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Modeling Supply Chain Firms' Stock Prices in the Fertilizer Industry through Innovative Cryptocurrency Market Big Data

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Abstract: Due to the volatility of the markets and the ongoing crises (COVID-19, the Ukrainian war, etc.), investors are keen to exploit any potential chances to make profits. For this reason, the idea of harvesting data from cryptocurrency market users takes an innovative step. Potential investors in supply chain firms in the fertilizer industry need to know whether the observation of data originating from the cryptocurrency market is capable of explaining their stock price variation. The authors identify the innovative utilization of cryptocurrency markets' user analytical data to model and predict the stock price of supply chain firms in the fertilizer industry stock price. The main aim of this research is to evaluate the contribution of cryptocurrency market big data as a predicting factor for the stock price of fertilizer market firms. Such a finding improves the knowledge and decision-making of potential investors in the fertilizer market. Moreover, this study seeks to highlight the benefits of utilizing cryptocurrency market big data for other financial purposes, apart from stock price prediction. The analytical data was derived from cryptocurrency websites and applications and was then processed through statistical analysis (correlation and linear regressions), Fuzzy Cognitive Maps (FCM), and Hybrid Modeling (HM) modeling. The hybrid model's simulation showed that analytical data from the cryptocurrency markets tend to explain and predict the stock price of supply chain firms in the fertilizer industry. Such data refer to Bitcoin's website organic keywords and traffic costs, as well as paid traffic costs from cryptocurrency trade websites/apps. A rise in Bitcoin and cryptocurrency trade websites' organic and paid traffic costs tend to increase supply chain firms in the fertilizer industry's stock prices, while Bitcoin's website organic keywords variation decreases accordingly.

Keywords: cryptocurrency; blockchain; supply chain; fertilizer market; big data analysis; big data; decentralized finance; innovation; Decision Support Systems (DSS)

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1. Introduction

The fertilizer sector aims to provide sufficient supplies across the world to provide the necessary fertilizer products for the smooth operation of the global market. Such a task requires the utilization of supply chain firms' participation. Their role is critical to the development of modern economies. Supply chain firms seek to exploit any available technologies that would enhance their profitability, such as the increase of their stock price. Towards the satisfaction of the objective of supply chain firms, in the fertilizer industry, the capitalization of various digital innovations would be fruitful. Digital innovations like blockchain technology, applications, and the cryptocurrency market provide sufficient data to assist the aim of supply chain firms in achieving profitability. Thus, big data derived from decentralized finance applications like the cryptocurrency markets could be harvested in favor of enhancing the stock market price of supply chain firms in the fertilizer industry, hence their profitability.

The improvement of supply chain firms in the fertilizer sector through the increase of their stock market price can be impacted by various factors in the global economic landscape. The present paper focuses on the potential utilization of big data extracted from the cryptocurrency market, decentralized finance applications, and blockchain technology to model and predict the trajectory of the stock market price of supply chain firms in the fertilizer sector. More specifically, the study's interest is pointed to the big data from Bitcoin's website and the websites of the most-known cryptocurrency trade platforms/applications. The referred data, including those extracted from the websites of the supply chain films of the fertilizer industry, were compared with the variation of their stock market price, seeking to discern potential factors that are capable of efficiently predicting its course and variation. Such a finding would be of much interest both to fertilizer industry firms and potential investors that are keen on their stock market price.

Many issues arose from the improper use of terms (Peráček 2021), thus the authors opted to provide a clear definition of Bitcoin. Bitcoin (BTC) is a cryptocurrency, or virtual currency, meant to function as money and a means of exchange independent of a single individual, organization, or organization, hence eliminating the need for third-party participation in transactions involving money. It is given to blockchain producers as payment for their efforts in verifying transactions and may be acquired on multiple markets (Frankenfield 2023). The operation of the stock market exchange is a sensitive matter and would require more concise supervision regarding the security of trading (Sidak et al. 2023).

Moving to the paper's following sections, their organization is set as follows: in the Introduction section, a precise reference to the relevant literature to the paper's topic; the Materials and Methods section concerns the research hypotheses that were deployed for the study, as well as the information regarding the sample's data retrieval processes. In the Results section, the utilized methods for producing the required results from the sample's data are presented (linear regression models, Fuzzy Cognitive Mapping, and Hybrid Modeling processes), while in the Discussions and Conclusions section, an extensive analysis of the study's findings are presented based on the Results section. Moreover, in the Conclusions section, the study's limitations are highlighted to provide a deeper understanding of the research's context.

