# When Stablecoin is No Longer Stable - A Case Study on the Failure of TerraUSD

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# When Stablecoin is No Longer Stable - A Case Study on the Failure of TerraUSD

*Short Paper*

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## Abstract

*Comparing to other price-volatile cryptocurrencies, stablecoins provide a reliable way to store value and make transactions, and thus are more suitable for daily-life usage and investment risk control. However, there remains a lack of understanding of how stablecoin can gain success. This may lead to the introduction of stablecoins based on uninformed proposals, which may eventually fail. In turn, owners of these stablecoins may suffer from significant financial losses. Using theories of Information Systems and digital startups failures as the theoretical foundation, our study identified four underlying factors (lack of scarcity, lack of fiat reserve backup, decentralization, and failure of value creation) and two triggers (massive selling by major investors and algorithm malfunction) behind the collapse of a stablecoin, based on the case of TerraUSD's collapse. Our findings provide implications for stablecoins issuers to prioritize maintenance and foster user adoption, thus increasing the likelihood of success of stablecoins.*

**Keywords:** Stablecoins, TerraUSD, Tether, Cryptocurrencies, Failure

## Introduction

Cryptocurrency is a digital currency that uses cryptographic techniques for security and operates on a decentralised system, enabling participation from anyone (Li & Whinston, 2020). The appeal of cryptocurrencies lies in their ability to provide enhanced security, promote financial inclusion, eliminate intermediaries, offer faster transactions, and ensure transparency (Abramova & Böhme, 2016). Despite the potential of cryptocurrencies to revolutionise financial transactions and create an attractive option for those who value privacy, independence, and innovation (Hendershott et al., 2021), the fluctuating nature of cryptocurrency is a major obstacle for many potential users (Gandal et al., 2018). To address this issue, cryptocurrency businesses have introduced stablecoin, a type specifically designed to maintain a stable value, unlike other types known for their volatility. Stablecoins are typically pegged to more stable assets, such as gold or the US dollar and in comparison with traditional volatile cryptocurrencies such as Bitcoin, stablecoins aim to maintain a constant price which makes them more useable for payment, investment hedging, and cross-border transactions (Hsu et al., 2022).

The stablecoin sector has been on a steady rise with a market cap of US$122.17B, accounting for 10.28% of the total cryptocurrency market cap (Coincodex, 2023). And yet, not all stablecoins are guaranteed to achieve success. For example, in May 2022, one of the most promising algorithmic stablecoins, TerraUSD (UST), experienced a significant drop in value. The price plummeted so severely that TerraUSD's value decreased from its nominal value of US$1 to a mere US$0.10. The collapse resulted in the entire Terra ecosystem's (which includes TerraUSD and its sister cryptocurrency LUNA) market capitalisation shrinking by almost US$45 billion in just one week, sending shockwaves throughout the cryptocurrency market and raising concerns about the dependability of stablecoins (CoinDesk, 2022). Previous literature on cryptocurrencies, however, primarily focused on non-stable cryptocurrencies such as Bitcoin and Ethereum. The importance of stablecoins has been recognized, but the critical success factors or failing factors behind their proliferation and value maintenance are relatively unknown. A lack of understanding in this area may lead to uniformed development strategies of stablecoins and possibly unpredicted collapse of stablecoins. This may fail the stablecoin as a hedging of financial inclusion tool. To comprehend stablecoins, we must initially understand the reasons behind their failures. Otherwise, investors may continue to invest in unstable stablecoins, leading to the loss of their investments and the destabilisation of the future of the entire cryptocurrency world.

We started with a case study of TerraUSD, one of the prominent examples of stablecoin failure. Through an analysis of the factors that led to TerraUSD's downfall, we aim to enhance our comprehension of the factors that may drive the collapse of a stablecoin. This knowledge can contribute to the creation of a more reliable and secure digital currency ecosystem that can benefit users globally including investors and non-investor participants. Accordingly, our research question (RQ) for this study is: "What fails a stablecoin?"

