; things that must be studied and design decesions, the network and infrastructure needed to implement them should also be studied.{this paragraph need to be re-written and adjusted later}

- ***Network Readiness:***
  For a start let us agree that any investment in enhancing the network and internet infrastructure in Egypt, or any country, will be beneficial for many sectors in the country not just what we propose in this paper; ie, it's always worth it. Articles in [13,14] concludes that network readiness problems was the main failure element for El Salvador Bitcoin adaption, going back to table3 in [15] network readiness in Egypt was scaled to be **38.58%**, while El Salvador's was 37.27%. However, network facilities required in cryptocurrency adoption is not

[5] All are free up till now, unless very few abroad world wide commercial tourism companies (link)

[6] Naturally, we expect similar strategies to be applicable on Greece as mentioned in [49] or any country with ancient civilizations.

necessarily the same as for minting NFTs or implementing games and Metaverses; the target customer here is abroad tourists and thus what we care most about is to cope with the most advanced network speeds and capacities of people with high tech capabilities to spend hours in Metaverse worlds without being bored of low download or having fears of trojan horses attached to the software. Finally like El Salvador minister said in [14], adding a crypto payment option increased their USA tourists by 30% from youth generations who only use crypto money, thus we expect that adding NFTs and Blockchain technology to whatever remote tourism activity the government plans to do, will add a ratio from people who pay online only through crypto wallets.

- *Developers and team qualifications:*
  There are many sites that facilitate minting NFTs without much coding experience, still Egyptology experts and tourism economics experts need to be there to decide what to mint and in what floor price. However, designing NFT games or Metaverses that use NFTs and Blockchain technology does need programming experience; see [66] for an example of developing an NFT game, while [67] is a post graduate students experience in learning the technicalities of minting an NFT. We believe this is not much of a problem, Egypt has a lot of programmers (although don't have a statistic in hand) and moving from regular coding to smart contract coding is quite feasible; regarding virtual tours, the samples in [48,68] are done by Egyptians. In any case, training generations to code smart contracts and design games or Metaverses increases the country human resources. Also, artistic and creativity drawing will be needed to inspire from the history, and Egypt do not lack cartoon designers or applied arts faculties. As for the study in [15], it scaled Egypt ***Human Development Index (HDI)*** as 0.707 and ***Education*** to be 0.618, both in a 0 to1 scale. {probably need to be adjusted with statistics and better flow of thoughts}

- *Blockchain Choice & Design decisions*
  There are a lot of existing Blockchains each with certain features and characteristics, and countries do thorough studies and examine different proposals before they choose to mint on a certain Blockchain; examples from the above are El Salvador choice of Bitcoin, Ethiopia choice of Cardano, and Dubai choice of Ethereum. Factors that affect such choice include transaction fees [67], popularity of the network, energy consumption and eco-friendly, available auction mechanisms and whether it would be possible to divide the NFT ownership into

stakes that could be traded separately[7] to sell the NFTs, security guarantees; also compatibility or interoperability between different Metaverses, liabilities and defining responsibilities in an interactive user empowering environment as Metaverse, were some of the issues pointed out by the EPRS paper [65]. { some things here need to be double checked, and details added: is the auction depends on the site like OpenSea or on the Blockchain, Roblox for example accept NFTs from what networks}

- *NFT Copyrights and IP rights*
  As the NFT community which was initiated mainly by enthusiased youth gradually matures, it started to recognize and define different copyrights for different NFT types; there are edit rights, resell rights, royality rights for original owner resell profit ratio, buyers group mbership rights, and IP copyrights [69]. Buyers also sometimes are confused and sometimes get, or feel, decieved about they actually bought [70,71]. We will get back to that later in section. Thus, government scale projects should make carefully thought choices about each NFT kind they sell and be clear to their customers. For example, one may expect rare heritage NFT photos should have the same rights as pieces sold in international auctions, while memorial moderate to cheap NFTs may be user editable and may contain royality rights and maybe buyers benefits like bonuses or discounts on tours, also Metaverse NFTs could be rentable to be worn in a certain Metaverse world gathering.