1.1. Supply Chain Firms in the Fertilizer Market and Blockchain Applications

Various initiatives, like innovation advancement, studies, blog monitoring, and advertising, are critical for the expansion of fertilizer and agribusiness supply chain enterprises (Singh et al. 2022). Agribusinesses make contributions to the economy by increasing agricultural productivity, creating jobs, and supplying materials to multiple food supply chain enterprises (Qingxue and Wu 2016). The area set aside for agribusiness is small, but the need for agricultural output is significant. As a result, fulfilling demand with fewer resources is somewhat difficult, as sustainability solutions must be employed to achieve a sustainable future (Cappelli et al. 2022).

Multiple digital innovations across the fertilizer and supply chain context seek to transform the sector and facilitate additional flexibility in manufacturing processes, effective utilization of resources, and procedure optimization from smartphone tracking to the last-end delivery using innovations, such as the assimilation of cyber-physical systems (CPS), IoT, real-time customer engagement, digital applications, etc. (Kaburuan and Jayadi 2019). Therefore, for the fertilizer industry to increase production and sustainability, incorporating data and knowledge has grown increasingly important (Ghorbel et al. 2022). Internet of Things (IoT) innovations (Ketu and Mishra 2022; Frikha et al. 2021) greatly expand the availability and utility of data collecting, storing, interpretation, and usage in the sector.

The usage of blockchain is not just associated with cryptocurrencies, but additionally with other industries that are beginning to engage in specific application scenarios, such as Industry 4.0 and 5.0 (Xu et al. 2021). Leng et al. (2018) proposed a decentralized blockchain-based agricultural supply chain infrastructure. Li et al. (2006) developed an innovative modeling technique for agricultural and fertilizer supply chain firms. As a con-

sequence, they were capable of maximizing output, raising efficiencies, and reducing waste. Surasak et al. (2019) demonstrated a blockchain-based IoT monitoring platform tailored specifically for agricultural goods.

1.2. Cryptocurrency Markets and Decentralized Finance Applications

Decentralized finance, or DeFi, is an economy of financial services developed on a blockchain network (Binance 2023a). The purpose of DeFi should be to develop an alternative financial infrastructure that does not rely on financial institutions or trusted third parties. Cryptocurrencies were founded to decentralize finance, enabling simpler transactions, drastically cutting the duration required to move cash, and lowering processing costs. However, authority can be accumulated in the control of a handful of businesses, even with Bitcoin, if customers opt to employ centralized fiduciary facilities (Kumar et al. 2020).

Much experimental research has been conducted to investigate the possible factors of cryptocurrency values. Such variables are classified in terms of macroeconomic context and societal awareness (Clark et al. 2023). In terms of the macroeconomic landscape, stock market values, currency exchange, asset prices, and fiscal policy volatility have been highlighted as determinants of cryptocurrency pricing and returns. Numerous publications have examined the fiscal capacities of cryptocurrencies, particularly Bitcoin, by investigating their involvement in the market and where they stand in comparison to other commodities (Corbet et al. 2018, 2019).

Cryptocurrency markets are the principal and, in many cases, the only place to buy, sell, and swap cryptocurrencies and coins. Several trades run 24 h a day, seven days a week, with no regional restrictions. Investors from virtually everywhere are allowed to participate in trading with no constraints or limitations. Many markets allow every investor to register and begin exchanging in seconds, unless an authentication procedure is necessary, which can involve anything from a couple of seconds to days (Saleh 2018).

1.3. Innovative Utilization of Big Data Analytics in Modeling Initiatives

Big data has provided fresh options for doing data processing work to enhance decision-making assistance mechanisms (Power 2015). Big databases are becoming more widely accessible as technology progresses in commercial operations. Big Data Analytics can alter enterprises and offer them the knowledge management to adjust to existing prospects and problems (Seles et al. 2018). Physically acquiring, retrieving, and evaluating data would not be necessary anymore (Falahat et al. 2023). This opens the way for utilizing Big Data Analytics in modeling and predicting share prices course.

