university of groningen / faculty of economics and business

The effect of Twitter's unstructured data on the value of Non-Fungible Tokens

University of Groningen

Faculty of Economics and Business

Department of Marketing

Msc Marketing Analytics & Data Science

Alejandro Villanueva Lledo

a.j.villanueva.lledo@student.rug.nl

S4632613

Supervisor: A.E. Tatar

Abstract

Table of Contents

1. Introduction

Non-fungible tokens (NFTs) are defined as *"cryptographic assets on a blockchain with unique identification codes and metadata that distinguish them from each other"* (Investopedia, 2022). The non-fungibility characteristic of these tokens means that each token is unique and non-interchangeable with one another. For example, in fiduciary currency a 50€ bill has the same value and can be equally exchanged for two 20€ bills plus a 10€ bill or a 1€ coin can be equally exchange for a different 1€ coin and value will remain, on the other hand, NFTs don't have an agreed-upon value, but are instead valued by different unique properties, and one NFT cannot be easily exchanged for another. One of this unique traits comes from NFT's use of blockchain technology to keep a record of ownership, allowing confirmation of origin, custody and history of transfer of different digital, intangible or tangible assets.

In 2017 two Canadian artists created an experimental project named CryptoPunks, an NFT collection on the now famous Ethereum blockchain. The project consisted of 10.000 unique characters, or tokens, inspired by London's punk scene. Not two tokens would be the same and it would be a limited release. Back then all CryptoPunks were free of purchase, with interested parties needing only to pay for the computational power required to create the tokens (gas prices). Since then NFTs trading volume has skyrocketed, going from $100 million in 2020 to $23 billion in 2021, a staggering increase of over 22000%[1] and it's a pace that does not seem to slow down. The NFT platform OpenSea has already reached a trading volume of $5 billion as of January 2022, breaking its previous record of $3.4 billion in August of 2021[2]. Beyond this, companies such as Starbucks, Pepsi or Pringles have announced their plans to drop their own NFTs, and artist like Shawn Mendes, Mila Kunis and Justin Bieber have shown interest in the NFT market, buying and creating projects, highlighting the rise of NFTs in pop-culture. More recently, NFTs have been used to help fund the Ukrainian government on its war against Russia, with anonymous donors gifting valuable NFTs to Ukraine's digital wallet, as simultaneously, Ukraine creates and sells its own NFTs based on a timeline of its conflict with Russia. This shows how different industries, countries and policy makers are increasingly adopting and making use of digital art and blockchain technology.

---

[1] https://www.financialexpress.com/market/nfts-generated-over-23-billion-in-trading-volume-in-2021-amid-craze-for-digital-assets/2390144/

[2] https://hypebeast.com/2022/2/opensea-new-record-nft-sales-january-2022

Giving these assets a layer of ownership and authenticity throughout the use of blockchain technology was necessary with the increasingly digitalisation of art. The value of digital art is often subjective and generally all factors taken into consideration when evaluating physical art can be applied to digital art and NFTs, encompassing factors such as, the creator's personality or reputation, the narrative and the marketing associated with it (Irina Watkins, n.d.; Arnav Kapoor et al., 2022). For example, the value of one of Ukraine's NFTs may come from its authorship, the socio-political context in which it was created and/or its predicted historical relevance.

An earlier study by Arnav Kapoor et al. (2022) takes a more marketing related approach into NFTs, looking at Twitter as a marketing tool that builds public perception and attracts buyers. Considering Twitter as a tool for NFT creators to promote their work, they make use of Twitter and OpenSea quantitative data to measure the possible effect, on NFT value, of variables including number of likes and retweets of the promoting tweet and/or number of followers on the creator's Twitter account. However, to the best of my knowledge there are no studies that examine the possible effect of Twitter's unstructured data on the value of NFTs. This research will expand on the idea of Twitter's effect on the value of NFTs and will focus in including text sentiment analysis and broadening the scope of the study from promotional tweets to include all relevant tweets and their content. Consequently, the research question central to this paper is:

How can Twitter help determine and predict the value of NFT projects using unstructured data?

Therefore, this study builds on previous literature by including non-promotional tweets and by investigating the effect of electronic word-of-mouth (eWOM) in the value of NFTs.
There are many different variables that can have an influence in the value of these digital tokens, variables related to the digital art and the artist, as mentioned before, historical and contextual characteristics of the project, as it is the example with Ukraine's NFTs and marketing factors that affect decision-making. eWOM is an important variable that can affect the value of an NFT. Research shows that people trust seemingly disinterested opinions from people outside their immediate network (Cantallops et al., 2014) and Twitter puts this

information out for everyone almost immediately. This leads to eWOM having a great influence in consumers when choosing products and/or services and, consequently, purchase intention.