# Literature review

## *Cryptocurrency and Stablecoins*

Cryptocurrencies are digital currencies that are operated on a decentralised ledger called a blockchain. Transactions made using cryptocurrencies are anonymous and irreversible, in contrast to traditional payment methods (Tschorsch & Scheuermann, 2016). Many cryptocurrencies have a limited supply, but their prices can be highly volatile (Ali et al., 2014). Additionally, there are risks associated with cryptocurrencies, such as fraud and hacking (Singh & Singh, 2016). In response to the issue of price volatility, some businesses have launched stablecoin, a type of cryptocurrency that pegs its value to the price of another real-world asset. These stablecoins implement stabilisation mechanisms to ensure their price aligns with the value of the underlying asset (Hsu et al., 2022). With prices being non-volatile, stablecoins are more reliable for storing value, carrying out transactions and other daily-life purposes (Baur & Hoang, 2021). Table 1 provides a selection of previous studies that describe key characteristics and benefits of stablecoins and the significant drivers of stablecoin adoption.

As a result of the benefits, stablecoins significantly impact the economies and have become a critical part of the cryptocurrency world. Regarding the proliferation of a cryptocurrency, Narayanan et al. (2016) suggested that cryptocurrency value is driven by the interplay of three factors, including (1) the security of the blockchain, (2) the activities of the members of the overall ecosystem, and (3) the value of the currency. However, their arguments were developed prior to the emergence of stablecoins, and were not supported based on empirical evidence. Li and Au (2022) conducted a case study on EOS[1], a successful volatile cryptocurrency, to identify success factors. However, implications were limited to non-stable cryptocurrencies. Conversely, the development of stablecoins including the factors behind their success and failure remain unclear. This may lead to their uninformed development, and possibly the failure of price maintenance. This would be more disastrous than failures of non-stable cryptocurrencies since stablecoins are used for risk control and value stability. In response to our RQ, we assume stablecoin failures involve failures of Information Systems (stablecoins) or digital startups (issuers), and turn to the literature in this field to build a set of theoretical lenses. Thus, we conduct a case study to explore and identify additional factors associated with the failure of stablecoins. This lens is suitable because stablecoin can be viewed as a digital innovation launched by a startup (i.e., the issuer), which also requires an understanding on the

[1] As indicated by the case study and the cryptocurrency whitepaper, EOS is the full name, but not an abbreviation or acronym, of the cryptocurrency.

factors behind its success and failure. Additionally, the failure of stablecoins can lead to a significant loss of investments, similar to the failure of digital startups.

| Aspects | Arguments |
|---|---|
| **Key Characteristics and Benefits of Stablecoins** | |
| Price Stability | Stable cryptocurrencies sustain parity with stable benchmarks (e.g., fiat, commodities). Pricing established via algorithmic/collateral configurations, the latter comprising fiat, commodities (Mita et al., 2019). |
| Transparency | Many stablecoins strive to be transparent about their operations and backing assets. This allows investors to have greater confidence in the stability and legitimacy of the stablecoin (Ante et al., 2021). |
| Flexibility | Stablecoin issuers can adjust supply in response to demand, offering user flexibility (Arner et al., 2020; Lipton, 2020; Sidorenko, 2020). |
| Accessibility | Stablecoins can be used by anyone with an Internet connection, regardless of their location or financial status (Arner et al., 2020; Lipton, 2020). |
| Supported by Collaterals | Stablecoins maintain price stability through collateral reserves of fiat currencies or cryptocurrencies. This collateralizes value, reliably tying stablecoins to underlying assets. It offers users predictable and trustworthy interactions by reducing volatility via linked reserved values (Liao & Caramichael, 2022; Mita et al., 2019). |
| **Stablecoins' Adoption Drivers** | |
| Efficiency | Stablecoins can be transferred quickly and efficiently, often with lower transaction fees compared to traditional payment methods. This makes stablecoins an attractive option for cross-border payments and remittances (Lipton, 2020). |
| Cost effectiveness | Stablecoins-based transactions are less costly than traditional transaction methods. Such an advantage is especially significant in cross-border transactions (Ante, 2021). |
| Need for Risk Control | Cryptocurrencies are highly volatile in price, which may create significant risks for investors. Conversely, by moving funds to stablecoin, investors may reduce their risk in asset turnover (Sidorenko, 2020). |