Big Data Analytics is applying superior analysis techniques, both quantitative and qualitative, to massive amounts of organized and unorganized information. Forecast analytics (Schoenherr and Speier-Pero 2015), digital marketing analytics, big data analytics, and supply chain analytics (Wang et al. 2016) are examples of such research. Forecast analytics, for instance, is a significant element in Supply Chain Management (SCM), in projecting market trends and projected consumption, limiting inventory levels sometimes throughout situations of unexpected demand, such as in the latest years. It may be utilized to uncover SCM's latent capability in terms of necessary competencies (Schoenherr and Speier-Pero 2015).

Apart from the referred application of Big Data Analytics, such tools could be used in producing important financial insights, such as the prediction of stock price variations. These data are capable of providing sufficient information for the development of innovative models to achieve digital marketing efficiency (Sakas et al. 2022b, 2022c). Capitalization of Big Data Analytics, combined with blockchain applications' innovativeness, would be capable of producing the required value of data for potential investors in specific markets. Hence, while building a more universal product that may deliver analytical benefits to even more sectors may be difficult, it is not out of the realm of possibility through the utilization of Big Data Analytics (Mousavian et al. 2023).

1.4. Approach of the Study

Recent studies in the field of cryptocurrency markets and their applications have stated important insights so far. Singh et al. (2022) acknowledged the relevance and implementation of Industry 4.0 innovations for agriculture and fertilizers, including the IOT, cloud services, deep learning, blockchain, and big data, to augment classical procedures of infection diagnosis, fertigation monitoring, fertilizer monitoring, competence recognition, brand management, and supply chain, nutrient retention, and climate regularities during the harvest period. Increasing supply and distribution expenses, post-harvest expenditures, and security and hygiene concerns that characterize supply-chain damages could be mitigated using blockchain both during and following cultivation (Singh et al. 2022).

Ghorbel et al. (2022) concentrated on the application of a smart agricultural foundation controlled by a decentralized mechanism depending on blockchain since it is a novel platform defined by decentralization when employed, credibility, and visibility of exchanges, impossibility, dispersion, perseverance, the confidentiality of all data, and increased confidence. According to Lotfi et al. (2021), the application of Bitcoin's price variations, combined with data-driven and fuzzy approaches, could lead to optimized decision-making.

Marketing knowledge predictive analytics may be employed to forecast and estimate forthcoming merchandise demand (Chase 2015). Predictive analytics is frequently applied to analyze client purchasing behavior as well as give shopping recommendations (Greco and Aiss 2015). Predictive analytics may similarly be used to forecast the leftover lifespan of consumable commodities using sensory systems (Li and Wang 2015).

Economic executives and investors, who are increasingly mindful of cryptocurrency's sustainability challenges, consider the potentially adverse ecological effects of cryptocurrencies whenever trading these monetary products (Clark et al. 2023). Multiple applications and benefits have been analyzed and emerged from the literature. Those applications vary from the air forwarding sector of supply chain firms (Sakas and Giannakopoulos 2021a, 2021b; Sakas et al. 2021) to the connection of centralized and decentralized markets with various crises and phenomena (Sakas et al. 2022a).

2. Results

This section focuses on statistical data analysis, which aims in extracting variables' coefficients by performing linear regression models. Before that, the authors deployed a table with the basic descriptive statistics for all the variables of the study (Table 1). Those descriptive statistics range from the mean to the std. deviation of the study's variables and aim to provide a first glimpse of their metrics. Furthermore, in Table 2, the authors performed a correlation analysis including all of the research's variables, based on Pearson's coefficient (Pearson 1985), to extract the most statistically significant relationships. The analysis of the variables' correlations will assist in the selection of the most suitable independent variables for the explanation of fertilizer firms' stock price variations. The variables with the strongest (in terms of the level of significance) with fertilizer stock prices were the ones tested through linear regression models to evaluate their impact on the stock price's variation.

Moreover, to enhance the robustness of the performed linear regressions, the authors conducted normality tests for the total of the paper's selected variables (Shapiro–Wilk's test), as seen in Table 1. All of the variables were found to follow the Normal distribution: since the significance level of the Shapiro–Wilk's statistic is above a = 0.05, the hypothesis of the normality of the variables' distribution is not rejected. Based on the variables' normality of distribution, strong correlations, and the absence of outliers strengthen the validity and credibility of the linear regression models presented below.

Table 1. Descriptive Statistics of the Bitcoin and the 10 Cryptocurrency Trade websites during six months.

