Navigating the Landscape: A Taxonomy Approach to Blockchain-based Derivative Protocols

Ricky Lamberty
German University of Digital Science
Robert Bosch GmbH
ricky.lamberty@bosch.com

Ferdinand Mann
Robert Bosch GmbH
ferdinand.mann@bosch.com

Tobias Kölbel
Karlsruhe Institute of Technology
Bosch Corporate Research
tobias.koelbel@kit.edu

Abstract

Blockchain-based derivative protocols have the potential to revolutionize the current risk management landscape. However, despite their increasing adoption, a comprehensive understanding of the dimensions and characteristics of these protocols is still lacking in the literature. To address this research gap, we present an analysis of currently available blockchain-based derivative protocols, focusing specifically on their applicability in corporate commodity risk management. Drawing upon interviews with five professionals from diverse corporations, we identify the requirements of corporate financial asset and commodity risk managers as the basis for our taxonomy development. Leveraging a data set derived from the analysis of 10 distinct blockchain-based derivative protocols through two successive research loops, we provide a structure that enhances our understanding of these protocols. Our taxonomy unveils 5 meta-characteristics, encompassing 21 dimensions and 64 characteristics, offering insights into the nature of blockchain-based derivative protocols.

Keywords: taxonomy, classification, characteristics, derivatives, protocols, commodities, risk management

1. Introduction

Derivatives, as financial contracts and instruments, play a crucial role in modern financial markets. They offer numerous benefits that contribute to efficient risk management, price discovery, and market liquidity (Witzany, 2020). Derivatives serve as valuable tools for investors and corporations, allowing them to minimize and mitigate price risks associated with their purchasing and sales activities. These risk management instruments provide a means to hedge physical exposure and safeguard against adverse price movements (Federal Reserve Bank of Chicago, 2013).

However, within traditional finance, there are systematic challenges for derivatives, including limited access, inefficiency, lack of interoperability and opacity (Harvey et al., 2021). Moreover, there are more phenomena in the specific area of corporate commodity risk management. For example, a lot of banks have canceled their business in the commodity area in the past years (InternationalBanker, 2014; Reuters, 2011). There is only a limited amount of liquidity available and for some commodities like steel, there are limited hedging options available (CME-Group, 2020; Global, 2022). Additionally, the absence of standardized infrastructure and the lack of unified procedures or IT-tools further hinder the seamless execution of derivative trades and disconnect the associated processes within treasury departments, requiring manual effort and increasing operational inefficiencies (Bloomberg, 2022).

To address these challenges, there is a growing interest in decentralized finance (DeFi) and its potential to revolutionize derivative markets through blockchain-based protocols and smart contracts. Nevertheless, there was no systematic characterization and classification of blockchain-based derivatives protocols available at the time of writing. This paper aims to provide valuable insights into the field of blockchain-based derivative protocols by answering the following research questions:

1. What are dimensions and characteristics of blockchain-based derivative protocols?
2. What are the requirements that managers of commodity risks and corporate financial assets impose on these protocols?

By answering these questions, we aim to assist

URI: https://hdl.handle.net/10125/107102
978-0-9981331-7-1
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practitioners in evaluating derivative protocols to effectively hedge corporate commodity risk exposure, bridge the existing knowledge gap by providing a taxonomy for blockchain-based derivative protocols, and foster advancements in risk management practices through a deeper understanding of these protocols.

2. Background

2.1. Decentralized Finance

Decentralized finance (DeFi) leverages blockchain technology and smart contracts to create a transparent, open, and permissionless financial system. It aims to disintermediate traditional intermediaries and transform financial services into decentralized protocols accessible to anyone with internet connection (Harvey et al., 2021).

DeFi protocols enable trustless and automated execution of financial transactions and management of digital assets through decentralized and transparent transaction protocols. Users rely on the underlying code, distributed database, consensus mechanism, and cryptography, eliminating the need for trusted third parties and enabling new ways of organizing economic activities (Schär, 2020).