**Table 1. Key Characteristics and Adoption Drivers of Stablecoins**

## *Theories on Information Systems (IS) and Digital Startup Failure*

Despite the potential power of Information Systems (IS) and disruptions that can be brought by digital startups, their failures are not uncommon (Eisenmann, 2021; Lucas, 1975). IS failure can lead to lost productivity, decreased revenue, and even legal ramifications if sensitive information is compromised. On the other hand, digital startup failures can lead to significant loss of investments or even the loss of social benefits in the case of failures that involves startups aiming to address social needs (e.g., financial inclusion for FinTech). Table 2 shows a selected list of reasons related to IS and digital startup failures.

As indicated in Table 2, IS failure may result from various factors, such as technical malfunction, inadequate maintenance and support, economic obsolescence, limited capabilities in change management, and a lack of user adoption. In addition, digital startup failures can be attributed to poor financial management, inadequate team or leadership, and technical or operational challenges. The impact of both types of failures is significant and have drawn researchers' attention to identifying how they can be prevented. For example, testing business ideas through crowdfunding or small-scale experiments (Au et al., 2018) can help digital startups collect customer feedback and test market responses before expanding their businesses.

| Failure Reasons | Description |
|---|---|
| **IS Failure** | |
| Technical malfunction | Technical malfunctions can stop the entire IS. It should be addressed by comprehensive analysis, further testing, troubleshooting and pre-malfunction preventive measures (Bartis & Mitev, 2008; Lyytinen & Newman, 2008). |
| Inadequate Maintenance and Support | Neglecting maintenance and support could result in issues like downtime, security breaches, and reduced performance. Prioritizing these aspects is crucial for ensuring smooth operation of information systems and preventing such problems (Limayem et al., 2007; Pitt et al., 1995). |
| Economic obsolescence | Technological advances and market shifts threaten economic viability over time. Assets regularly reassessed and strategies adapted help businesses avoid diminishing usefulness and competitiveness signaling impending failure due to unintended obsolescence (Pearlson et al., 2019). |
| Limited Capabilities in Change Management | To compete, businesses must adapt rapidly. This involves effective change execution, including plan implementation, stakeholder communication, training, and monitoring (Hornstein, 2015). |
| Lack of User Adoption | With numerous of IS solutions available in the market, it can be challenging for IS solution providers to attract and retain users. Failure to attract users can result in wasted resources and lost revenue. To engage more users, IS solution providers can develop targeted marketing campaigns, conduct user training programs, and provide ongoing customer support (Lyytinen, 1988). |
| **Digital Startup Failure** | |
| Poor financial management | Digital startups require significant financial resources to develop and market their products or services. A failure to properly manage cash flow, secure adequate funding, or control expenses can quickly lead to insolvency and business failure (Cantamessa et al., 2018; Yeo, 2002). |
| Inadequate team or leadership | A strong team with the right mix of skills and experience is critical to the success of any startup. Team leaders who are weak in team building or cannot communicate their vision effectively may struggle to attract and retain the talent that they need (Oz & Sosik, 2000; Sherer & Alter, 2004). |
| Technical or operational challenges | Developing a digital product or service can require a high degree of technical expertise. A failure to address technical challenges, scalability issues, or operational inefficiencies can hamper a startup's ability to deliver a quality user experience and, ultimately, lead to customer dissatisfaction and churn (Cantamessa et al., 2018; Salamzadeh & Kesim, 2015). |

**Table 2. Literature related to IS and Digital Startup Failure**

# Methodology

We adopted a case study with netnography for several reasons. First, case research methods are robust at exploring 'what' research questions (Benbasat et al., 1987) and processes inseparable from their contexts (Rynes & Gephart Jr, 2004). Second, given the phenomena of stablecoins is multi-dimensional with both external and technological aspects, it has become too complex to adopt an objective research approach (Gable, 1994). Therefore, a case study approach is more appropriate to examine such phenomena, as it facilitates the interpretation of understanding on different stakeholders (Klein & Myers, 1999). Given the exploratory nature of our study on a less-addressed phenomenon, we deemed a single case research design suitable (Benbasat et al., 1987). Also, netnography is a written account of studying the cultures and communities that emerge from Internet-based communications. The traditions and techniques methodologically inform both the fieldwork and the textual interpretation of cultural anthropology (Kozinets, 2010). It can help discover more profound insights from experiences less addressed in earlier

research (Langer & Beckman, 2005) and may be used with qualitative methods (Kozinets, 2010). As part of our data included Internet users' online activities, netnography would become a suitable option to be included in our method.