Thus, this study aims to understand if the value of auctioned NFTs can be predicted by studying eWOM spread through the microblogging site, Twitter. It is an exploratory research that will use both quantitative and qualitative data. Results could help artists/creators understand the effect of eWOM better and use it as a marketing tool, and investors/collectors can use it to assess potential NFT investments. At the very least this study will help better understand a field that is still scarcely researched.
The data for this research will be mined from Twitter and OpenSea and will include different NFT projects selected at random.

The remainder of this paper will proceed as follows: In section 2 existing literature is discussed and reviewed and hypothesis of relevance to the study are specified. The methodology is presented in section 3.

2. Literature Review

Due to the novelty of the subject literature and research is limited. Much of the existing literature related to NFTs functions as an introduction to the concept of NFT and the link between NFTs, cryptocurrency and the blockchain. Similarly these articles discuss future opportunities and challenges that can be found in the NFT market. Often these opportunities relate to possible applications of NFT technology in the digital world such as the gaming industry or the, increasingly hyped, metaverse (Qin Wang, 2021).

Iryna Watkins (n.d.) explains how through the use of blockchain technology the origin, history of transfer and custody of a digital creation can be easily accessed, giving digital art and creations the property of ownership, authenticity and uniqueness. Simultaneously, the author argues that the same factors taken into consideration when evaluating physical art can be extrapolated to the digital world. This idea is broadly supported by existing literature, Qin

Wang et al (2021) agree on the benefits attached to creators being able prove the existence and ownership of digital assets as one of the most relevant characteristics of NFTs.

Recently, Raeesah Chohan (2021) dived into the future of NFT and how this developing technology creates an opportunity for marketers, giving a framework on how NFTs can be marketed based on the same principles of ownership and uniqueness explained before. The author argues that NFTs may significantly transform marketing functions. Additionally, Raeesah Chonan (2021) creates a comparison between decentralised applications (NFT) and more traditional products and the related marketing implications. When buying or acquiring a product or service, customers consider trust and the risk linked to a purchase (Kim, Ferrin, & Rao, 2008), echoing this Gefen and Pavlou (2012) argue that guarantees by the vendor can influence the perception of the risk taken in the purchase decision. The security inherent in blockchain technology can help reduce the perception of risk due to the upkeep of its transaction and ownership records. The author also uses the concept of scarcity to explain how the digital scarcity of NFTs is an asset to be exploited by marketers under the idea of consumers seeking to gain competitive advantage over others by identifying scarce resources that convey the feelings of distinctiveness and/or uniqueness. Moreover, the main notion of non-fungibility and not being limited by physical distribution are some of the aspects the author considers of relevance when marketing NFTs.

2.1 Twitter

The increasing use of social media marketing is obvious (Lan Jiang & Mehmet Erdem, 2017; Abdullah Alhidari et al., 2015) and a platform that has growingly and consistently been used as a marketing tool is Twitter. In contradiction with some authors that denied the plausibility of Twitter as a marketing tool (Martin Giles, 2010; Dorbian, 2010), Reema Aswani (2018) explains how platforms like twitter are often used by organisations for marketing purposes. Already in 2008 Cooke and Buckley (2008) predicted social media becoming a marketing tactic, and as soon as 2009, 53% of marketers claimed to plan increasing their social media investment further (Davidson, 2009). Authors such as Lan Jiang et al (2017) and Marius Bulearca (2010) support this view of twitter as more than just a microblogging platform, but a new *"path for businesses to attract and retain customers"*. Social media is now considered a

significant part of the marketing mix (Jiang & Erdem, 2017; Withiam, 2010; Palmer & Koenig-Lewis, 2009) and it has opened an opportunity for consumers to offer consumption-related advice to a multitude of people and institutions by means of electronic word-of-mouth (eWOM) (Hennig-Thurau et al., 2015). Research has been made on the effect of number of followers

Considering Twitter as a communication tool that facilitates eWOM (Eunice Kim et al. 2014; Jansen et al., 2009; Zhao and Rosson, 2009), which has been acknowledge as one of the most effective forms of marketing (Jansen et al., 2009) can help shine some light into the relation between the value of NFTs and Twitter as a marketing tool and the development of eWOM.

Furthermore, Thorsten Hennig-Thurau et al. (2015) argue that Twitter eWOM can affect early product adoption and it can be especially relevant on products that depend on a hyped release, which can be the case for auctioned NFTs.