Tokenization is a key concept in DeFi, converting assets into digital tokens, which in turn eliminates the need for traditional intermediaries like banks (Lamberty et al., 2023). Tokenization represents tangible (e.g., steel) and intangible assets (e.g., emission certificates) on a blockchain through cryptographically secure tokens that link economic value and rights to the underlying asset (Freni et al., 2020; Kölbel, Lamberty, et al., 2022).

2.2. Related Work on Blockchain-based Derivative Protocols

Research and classification efforts have been made in the field of blockchain technology and its applications. These efforts aim to categorize and classify various aspects of DeFi and blockchain protocols. For example, studies have focused on taxonomies of distributed ledger designs, decentralized platform-based business models, blockchain-based development platforms, blockchain configuration and design options (Ballandies et al., 2021; Moormann et al., 2020; Tönnissen et al., 2020; Xu et al., 2017).

Taxonomies and classifications have also been proposed for blockchain platforms and applications, and blockchains in general (Sarkintudu et al., 2020; Wieninger et al., 2019). In the context of asset tokenization, publications have aimed to classify and characterize tokens from academic and regulatory perspectives (Ankenbrand et al., 2020; Freni et al., 2020; Kölbel et al., 2023).

Existing literature provides insights into the diverse dimensions and characteristics of blockchain-based markets and protocols (Kölbel, Dann, et al., 2022; Labazova et al., 2019). However, no framework specifically addresses blockchain-based derivative protocols, particularly from a risk management perspective. This paper aims to bridge this gap by proposing a taxonomy specifically for the derivatives market in the DeFi space, incorporating aspects and expanding previous studies.

3. Method

In our study, we combine qualitative and quantitative research methods to develop the taxonomy. We identified a set of principal requirements for blockchain-based derivative protocols in two steps. In the first step, we conducted five semi-structured interviews according to (Kromrey, 2009). In the second step, we applied qualitative content analysis to the transcripts in order to extract requirements for blockchain-based derivative protocols (Mayring, 2015). These requirements build the basis for the taxonomy development.

The starting point of our taxonomy development process forms the empirical-to-conceptual approach and follows the taxonomy development method of Nickerson et al. (2013). The first empirical-to-conceptual loop involves a sample of seven different blockchain-based derivative protocols. The intermediate result of this loop are seven factsheets, which are an extensive data collection of the characteristics of each protocol. They represent the filtered analysis for common dimensions and their characteristics between the seven blockchain-based derivative protocols. Based on these factsheets a first draft of the extensive taxonomy is created. Since the ending conditions are not met, a second loop with an conceptual-to-empirical approach is executed. The reduced taxonomy is evaluated and checked by three randomly chosen blockchain-based derivative protocols and adjusted accordingly. If the ending conditions are met the final taxonomy is the result of the research process. This approach was chosen to address the multifaceted nature of the subject and to account for the dynamic character of the blockchain-based derivative protocols.

A comprehensive illustration of the complete applied research model and processes is depicted in the following Figure 1.

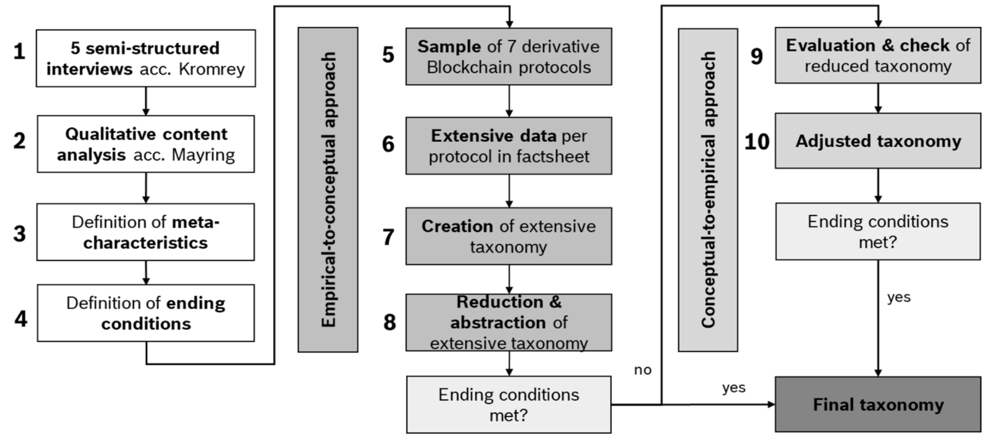

Figure 1. Research model in accordance with Nickerson et al. (2013)