	Mean	Min	Max	Std. Deviation	Shapiro–Wilk's Stat.	Shapiro–Wilk's *p*-Value
Supply chain firms in the fertilizer industry' Stock Price	225.54	212.50	246.16	13.90	0.841	0.100
Bitcoin's Website						
Returning Visitors	1,982,770.00	1,363,880.00	3,247,254.00	636,888.39	0.890	0.274
New Visitors	1,566,656.29	1,085,621.00	2,509,345.00	482,036.36	0.871	0.190
Bounce Rate	0.55	0.53	0.57	0.01	0.831	0.081
Time on Site	299.86	282.00	331.00	16.72	0.916	0.439
Pages per Visitor	2.78	2.46	3.25	0.29	0.819	0.063
Organic Traffic	3,832,765.43	3,526,266.00	3,983,717.00	206,708.62	0.811	0.059
Organic Keywords	74,473.43	63,035.00	93,393.00	12,895.44	0.791	0.053
Organic Traffic Costs	7,287,458.14	6,875,887.00	7,574,003.00	271,622.87	0.845	0.110
Cryptocurrency Trade Websites						
Returning Visitors	333,863,415.43	254,435,739.00	555,273,045.00	101,792,551.24	0.834	0.088
New Visitors	75,225,162.14	56,223,718.00	107,826,945.00	18,344,325.06	0.789	0.052
Bounce Rate	0.41	0.38	0.43	0.01	0.820	0.064
Time on Site	1216.83	1086.00	1500.00	134.98	0.803	0.054
Pages per Visitor	5.50	4.56	7.15	0.82	0.846	0.112
Organic Traffic	22,665,098.00	13,824,963.00	29,528,282.00	6,500,770.04	0.877	0.212
Organic Keywords	1,219,129.57	1,166,843.00	1,268,663.00	38,133.08	0.913	0.417
Organic Traffic Costs	70,830,270.29	29,396,438.00	116,619,096.00	40,358,541.96	0.824	0.055
Paid Traffic	1,058,112.00	470,763.00	1,559,607.00	447,348.61	0.889	0.270
Paid Keywords	7794.14	4911.00	10,815.00	2210.65	0.935	0.595
Paid Traffic Costs	4,964,784.29	1,565,180.00	9,003,356.00	2,927,311.50	0.928	0.531

N = 180 observation days for the Bitcoin and the 10 Cryptocurrency Trade websites.

Table 2. Correlation analysis matrix.