In response to our RQ, we treated a failed stablecoin as the unit of analysis and established a few case selection criteria. First, the stablecoin should be well-known for its failure so that we can identify more data and online discussion around the selected stablecoin. Second, the failure of the selected stablecoin should have impacted the cryptocurrency world significantly so that we can identify more diversified implications related to stablecoin failures. Based on these criteria, we selected TerraUSD as our study target. The associated project started in 2018, while TerraUSD quickly emerged to become one of the leading stablecoins in less than two years. And yet, TerraUSD faced several challenges that ultimately led to its failure in May 2022. All these suggested that TerraUSD is a suitable study target. Our study consisted of a preparatory phase and a fieldwork phase. The preparatory phase focused on collecting and analysing data from various secondary sources to gain an overview of TerraUSD, while the currently ongoing fieldwork phase focuses on collecting primary data specific to our RQ and the phenomenon of stablecoin failure.

For data collection, we included online forums and social media (e.g., Reddit, 4chan, Twitter, Telegram, and Facebook) capturing different viewpoints. These sources discuss technical issues/economic implications in real-time, including skeptics and dissents pre-collapse. News reports in our data source covered de-pegging from May 7 2022 onwards. Forums/social media capture public discussions while report timeline institutional perspectives. Sources facilitate analysis triangulation across elite and public narratives. Data analysis is performed concurrently with data collection to take full advantage of the flexibility case research methods afford (Eisenhardt, 1989). A set of aggregate theoretical dimensions and second-order themes (Gioia et al., 2013) were first derived from the existing literature on IS and startup failure to serve as the theoretical lens to guide our data collection. The data collected was then coded using a mix of open, axial, and selective coding (Strauss & Corbin, 1998). More specifically, open coding was used to identify new and validate existing theoretical dimensions (e.g., stablecoin, startup failure), while axial coding was used to identify new and validate existing, second-order themes that fall under those dimensions (e.g., characteristics of stablecoins). Selective coding was then used to distil our case evidence into a number of first-order categories, which were then assigned to the appropriate dimensions and themes (Pan & Tan, 2011). Visual mapping and narrative strategies were also used to help us make sense of the voluminous amount of data collected (Langley, 1999; Myers & Klein, 2011). The former involved documenting, for example, the key milestones and stages of TerraUSD development. Visual maps shown during the data analysis were gradually converted and merged into our model shown in the preliminary findings. The latter, on the other hand, entailed creating a textual summary of the key events, activities, and decisions that led to the failure of TerraUSD. Iterations between data, analysis, and theory development will continue until theoretical saturation is reached (Eisenhardt, 1989).

## Preliminary Findings

Our preliminary findings suggest that the failure of TerraUSD was primarily due to at least four underlying causes, including (1) Lack of scarcity, (2) Lack of fiat reserve backup, (3) Decentralisation, and (4) Failure of value creation. In addition, proximate causes are extreme events that lead to value collapses, such as massive selling by major investors and algorithm malfunctions. Figure 1 shows our theoretical model of stablecoin failures, including the underlying causes and proximate causes.

### *Lack of Scarcity*

The cryptocurrency market has become increasingly competitive in recent years, with thousands of cryptocurrencies failing or vying for attention (Coinopsy, 2022). To gain wider adoption and acceptance, Terra, the issuer of TerraUSD, established the Anchor Protocol, a Decentralised Finance (DeFi) agreement which allows users to borrow and deposit funds in TerraUSD. The protocol offered an attractive interest rate of 19.5% per annum, which, coupled with the appearance of stability, contributed to the growth of TerraUSD in terms of both the number of owners and the amount of issuance. For cryptocurrency owners looking for a safe-haven investment, a stablecoin associated with a stable return could prove alluring (Sidorenko, 2020). However, concerns soon arose about the source of the funds behind TerraUSD's growth. More specifically, Terra had been burning investor funds to support users (Cantamessa et al., 2018; Yeo, 2002) in response to a 50-fold increase in deposits between March 2021 and March 2022 (Komarovsky,

2022). While it indicated the increasing adoption of TerraUSD, such significant growth also means the loss of scarcity of TerraUSD, given Terra had to create more TerraUSD to fulfil its interest-rate promise.