3.1. Development of a Set of Requirements for Blockchain-based Derivative Protocols

The data collection methods consist of two main items which are the semi-structured interviews and the qualitative content analysis. As a first step, we define certain meta-requirements of the taxonomy through semi-structured interviews of five interviewees from a risk management perspective (Kromrey, 2009). For the semi-structured interviews, the qualitative sampling method, *purposive sampling*, is selected.

We filtered the set of potential interviewees by the experiences of corporate commodity risk and asset managers. The variance of the sample is intentionally minimized and focused on interviewees with a similar background and experiences on corporate asset and risk management. This method suits for the aim to investigate with a concentrated focus of a specific group and thereby creates a high equality and similarity in terms of the outcomes of the interviews (Misoch, 2019).

For the transcription of the five semi-structured interviews, we used the simple transcription method (Dresing & Pehl, 2011). The decision was done as the outcomes are expected to deliver hard facts like legal, corporate or practical requirements, expectations and questions of the corporate risk and asset managers (Kromrey, 2009). These requirements are incorporated into the taxonomy. This means, upon identifying "*collaterized assets*" as significant through interviews, the analysis encompassed the corresponding characteristic "*collateralization*", effectively linking the importance of this requirement to the subsequent protocol analysis and taxonomy development.

3.2. Qualitative Content Analysis

We applied a qualitative content structuring analysis (Mayring, 2015). In general, the decision for or against consideration is made under the assumption of the researchers, that the requirement provides a value-add in the taxonomy development of blockchain-based derivative protocols and fits to the intention of creating a general characterization and classification of these protocols. Too specific requirements, such as "German Banking Frame Regulation", are therefore not included in the taxonomy development.

From the interviews we extracted 3 meta-requirements (i.e., corporate, legal, market), with 16 categories (e.g., counterparty, trade-related, reporting, pricing, redemption) and 34 requirements from which 11 have been considered for the taxonomy development. Certain requirements (e.g., reporting, EMIR compliance) are too specific and therefore were excluded due to the defined consideration framework.

3.3. Taxonomy Development

The starting point of our taxonomy development process forms the empirical-to-conceptual approach (Nickerson et al., 2013). The definition of meta-characteristics should be based on the purpose of the taxonomy as well as the expected use of the intended user group. However, the meta-characteristics may not become clear until the taxonomy is partially developed. We defined subjective and objective ending conditions according to Nickerson et al. (2013). The aim of ending conditions is to conclude a taxonomy with dimensions that contain mutually exclusive and collectively exhaustive dimensions and to not stop before this status is reached. The taxonomy development process iterates until the ending conditions are met.

3.3.1. Data Collection per Blockchain-based Derivative Protocol The data collection process was structured to address the challenges arising from the limited presence of white literature in the emerging domain of blockchain-based derivative protocols. Our initial data collection strategy employed a precisely defined set of search queries, including "*blockchain-based derivatives*", "*DLT-based derivatives*" and "*derivative protocols*". These queries were crafted to target academic references offering foundational insights into the subject matter. However, due to the novel and evolving nature of this field, we acknowledge the potential constraints in uncovering traditional academic sources. As such, we intend to account for the short history of blockchain-based derivative protocols, ensure that our study is as comprehensive and up-to-date as possible, and critically assess non-peer-reviewed material and gray literature. Therefore, we only considered publications that explicitly focus on characteristics or design considerations of blockchain-based derivative protocols along our meta-characteristics (Adams et al., 2017).