	Fertilizer Stock Price	Btc Return Visitors	Btc New Visitors	Btc Bounce Rate	Btc Time on Site	Btc Pages per Visitor	Btc Organic Traffic	Btc Organic Key-words	Btc Organic Traffic Costs	Trade Return Visitors	Trade New Visitors	Trade Bounce Rate	Trade Time on Site	Trade Pages per Visitor	Trade Organic Traffic	Trade Organic Key-words	Trade Organic Traffic Costs	Trade Paid Traffic	Trade Paid Key-words	Trade Paid Traffic Costs
Fertilizer Stock Price	1	−0.174	−0.127	0.445	−0.461	−0.590	0.403	−0.620	0.376	−0.362	0.038	0.080	0.559	0.495	0.839 *	0.060	0.947 **	0.842 *	0.801 *	0.925 **
Btc Return Visitors	−0.174	1	0.997 **	−0.878 **	−0.058	0.557	0.602	0.642	0.568	0.909 **	0.909 **	−0.969 **	0.321	0.022	−0.529	0.484	−0.268	−0.516	−0.422	−0.399
Btc New Visitors	−0.127	0.997 **	1	−0.863 *	−0.114	0.538	0.648	0.620	0.603	0.897 **	0.915 **	−0.964 **	0.340	0.029	−0.491	0.504	−0.217	−0.481	−0.398	−0.361
Btc Bounce Rate	0.445	−0.878 **	−0.863 *	1	0.019	−0.868 *	−0.545	−0.916 **	−0.578	−0.804 *	−0.607	0.754	0.142	0.425	0.811 *	−0.640	0.572	0.813 *	0.715	0.704
Btc Time on Site	−0.461	−0.058	−0.114	0.019	1	−0.130	−0.716	−0.079	−0.688	0.098	−0.074	0.013	−0.160	0.006	−0.149	−0.574	−0.373	−0.130	−0.005	−0.237
Btc Pages per Visitor	−0.590	0.557	0.538	−0.868 *	−0.130	1	0.404	0.989 **	0.491	0.558	0.211	−0.377	−0.529	−0.712	−0.915 **	0.740	−0.749	−0.916 **	−0.902 **	−0.819 *
Btc Organic Traffic	0.403	0.602	0.648	−0.545	−0.716	0.404	1	0.398	0.968 **	0.360	0.496	−0.512	0.209	−0.147	−0.082	0.772 *	0.275	−0.107	−0.113	0.054
Btc Organic Keywords	−0.620	0.642	0.620	−0.916 **	−0.079	0.989 **	0.398	1	0.476	0.628	0.307	−0.480	−0.438	−0.637	−0.940 **	0.683	−0.766 *	−0.942 **	−0.892 **	−0.850 *
Btc Organic Traffic Costs	0.376	0.568	0.603	−0.578	−0.688	0.491	0.968 **	0.476	1	0.306	0.410	−0.476	0.134	−0.203	−0.159	0.831 *	0.190	−0.175	−0.148	0.005
Trade Return Visitors	−0.362	0.909 **	0.897 **	−0.804 *	0.098	0.558	0.360	0.628	0.306	1	0.867 *	−0.876 **	0.181	−,006	−0.604	0.434	−0.446	−0.564	−0.581	−0.469
Trade New Visitors	0.038	0.909 **	0.915 **	−0.607	−0.074	0.211	0.496	0.307	0.410	0.867 *	1	−0.963 **	0.628	0.396	−0.229	0.278	−0.017	−0.196	−0.154	−0.093
Trade Bounce Rate	0.080	−0.969 **	−0.964 **	0.754	0.013	−0.377	−0.512	−0.480	−0.476	−0.876 **	−0.963 **	1	−0.521	−0.259	0.397	−0.333	0.165	0.372	0.256	0.261
Trade Time on Site	0.559	0.321	0.340	0.142	−0.160	−0.529	0.209	−0.438	0.134	0.181	0.628	−0.521	1	0.921	0.481	−0.252	0.577	0.508	0.596	0.549
Trade Pages per Visitor	0.495	0.022	0.029	0.425	0.006	−0.712	−0.147	−0.637	−0.203	−0.006	0.396	−0.259	0.921 **	1	0.578	−0.478	0.534	0.624	0.664	0.622
Trade Organic Traffic	0.839 *	−0.529	−0.491	0.811 *	−0.149	−0.915 **	−0.082	−0.940 **	−0.159	−0.604	−0.229	0.397	0.481	0.578	1	−0.435	0.932 **	0.994 **	0.937 **	0.958 **
Trade Organic Keywords	0.060	0.484	0.504	−0.640	−0.574	0.740	0.772 *	0.683	0.831 *	0.434	0.278	−0.333	−0.252	−0.478	−0.435	1	−0.179	−0.420	−0.535	−0.232
Trade Organic Traffic Costs	0.947 **	−0.268	−0.217	0.572	−0.373	−0.749	0.275	−0.766 *	0.190	−0.446	−0.017	0.165	0.577	0.534	0.932 **	−0.179	1	0.915 **	0.885 **	0.934 **
Trade Paid Traffic	0.842 *	−0.516	−0.481	0.813 *	−0.130	−0.916 **	−0.107	−0.942 **	−0.175	−0.564	−0.196	0.372	0.508	0.624	0.994 **	−0.420	0.915 **	1	0.928 **	0.975 **
Trade Paid Keywords	0.801 *	−0.422	−0.398	0.715	−0.005	−0.902 **	−0.113	−0.892 **	−0.148	−0.581	−0.154	0.256	0.596	0.664	0.937 **	−0.535	0.885 **	0.928 **	1	0.891 **
Trade Paid Traffic Costs	0.925 **	−0.399	−0.361	0.704	−0.237	−0.819 *	0.054	−0.850 *	0.005	−0.469	−0.093	0.261	0.549	0.622	0.958 **	−0.232	0.934 **	0.975 **	0.891 **	1

* and ** indicate statistical significance at the 95% and 99% levels, accordingly. Btc and Trade refer to Bitcoin's and Cryptocurrency Trade websites accordingly.