2.2 eWOM

Antoni Serra Cantallops et al (2014) categorise online reviews, recommendations and opinions within the scope of eWOM, similarly, Litvin et al (2008) define eWOM as "*all informal communications directed at consumers through Internet-based technology related to the usage or characteristics of particular goods and services, or their sellers*".

Traditional word-of-mouth (WOM) is an already important factor in consumer's decision-making process and product evaluation (Antoni Serra Cantallops et al., 2014; Sun-Jae Doh et al., 2009; Litvin et al, 2008; Engel et al. 1969; Gilly et al. 1998), a factor that only gains relevance when considering the increase in time spend on social media by consumers (Abdullah Alhidari et al., 2015) and the broader impact-reach and speed-of-interaction of eWOM (Antoni Serra Cantallops et al., 2014; Sun et al., 2006).

The relationship between eWOM and purchase intention has already been established by previous research (King et al., 2014; Park & Kim, 2009). See-To and Ho (2014) agree that eWOM influences online consumer's purchase intention and it impacts other consumers' buying behaviour by creating brand value, moreover, eWOM is more important in persuading consumers to try new products (Alreck and Settle 1995), such as NFTs. This study will follow

on the steps of previously stablished eWOM conceptual background investigating the effect of the direction of a tweet in NFT value. Christin Seifert (2018) carried sentiment analysis of eWOM in social networking sites (SNS) defining SNS users narrative on a brand as positive, negative or neutral, in accordance with literature that established direction of the tweet as whether the information within the tweet is positive, negative or neutral (Lee and Youn, 2009). The valence of eWOM has been proven to have a significant impact on product evaluation and purchase decision (Antoni Serra Cantallops et al, 2014). More specifically in Twitter 20% of tweets mention a specific brand and of these tweets 1 in 5 express negative or positive feelings towards the aforementioned brand (Jensen et al., 2009).

H_1: *Valence of a tweet impacts NFT value*

Additionally, Abdullah Alhidari et al. (2015) hypothesise that due to eWOM generally helping with better informed purchase decisions *"eWOM on SNS will be positively associated with purchase intentions on SNS."*

H_{1a}: *Tweets with a neutral sentiment will have a positive impact on NFT value*

This phenomenon was equally explained by Olson and Mitchell (2000) under the term "brand attitude". In line with studies by Wu and Wang (2011) and Park et al. (2007), they explain that brand attitude is an important predictor of consumer behaviour and a positive brand attitude results in continuous preference from the customer toward that brand and has a positive effect of purchase intention.

H_{1b}: *Positive sentiment towards an NFT project will lead to a higher NFT value*

On the contrary, negative brand attitude has been associated with a negative effect on recommendations to friends (Lee and Youn, 2009), hotel choice (Vermeulen and Seegers, 2009) and lower movie sales (Rui et al., 2013).

H_{1c}: *Negative sentiment towards an NFT project will lead to a lower NFT value*

Additionally, Skowronski and Carlston (1989) find that negative information has a larger impact in customers than positive information. Negative information and WOM is more "attention grabbing" and has a larger influence on brand's perception and purchase intention than positive WOM (Arndt, 1967; Mizerski, 1982; Richins, 1983; Wright, 1974; Brown and Reingen, 1987; Weinberger et al., 1981 ; Homer and Yoon, 1992; Baumeister et al. 2001; Rozin and Royzman, 2001).

H_{1d}: *Negative eWOM will have a larger impact on NFT value than positive eWOM*

NFT, eWOM and Twitter

Existing literature has studied the influence of Twitter on the value of NFTs. Arnav Kapoor et al (2022) analyse Twitter data on users promoting NFT assets through the social media platform. This data consisted of number of likes, retweets and time stamp of the promoting tweet (tweet with a link to an OpenSea project) and number of followers, following, bio and date of account creation of the account linked to the tweet. Similar to Seung-A Annie Jin and Joe Phua (2014), who studied the effect of number of followers on brand-related outcomes and argue that the larger the number of followers on Twitter the greater the social influence, Arnav Kapoor et al. (2022) found a positive correlation between number of followers and NFT value, albeit a week one.