To overcome these limitations and ensure a thorough analysis, we embraced a multifaceted approach. Our investigation involved a diverse data set comprising 60 sources, encompassing 17 whitepapers and 43 web resources in the field of blockchain-based derivative protocols. This qualitative analysis enabled the identification of common themes, use-cases, designs and novel features intrinsic to derivative protocols that are not yet covered by academic sources and white literature (Adams et al., 2017).

To introduce a layer of objectivity, we incorporated quantitative metrics from reputable crypto information platforms (CoinMarketCap, 2022; DefiPulse, 2022). These platforms supplied quantifiable data, encompassing metrics such as Total Value Locked (TVL), trading volume, and market capitalization. This criterion was chosen under the assumption that a higher TVL within the protocols signifies greater maturity and significance within the DeFi ecosystem. The quantitative facet of our analysis facilitated a comparative evaluation of the protocols' accomplishments and significance within the broader DeFi landscape.

Overall, our investigation encompassed seven blockchain-based derivative protocols which were taken into consideration for the subset, which are listed in the following table:

Table 1. Sample of derivative blockchain protocols and their total value locked for the first loop

Derivative protocols	Total value locked in February 2023
Synthetix	641 million USD
dYdX	389 million USD
UMA	159 million USD
Nexus Mutual	284 million USD
RibbonFinance	90 million USD
Opyn	39 million USD
BarnBridge	35 million USD

For this paper the conceptual reduction approach is applied in the form that in a first step, so-called factsheets are created, which represent an extensive data collection (Bailey, 1984). They represent the filtered analysis for common characteristics and their dimensions between the seven sample derivative blockchain protocols. They contain extensive data about their functionalities and characteristics without a reduction in this step. On the one hand, the corporate requirements of the interviewees were taken into account. On the other hand, the findings from the analysis of all individual protocols in the factsheets were considered. The factsheets are recorded in the form of a simple listing in the following three columns: meta-characteristics, dimensions and characteristics (Nickerson et al., 2013).

3.3.2. Extensive Taxonomy Development The extensive data collection per blockchain-based derivative protocol is used to conceptualize an extensive taxonomy. In particular, the extensive taxonomy is an overview and compilation of all the factsheets collected beforehand. All factsheets serve as the data source per each protocol and form together a first draft for the taxonomy. The taxonomy is an intermediate result of the executed research design (Nickerson et al., 2013).

3.3.3. Reduction and Abstraction of extensive Taxonomy The extensive taxonomy is an intermediate result of the executed research design. The reduced taxonomy is on the one hand the subsequent result of the extensive taxonomy after discarding certain characteristics, sub-dimensions or dimensions, which are not in scope of our consideration framework (e.g., regulatory requirements). On the other hand, it also provides the subsequent result of an abstraction of protocol-specific data to a general, super-ordinate level. It aims to move from a descriptive and identifying level to a more general situated domain level.The targeted outcome is a reduced taxonomy which is then checked for the positive or negative fulfilment of our defined ending conditions (Nickerson et al., 2013).

3.3.4. Check for ending Conditions Since we did not meet the termination conditions during our reduction process, we decided for an additional approach (Nickerson et al., 2013). In our second loop, we decided to employ a conceptual-to-empirical approach, leveraging our acquired knowledge from the initial step. This allowed us to examine additional objects of interest and assess the completeness of our taxonomy. Through this evaluation, we were able to identify any missing or unnecessary elements in the taxonomy and make necessary adjustments to ensure its accuracy and comprehensiveness. Three protocols were randomly selected based on the list of DeFi projects on *DefiPulse* (DefiPulse, 2022). This random selection was deliberately chosen to test the current draft of the taxonomy, as it is assumed that the final taxonomy can fully characterize all protocols:

- Mettalex: Decentralized exchange protocol for commodity derivatives and other financial instruments (Mettalex, 2020)
- TokenSets: Protocol which offers issuance of customizable indexes and baskets (derivatives with multiple underlying assets) (Set, 2022)
- CompliFi: Protocol which offers issuance of derivatives for cryptocurrencies (CompliFi, 2022)

Those protocols have been adduced for the evaluation and validation of the taxonomy. The protocols were reviewed by checking each characteristic of the reduced and abstracted taxonomy, whether the characteristics are already included or missing. In case the characteristic was included, the fit was checked once again for correct description and naming. In case the characteristic was missing the characteristic was added to the taxonomy. The taxonomy was again reviewed for dimensions, which are to be erased or missing. *Mettalex* as the first in the order as well as the *TokenSets* protocol as the second in the order lead to adaptions of the taxonomy. The third reviewed protocol *CompliFi* led to no additional adaptions anymore.