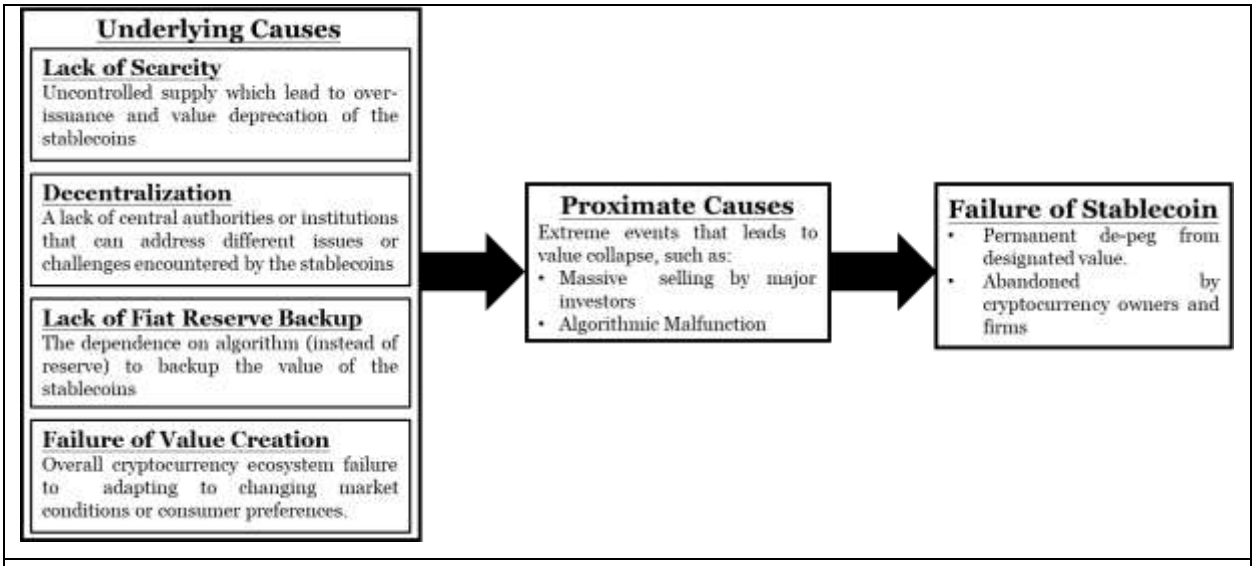


**Figure 1. Underlying Causes and Proximate Causes that Lead to Failures of Stablecoin**

### *Decentralisation*

Unlike collateralised stablecoins that are under the control of a centralised issuing body, TerraUSD lacks central authorities or institutions that can effectively address various issues or challenges. More specifically for TerraUSD, neither Terra nor Anchor Protocol possesses centralised tools, other than capital injections, to help maintain the price or mitigate potential issues in the worst-case scenario (Moin et al., 2020). If there are technical malfunctions, the entire blockchain of TerraUSD could be disrupted, given no developers could solve the problem or control the situation (Limayem et al., 2007; Pitt et al., 1995). Therefore, when news of Anchor's collapse spread, people became panic and withdrew their funds.