In Tables 3 and 4, we can discern the outcomes of the linear regressions of supply chain firms in the fertilizer industry's stock price, as a dependent variable, and the rest of the variables as an independent. At first, the linear regression of supply chain firms in the fertilizer industry' stock price with Bitcoin website users' metrics does not appear to be significant since its p-value = 0.762 is above the level of significance (a = 0.05), despite its high R^2 = 0.736 (Table 3). In Table 4, where the regression of cryptocurrency trade websites users' metrics is the independent variable, no significance arises for supply chain firms in the fertilizer industry's stock price. This occurs due to the regression's high p-value = 0.772 > a = 0.05 level of significance. In the deployed linear regressions (Tables 3 and 4), the low R^2 values (<75%) indicate that the independent variables do not explain an efficient amount of the stock price's variation, thus normality and credibility issues arise for the performed regressions.

$$\begin{aligned} &Fertilizer\ Stock\ Price_t \\ &\quad = -0.107 Returning\ Visitors_t - 0.899 New\ Visitors_t \\ &\quad -2.196 Bounce\ Rate_t - 0.796 Time\ on\ Site_t - 2.057 Pages\ per\ Visit_t + e_t \end{aligned}$$

$$\begin{aligned} &Fertilizer\ Stock\ Price_t \\ &\quad = -0.673 Returning\ Visitors_t + 1.427 New\ Visitors_t \\ &\quad +1.407 Bounce\ Rate_t + 1.656 Time\ on\ Site_t - 1.235 Pages\ per\ Visit_t + e_t \end{aligned}$$

where, the numbers on front of each independent variable reflect the standardized coefficients (β1 for returning visitors, β2 for new visitors, β3 for bounce rate, β4 for time on site, and β5 for pages per visit) presented in Tables 3 and 4 below. The standardized coefficients show the percentage of the dependent variable's variation (fertilizer stock price) when the independent ones rise by 1%.

Table 3. Impact of Bitcoin Website Users' Analytics on Supply chain firms in the fertilizer industry's Stock Price.

Variables	Standardized Coefficient (β1–β5)	R^2	F	p-Value
Constant	-	0.736	0.557	0.762
Returning Visitors	−0.107			0.995
New Visitors	−0.899			0.964
Bounce Rate	−2.196			0.739
Time on Site	−0.796			0.652
Pages per Visit	−2.057			0.633

Table 4. Impact of Cryptocurrency Trade Websites Users' Analytics on Supply chain firms in the fertilizer industry's Stock Price.

Variables	Standardized Coefficient (β1–β5)	R^2	F	p-Value
Constant	-	0.726	0.530	0.772
Returning Visitors	−0.673			0.989
New Visitors	1.427			0.982
Bounce Rate	1.407			0.860
Time on Site	1.656			0.979
Pages per Visit	−1.235			0.967

Next, the linear regressions of organic traffic metrics of cryptocurrency trade and Bitcoin's websites, as independent variables, with supply chain firms in the fertilizer industry' stock price, as the dependent variable. Firstly, the linear regression of supply chain firms in the fertilizer industry's stock prices is verified overall, with p-value = 0.005 < a = 0.01 level of significance and R^2 = 0.979. The first linear regression, the impact of Bitcoin websites' organic traffic metrics on supply chain firms in the fertilizer industry's stock prices, is verified overall, with p-value = 0.005 < a = 0.01 and R^2 = 0.979. From the rise of 1% in organic keywords and traffic costs, supply chain firms' stock prices variate up to −107% and 131.4%, respectively, since they are the only significant ones (p-values < a = 0.05).

The linear regression of supply chain firms in the fertilizer industry's stock prices is produced, with independent variables of the analytic metrics of cryptocurrency trade organic traffic metrics. This regression is verified overall, with p-value = 0.014 < a = 0.05 level of significance and R^2 = 0.958, despite the fact that none of the independent organic analytic metrics had a significant impact individually (p-values > a = 0.05).

$$\begin{aligned} &Fertilizer\ Stock\ Price_t \\ &\quad = -0.443 Organic\ Traffic_t - 1.070 Organic\ Keywords_t \\ &\quad +1.314 Organic\ Traffic\ Costs_t + e_t \end{aligned}$$

$$\begin{aligned} &Fertilizer\ Stock\ Price_t \\ &\quad = 0.335 Organic\ Traffic_t + 0.331 Organic\ Keywords_t \\ &\quad +0.694 Organic\ Traffic\ Costs_t + e_t \end{aligned}$$

where, the numbers on front of each independent variable reflect the standardized coefficients (β1 for organic traffic, β2 for organic keywords, and β3 for organic traffic costs) presented in Tables 5 and 6 below. The standardized coefficients show the percentage of the dependent variable's variation (fertilizer stock price) when the independent ones rise by 1%.