3.3.5. Adjustment of Taxonomy The decision to adapt the taxonomy was driven by several reasons and considerations. First, by conducting the second loop of our research with three randomly selected derivative protocols, we gained valuable insights into their specific characteristics and features. This empirical examination allowed us to identify aspects of the initial taxonomy that needed adjustment or refinement to better capture the nuances and variations within derivative protocols.

Second, through the analysis of these selected protocols, we discovered certain dimensions, dimensions, or characteristics that were not adequately represented or were missing entirely in the original taxonomy. In order to ensure comprehensiveness and accuracy, it was necessary to incorporate these additional elements into the taxonomy.

Furthermore, during the second loop, we also encountered certain dimensions or characteristics that were initially included in the taxonomy but proved to be less relevant or not essential for our research objectives. In the interest of streamlining and focusing the taxonomy on the most relevant aspects of derivative protocols, we decided to remove or exclude these non-essential elements.

Summarized, 8 changes were made after the second loop was conducted with three randomly selected derivative protocols. 3 dimensions (i.e., majority of token ownership, consensus mechanism and code) were erased as they were not deemed decisive. 5 characteristics (i.e., change proposal, solution types, underlying asset scope, usage of native token and rewards) have been added as they were missing and provide decisive factors for characterizing blockchain-based derivative protocols.

Overall, the adaptations made to the taxonomy were driven by the need to enhance its coverage, accuracy, and relevance to the specific domain of blockchain-based derivative protocols. By incorporating new elements and eliminating non-essential aspects, we aimed to create a more targeted taxonomy that effectively captures the meta-characteristics and characteristics of blockchain-based derivative protocols.

4. A Commodity Risk Management Perspective on Blockchain-based Derivative Protocols

This section presents our adjusted and final taxonomy of blockchain-based derivative protocols from a commodity risk management perspective. It also indicates whether a dimension is exclusive (E) or non-exclusive (N) and in which iteration the attributes were added or revised. For exclusive dimensions, exactly one characteristic is observable at a time; for non-exclusive dimensions, multiple characteristics can be observed simultaneously.

Figure 2 illustrates 5 meta-characteristics, 21 sub-dimensions and 64 characteristics. Further dimensions would unnecessarily extend the taxonomy without providing additional information. The following section explains each dimension and characteristic in an comprehensive way.

	Dimension	Characteristic						N/E*
Derivative properties	Underlying asset scope[2,3]	Any asset[2]	Cryptocurrencies[2]	Indexes[2]	Fiat[2]	Commodities[3]	Stocks[3]	N
	Collateralization[1]	Overcollateralized[2]	Fully[2]	Partially[2]	None/Flash[2,3]			E
	Derivative design[2]	Perpetual-like[2]	Future-like[2]	Swap-like[3]	Option-like[2]			N
	Price feed[1]	On-chain[2]	Off-chain[2]					E
	Issuance[2]	Unconditional[2]	Flexible[2]	Conditional[2]				E
	Redemption[2]	Impossible[2]	Conditional[2]	Partially[2]	Fully[2]			E
Governance	Distribution of power[2]	Mainly centralized[2]	Semi decentralized[2]	Mainly decentralized[2]				E
	Change proposal[2]	Conditional[2]	Unconditional[2]	Not possible[3]				E
	Voting[2]	On-chain[2]	Off-chain[2]	None[2]				E
	Delegated Voting[2]	Yes[2]	No[2]					E
Design	Legal structure[1]	Regulated[1]	Unregulated[1]					E
	Value-add scope[2]	Minting[2]	Trading[2]	Yield strategies[2]				N
	Solution types[2,3]	Exposure[2]	Speculation[2]	Protection / Hedging[2]	Arbitrage[3]			N
Native Token	Usage of native token[3]	Yes[3]	No[3]					E
	Usage types[2]	None[2]	Governance exclusive[2]	Multi-functional[2]				E
	Tradability[1,2]	Tradable[2]	Non-tradable[2]	Delegable[3]				N
Incentive	Rewards[2,3]	Governance related[2]	Trading related[2]	Liquidity related[2]	Liquidation related[2]	Other[3]	None[3]	N
	Claims[2]	None[2]	By activity[2]	By activity & demanding[2]				E
	Fees[2]	None[2]	Pro-rata[2]	Fixed[2]				E