- *Security & Privacy, Data Protection*
  It's expected that any virtual or augmented reality application will get some information about its users that will increase with like the dimensions of the room they're in, their figure shape, arm length or strength,...etc all these information are used by the application [72]; naturally a complete Metaverse world with clothes and accessories to be worn will know more about its users [73,74]. For those threats and more many voices claim blockchains are essential to Metaverses; blockchains provide cryptographically secure transactions and authentication [select from the4above]. ***Meta Guard*** is a recently proposed solution [75], where techniques we could relate to differential privacy that protects people privacy when gathering statistics, or to obfuscation that is sometimes used in web browsers [76] or blockchains to hide transactions details or smart contract codes [77],

[7] See (https://youtu.be/8WpIGsmyF2A) for a securitization and repurchase scheme for shared NFTs based on Stakelberg game model, and (https://timroughgarden.github.io/fob21/reports/r2.pdf)for constraints/goals and impossibility results in designing an optimal NFT auction

by mangling different users data so none is revealed, or injecting random data is in each user data; see the original paper [78] for the details and the trade offs. We have to know also that NFT different attacks are still there and have to be dealt with [79].{may adjust after reading the full paper}. In general, users should feel more confident to buy or get into authorities backed NFTs and Metaverses, and thus states are expected to design more robust and cryptographically secure applications. A merit or advantage which could be promoted is that parents should feel more safe for their children to spend time playing and learning history at the same time in governmental backed games and metaverses, with the all going talks about a massive number of risky games and expectedly future metaverses around.

- *Regulations & Liabilities*
  In any case, countries ought to decide on larger scope regulations for NFTs and cryptocurrency trading. In addition the EPRS paper [65] pointed out in its paper to the necessity of defining responsibilities in data sharing between different Metaverses and the challenge of allocating liabilities in an often overlapping roles environment as Metaverses; what the PWC [32] described as "*empowering users*" feature. Meaning that this users attracting feature that gives them the power to be creative and make their own rules, will make it harder for regulators to separate such overlapping roles and define responsibilities when something wrong happens. So, if governments will design their state backed Metaverses, they have to be more cautious in defining user capabilities and constrains inside the Metaverse without being so repulsively constraining them. {Maybe should be written in a better way/words}

- *Analysis of risk & return*
  Many studies and discussions are there in the literature about NFTs risk & return analysis [80,81], and more is expected to evolve about Metaverses. We believe this can't be considered enough to judge the proposed applications; the analysis should be done in a case by case basis, where the people passion about the NFT or Metaverse subject is a correlated variable. The target customers willing to pay amount should be studied with the project cost to determine fees and prices. [82] is an example recent (April 2022) marketing study on metaverse's potential audience focusing on the specific case of museums Metaverses; while [83,84] are less newer studies analyzing the economic potential of virtual tours and other factors during COVID-19, with [84] focusing on Egypt although done in Oman, [85] is a forecasting study using neural networks. {may adjust or add more details after reviewing my read to 68, and checking newer links since

this is SoK paper}

The rest of the paper is organized as follows, section2 gives a preface about NFTs in general what are they, their uses and research areas, section 3 discusses in detail the European Museums selling of NFTs and what kind of NFTs can be sold in Egypt, then section4 touches briefly on possible NFT game and art possible projects. Then section5 gives a necessary preface about Metaverses; existing ones, future possibilities, and also their connection to blockchains and NFTs. Section 6 discusses previous VR/AR/XR experiments and how their results along Egyptology as a science and fans creates a variety of Metaverse projects; we will detail a few proposals. Section 7 presents security risks and design decisions associated with such projects, and section 8 concludes the paper. {section 7 maybe stretched to 2 sections}

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