H_2: *Number of followers will have a moderation effect with sentiment analysis on NFT value*

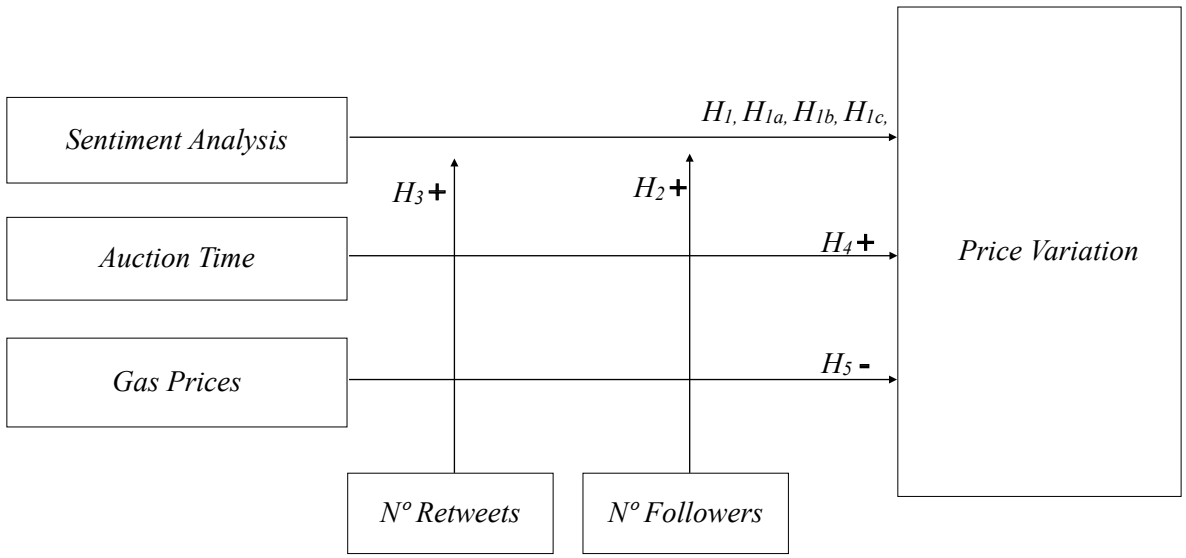
In addition, retweets can be a powerful message reinforcing tool (Cha et al., 2010; Hung and Li, 2007), helping the original tweet reach an even broader audience facilitating the flow of information (Sun et al. 2006). Retweeting can be a medium to validate and engage with others, strengthening the original message and its valence. Already Kapoor et al (2022) found that the number of retweets has an influence in their model output on NFT value.

H_3: *Number of retweets will have a moderation effect with sentiment analysis on NFT value*

2.4 Online auctions

There are two school of thoughts regarding auction duration, one suggest that longer auctions result in more bidders and bids and therefore, higher prices. The opposing view is that shorter auctions might appeal impatient bidders or result in more competitive dynamics. Ernan Haruvy and Peter T. L. Popkowski Leszczyc (2010) conducted comparisons in two different online auction sites and the results showed that auctions conducted in a platform with a higher and more fluctuating number of bidders (eBay) benefit from longer auctions, meanwhile, auction sites with a more steady stream of bidders and fewer auctions benefit from shorter auctions. Due to the volatility of the NFT market and the large number of projects:

H4: *Time given to the auction has a positive effect on price variation*



3. Methodology

This paper proposes to expand on the aforementioned study by Arnav Kapoor et al. (2022) analysing the effect of eWOM on the value of NFTs through the implementation of sentiment analysis, additionally, I aim to analyse twitter KPIs not only as a promotional tool by those creators publicising their NFTs, but as a measure of reach and popularity of accounts that

“specialise” in microblogging about NFTs, as well as, auction related factor, such as, auction duration.

This paper aims to elaborate a predictive model where hypothesis 1 to 1d will follow a qualitative approach and hypothesis 2 to 4 a quantitative approach.

3.1 Data collection

As previously stated this research makes use of both qualitative and quantitative data. Data is scrapped from OpenSea, the largest NFT platform, with over 120 million visits in January 2022 only, and Twitter the top social media network directing traffic to OpenSea with over 64% of Opensea’s social network traffic coming from Twitter alone (similarweb, 2022). Python is used to extract tweets that mention specific NFT projects, and simultaneously is used to extract information on NFT projects from OpenSea.

The projects selected will be randomly pooled from all projects launched during the year 2021 on OpenSea, through this random selection, tweets which have mentioned the projects will be further examined for sentiment analysis.

3.2 Data analysis

This research employs a dataset of tweets and twitter account information and NFT projects. Methodologically, this study relates to the existing literature on unstructured text analysis and text mining methods and will follow a supervised, pre-trained, neural network model based on RoBERTa (Liu et al. 2019) developed by Hartmann et al. (2021) that classifies text sentiment into positive, neutral and negative. This deep learning model takes *“context dependencies of individual text elements into account”* (Hartmann et al., 2021) being able to differentiate similar words through context resulting in high accuracy levels.

Once tweet sentiment and the remaining dependant variables have been extracted a regression model can be used to relate sentiment analysis to the quantitative variables and predict the value of NFTs through moderating effects.

References