*E = Exclusive dimension (one characteristic observable); N = Non-exclusive dimension (More than one characteristic observable)
Dimensions and characteristics added or revised in the following iteration: [1] first, [2] second, [3] third

Figure 2. Taxonomy of blockchain-based derivative protocols

4.1. Dimension: Derivative Properties

Derivative properties categorize the focus and scope of protocol properties based on the outlined dimensions. The **underlying asset scope** classifies the range of underlying assets supported by a protocol.

The *universal issuance of any asset* characteristic allows for the issuance of any type of asset, including traditional financial assets and crypto-based assets. *Cryptocurrency-based derivatives* specialize in derivatives like cryptocurrencies, stablecoins, and tokens. *Index-based derivatives* focus on derivatives based on financial market indices such as S&P 500 or NASDAQ. *Fiat-based derivatives* center on derivatives based on fiat currencies like the US Dollar. *Commodity-based derivatives* are based on physical commodities like gold, oil, or agricultural products. *Stock-based derivatives* are based on individual stocks or equity securities (Joo & Park, 2023; Mudgal, 2018). Many protocols cover multiple asset scopes, making this characteristic non-exclusive.

Collateralization determines the level of assets backing the derivatives issued by the protocol. It can be classified as *overcollateralized*, *fully collateralized*, *partially collateralized*, or *non-collateralized*. Overcollateralized protocols have a collateralization ratio exceeding 100%. Fully collateralized protocols have a collateralization ratio of 100%. Partially collateralized protocols have a collateralization ratio below 100%. Non-collateralized protocols have a collateralization ratio of 0%, making them highly risky (Schaer & Berentsen, 2021; Zhang et al., 2020).

The **derivative design** employed by a protocol is another crucial characteristic. It relates to the similarity of the contracts to certain functional designs, including *perpetuals*, *futures*, *swaps*, and *options*. Perpetual-like derivatives have no fixed ending date and can provide long-term funding and speculation opportunities. Future-like derivatives involve contracts to buy or sell an asset at a future date, similar to standardized futures contracts. Swap-like derivatives enable the exchange of one asset for another, resembling swap contracts. Option-like derivatives grant the holder the right, but not the obligation, to buy or sell an asset at a predetermined price, similar to options contracts. The derivative design impacts the available contracts, potential uses, and benefits for market participants (Ante, 2021).

The **price feed** represents the determination and availability of derivative prices. Price feeds can be *on-chain* or *off-chain*. On-chain price feeds utilize external data sources (oracles) to provide real-time price data, ensuring transparency and reliability but with potential limitations. Off-chain price feeds rely on mechanisms outside the protocol, offering flexibility but introducing uncertainty and potential manipulation (Ezzat et al., 2022).

Derivative issuance refers to the conditions for minting derivatives. It can be *unconditional*, *flexible*, or *conditional*. Unconditional issuance allows anyone to create derivatives without restrictions, providing accessibility and liquidity but increasing risks like over-issuance. Flexible issuance requires adjustable pre-conditions, offering adaptability but adding complexity. Conditional issuance imposes strict pre-conditions, enhancing security and control but limiting availability and usability (Surujnath, 2017).