### *Lack of Fiat Reserve Backup*

In addition, the value of TerraUSD was controlled by algorithms linked with its sister non-stable cryptocurrency LUNA, but not fully backed up by real-world assets equivalent to the nominal value of TerraUSD circulating in markets. More specifically about the mechanism of the algorithm, when the value of one unit of TerraUSD was temporarily greater than US$1, investors could buy some units of LUNA equivalent to the value of US$1 so that one new unit of TerraUSD could be minted. Vice versa, when the value of a unit of TerraUSD was temporarily lower than US$1, investors could buy a unit of TerraUSD at a discount price in exchange for some units of LUNA equivalent to the value of US$1. When the high interest rate on Anchor Protocol has attracted so many investors, the total amount of fund deposited in the protocol is lower than the nominal total value of TerraUSD circulating in the cryptocurrency world. With roughly four lenders for every borrower (Kelly, 2022), a liquidity crisis emerged (Pearlson et al., 2019). Aware of the crisis, some cryptocurrency experts openly stated their unfavourable views towards the future of TerraUSD. Emma Newbery, a journalist in the cryptocurrency world, stated her view of passing on Anchor's 20% APY.

> *"Anchor isn't generating enough income to pay the 20% rate. It's been eating into its reserves to pay its investors..... The idea is that eventually the Terra ecosystem will grow enough that it can support the high APY. But if not, Terra will continue to burn its reserves and eventually run out of money."*

Being aware of the public concerns, Anchor bolstered market and investor confidence by adding US$450 million to its reserves in February 2022 (Sun, 2022). However, the reserves quickly depleted, causing concern among stakeholders. To stabilise TerraUSD, US$1.5 billion in Bitcoin was purchased for a separate reserve fund (Macheel, 2022).

### *Failure of Value Creation*

The development of a cryptocurrency typically appeals to the establishment of a comprehensive ecosystem with a wide range of potential applications (Li & Au, 2022). Terra also followed this approach, but compared to other cryptocurrencies, the TerraUSD ecosystem (and its non-stablecoin counterpart LUNA) had only a small number of applications that could cater to diverse user needs (such as payment, entertainment and community building, depending on different roles of stakeholders), compared to the ecosystem of other more successful cryptocurrencies, such as EOS and Solana.

Consequently, less users are incentivized to adopt TerraUSD, while the ecosystem could not adapt to evolving external user requirements and market conditions. As a result, there are limited values created for users (Hornstein, 2015) other than the high interest rate, which some cryptocurrency experts nevertheless doubted.

### *Proximate of Failure and Ultimate Fate*

The weaknesses of TerraUSD were observed by some experienced cryptocurrency users or observers, such as Emma Newbery. But the value collapse was not triggered until there were (1) massive selling by major investors and (2) algorithm malfunction. On May 11, 2022, the value of TerraUSD dropped to 30 cents. Within a week, the collapse of TerraUSD and LUNA, wiped out nearly half a trillion USD from the cryptocurrency markets in just one week. In late May 2022, Nansen, a Blockchain analysis firm, issued a research report stating that a few TerraUSD owners sold a massive amount of TerraUSD as they perceived TerraUSD to be too risky.

> *"The de-peg of UST could instead have resulted from the investment decisions of several well-funded entities, e.g., to abide by risk management constraints or alternatively to reduce UST allocations deposited into Anchor in the context of turbulent macroeconomic and market conditions."*

The immediate price drops caused widespread panic (CoinDesk, 2022), which made no investors willing to exercise their right to purchase TerraUSD or LUNA at a discount. As a result, the value-pegging algorithm of USDT could not function (Bartis & Mitev, 2008; Lyytinen & Newman, 2008). Depreciation continued until both cryptocurrencies became valueless.

## Discussion and Concluding Remarks

While our study is still ongoing, we have identified four underlying causes and two proximate causes that can potentially fail a stablecoin. Failures of stablecoin, as well as those of IS and digital startups, may be driven by some common factors, such as technical issues and failure to adapt to changing circumstances. However, scarcity issues, massive selling by major owners, and issues of reserve backup are more unique for stablecoin.

Our subsequent research will extend and validate the process model by collecting and analysing additional data about TerraUSD and possibly other stablecoins. For example, we may compare successful cases (e.g., USDT) with failure cases (e.g., TerraUSD). In addition, future research directions may cover the aspects of users' need and value-pegging algorithms. These works will facilitate the identification on both successful and failure factors behind stablecoins. The boundary conditions and implications of our model will also be explicated through an ongoing literature review and further analyses of our data. By collecting and incorporating further data and subjecting the data to more in-depth analyses, we hope to refine our theoretical model further to build a more holistic understanding of stablecoins and, thus its strategic and organisational implications.

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