4.2. Dimension: Governance

The governance dimension of derivative protocols focuses on the frameworks and mechanisms used to govern and manage the operation of the protocol. It includes characteristics related to the distribution of power, change proposal mechanisms, voting systems, and delegated voting.

Distribution of power describes the degree of decentralization within the protocol's governance. It has three characteristics: mainly centralized, semi-decentralized, and mainly decentralized. In a mainly centralized system, control and decision-making primarily rest with a central authority, with little community influence. In a semi-decentralized system, control and decision-making are shared between the community network and a central authority, with some degree of decentralization. In a mainly decentralized system, control and decision-making are predominantly in the hands of the community network, with minimal influence from a central authority (Atici, 2022; Harvey et al., 2021).

The **change proposal** characteristic refers to the conditions for proposing changes to the protocol. It can be classified as unconditional or conditional. In unconditional systems, anyone can propose changes to the protocol without specific conditions. In conditional systems, certain requirements must be met before individuals or entities are allowed to propose changes, such as holding a specific amount of native tokens, having a certain level of reputation, or being a member of the community for a specified period. Some systems may not allow users to create change proposals, relying on a central authority or an inaccessible mechanism for proposing changes (Zamfir, 2017).

The **voting** characteristic determines where the governance process or activity takes place. It has three attributes: on-chain voting, off-chain voting, and no voting. On-chain voting occurs directly on the blockchain, with users casting their votes and recording the results on the blockchain. Off-chain voting takes place outside of the blockchain, utilizing separate platforms such as websites or apps for conducting the vote. Some protocols may not implement community voting at all, with decisions made by developers or a select group of users instead of the community as a whole (Werner & Freudige, 2021).

The **delegated voting** characteristic is a feature found in some blockchain networks that allows users to delegate their voting power to another user based on token holdings. With delegated voting, users can trust another user to vote on their behalf, effectively pooling their voting power and increasing the weight of their collective vote. In contrast, certain blockchain networks do not allow delegated voting, limiting users to voting individually with their own voting power based on token holdings. This can make it challenging for smaller token holders to have a significant impact on network decisions compared to larger token holders, potentially hindering the effective expression of the collective will of the community through voting (Jeong, 2020).

4.3. Dimension: Design

The meta-characteristic **design** dimension encompasses several dimensions that are important to consider when analyzing blockchain-based derivative protocols. The first dimension is the **legal structure** of the protocol, which can be classified as regulated or unregulated. Regulated protocols are operated by registered legal entities and are subject to legal and regulatory requirements, while unregulated protocols are created and operated by individuals or groups without any formal legal entity (Liu, 2021).

The second dimension within the design dimension is the **value-add scope** of the protocol. This refers to the intended usage scope of the protocol and can be categorized into three categories: minting, trading, and yield strategies. Minting protocols enable the creation of new derivatives, trading protocols facilitate the buying and selling of derivatives, and yield strategy protocols aim to generate yield for users by utilizing derivatives.

The third dimension in the design dimension is **solution types**. This characteristic provides information about the possible usage of derivatives on the platform. The taxonomy identifies four solution types: exposure, speculation, protection, and arbitrage. Exposure refers to the ability to gain exposure to assets without physically owning them, speculation involves betting on the future price of underlying assets, protection uses derivatives to hedge against market risks, and arbitrage exploits price differences in multiple markets (Zhang et al., 2020).

4.4. Dimension: Native Token

Moving on to the **native token** dimension, it plays an important role in blockchain-based derivative protocols. The first dimension is the **usage of native token**, which determines whether the protocol has its own native token or utilizes existing tokens. Native tokens can provide various benefits, such as incentivizing users to participate in the ecosystem or perform specific actions on the platform (Schaer & Berentsen, 2021).

The second dimension within the native token dimension is **usage types**, which describes how the native token is used within the protocol. Some protocols use native tokens exclusively for governance-related functions, while others have multi-functional tokens that can be used for various purposes such as transaction fees or staking. There are also protocols that do not have a native token at all.

The third dimension is **tradability**, which indicates whether the native token can be traded or delegated. Tradable tokens can be bought and sold on exchanges and have their own market value, while non-tradable tokens are used only within the protocol for internal purposes. Delegable tokens can be delegated to other users, often for rewards such as earning yields or receiving voting power (Ante, 2021).

4.5. Dimension: Incentive

Lastly, the **incentives** dimension focuses on the incentives provided by the protocol to encourage user participation. The first dimension is **rewards**, which can be governance-related, trading-related, liquidity-related, liquidation-related, or other types of rewards. These rewards incentivize users to engage in specific activities within the protocol (Ebrahimi et al., 2019).

The second dimension is **claims**, which refers to the ability of users to raise claims and receive rewards. Some protocols may not allow users to raise claims, while others provide rewards for rightful claims or specific activities.

The third dimension is **fees**, which can take different forms. Protocols may have no fees, pro-rata fees based on trading volume or impact, or fixed amount fees for specific actions. Designing the right incentives is crucial for attracting users, liquidity, and ensuring the long-term sustainability and growth of the protocol (Schär, 2020).

5. Discussion

The taxonomy developed in this study offers valuable insights for practitioners and researchers in the field of blockchain-based derivative protocols. It fills a research gap by providing a structured framework to understand and analyze the dimensions and characteristics of these protocols, that have been not considered before (e.g., derivative design, redemption, value-add scope). Similarly, we identify governance related, trading related, liquidity related, liquidation related, other and none rewards while alternative classifications report two or three characteristics (i.e., trading related, governance related, none) (Chen & Koo, 2017; Surujnath, 2017).

Among the seven legal requirements gleaned from our comprehensive interviews, we opted to incorporate only the *regulated environment* criterion into our taxonomy development process. This selection arose from the distinctive specificity characterizing the remaining requirements, which would not have lent themselves to a comprehensive categorization (Mayring, 2015). For practitioners, the taxonomy serves as a practical tool for evaluating existing blockchain-based derivative protocols and exploring alternative methods for hedging corporate commodity risk exposure. By diminishing reliance on traditional centralized financial systems, this taxonomy empowers risk managers with a broader array of strategic options (Zhang et al., 2020)).

However, there are certain limitations to acknowledge. The taxonomy does not cover the classification nor design of the underlying blockchain protocol, which can have a significant impact on derivative protocols. Future research could incorporate these aspects to provide a more comprehensive understanding of the ecosystem (Wieninger et al., 2019). Additionally, the sample used for collecting requirements was limited to a specific group of corporate financial asset and commodity risk managers in Germany. This restricts the generalizability of the findings, and future studies should aim for a more diverse and representative sample (Kromrey, 2009).

The taxonomy development method, although following established steps, may introduce subjective biases. To enhance objectivity in future research endeavors, external evaluations and a more extensive analysis of protocols could be incorporated.

6. Conclusion

The present study has successfully developed a taxonomy of blockchain-based derivative protocols, which serves as a valuable contribution to the field. This taxonomy offers a framework that elucidates 5 meta-characteristics, 21 dimensions and 64 characteristics of blockchain-based derivative protocols, addressing the identified research gap in the existing literature. It is noteworthy that the landscape of blockchain-based derivative protocols exhibits a wide range of scopes and functionalities. While cryptocurrencies and yield generating products dominate the market, there is a relatively limited focus on commodities nowadays. Compared to existing taxonomies of general DeFi protocols, the proposed taxonomy provides several distinct advantages. Firstly, it offers a clear and comprehensive structure that facilitates the specific understanding of blockchain-based derivative protocols. This enhances practitioners' ability to design and evaluate new derivative protocols effectively. Furthermore, the taxonomy enables the categorization of currently available blockchain-based derivative protocols, offering valuable insights for corporate financial asset and commodity risk managers. By leveraging this taxonomy, these managers can assess the suitability of different protocols for hedging corporate commodity risk exposure, ultimately improving their risk management practices. In conclusion, this paper's taxonomy of blockchain-based derivative protocols significantly advances the understanding and utilization of these specific protocols.

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