Table 5. Impact of Bitcoin Website's Organic Traffic metrics on Supply chain firms in the fertilizer industry's Stock Price.

Variables	Standardized Coefficient (β1–β3)	R^2	F	*p*-Value
Constant	-	0.979	46.259	0.005 **
Organic Traffic	−0.443			0.293
Organic Keywords	−1.070			0.002 **
Organic Traffic Costs	1.314			0.036 *

* and ** indicate statistical significance at the 95% and 99% levels accordingly.

Table 6. Impact of Cryptocurrency Trade Websites' Organic Traffic metrics on Supply chain firms in the fertilizer industry's Stock Price.

Variables	Standardized Coefficient (β1–β3)	R^2	F	*p*-Value
Constant	-	0.958	22.952	0.014 *
Organic Traffic	0.335			0.548
Organic Keywords	0.331			0.168
Organic Traffic Costs	0.694			0.224

* indicates statistical significance at the 95% level.

Finally, in Table 7, we analyzed the linear regression model of cryptocurrency trade websites' paid traffic on supply chain firms in the fertilizer industry's stock prices. This model is verified overall with a p-value = 0.020 < a = 0.05 level of significance, with R^2 = 0.948. From the independent variables, cryptocurrency trade websites' paid traffic

costs were the most significant, with a p-value < 0.05 level of significance. The rise of 1% in paid traffic costs lead to an increase of 223.3% in supply chain firms in the fertilizer industry's stock price.

$$\begin{aligned} &Fertilizer\ Stock\ Price_t \\ &\quad = -1.678 Paid\ Traffic_t + 0.369 Paid\ Keywords_t \\ &\quad +2.233 Paid\ Traffic\ Costs_t + e_t \end{aligned}$$

where, the numbers on the front of each independent variable reflect the standardized coefficients (β1 for paid traffic, β2 for paid keywords, and β3 for paid traffic costs) presented in Table 7 below. The standardized coefficients show the percentage of the dependent variable's variation (fertilizer stock price) when the independent ones rise by 1%.

Table 7. Impact of Cryptocurrency Trade Websites' Paid Traffic Metrics on Supply Chain Firms in the Fertilizer Industry's Stock Prices.

Variables	Standardized Coefficient (β1–β3)	R^2	F	p-Value
Constant	-	0.948	18.182	0.020 *
Paid Traffic	−1.678			0.108
Paid Keywords	0.369			0.381
Paid Traffic Costs	2.233			0.035 *

* Indicates statistical significance at the 95% level.

2.1. Exploratory Model Development

There is a need to illustrate the total of the factors that could dynamically affect supply chain firms in the fertilizer industry's stock prices through the scope of the cryptocurrency market. For this reason, the authors opted to deploy a macro-environment model that presents the variables of various cryptocurrency entities and their connection to fertilizer stock prices. Such a macro-environment model can be created through the Fuzzy Cognitive Mapping models, where various factors' intercorrelations are depicted (Case et al. 2018). To do so, the required variables' linearity and normality were ensured, to strengthen the model's credibility. Then, the necessary correlation coefficients extracted from the data statistical analysis were used as input for the deployment of the model. Through this macro-environment context, the authors seek to depict the relationships between supply chain firms in the fertilizer industry's stock prices and cryptocurrency trade organizations and Bitcoin users' behavioral data.

The developed fuzzy cognitive mapping process shows all the referred factors and variables of supply chain firms in the fertilizer industry's stock prices, as well as their stationary cause-and-effect relationships. Hence, a Fuzzy Cognitive Mapping (FCM) model was deployed through the capitalization of the online application platforms of MentalModeler (2022). The output of the model is discerned in Figure 1, where the variables' relationships are illustrated with red and blue arrows (negative and positive correlations), and the lines' thickness indicates an increase in correlation strength, as performed by Migkos et al. (2022). FCM grants the possibility of presenting the deployed relationships among important factors of the context, through quantitative weights and arrows. As a result, potential investors in supply chain firms in the fertilizer industry would have a clear picture of all the concerning variables of cryptocurrency market entities and organizations that would affect their stock price.

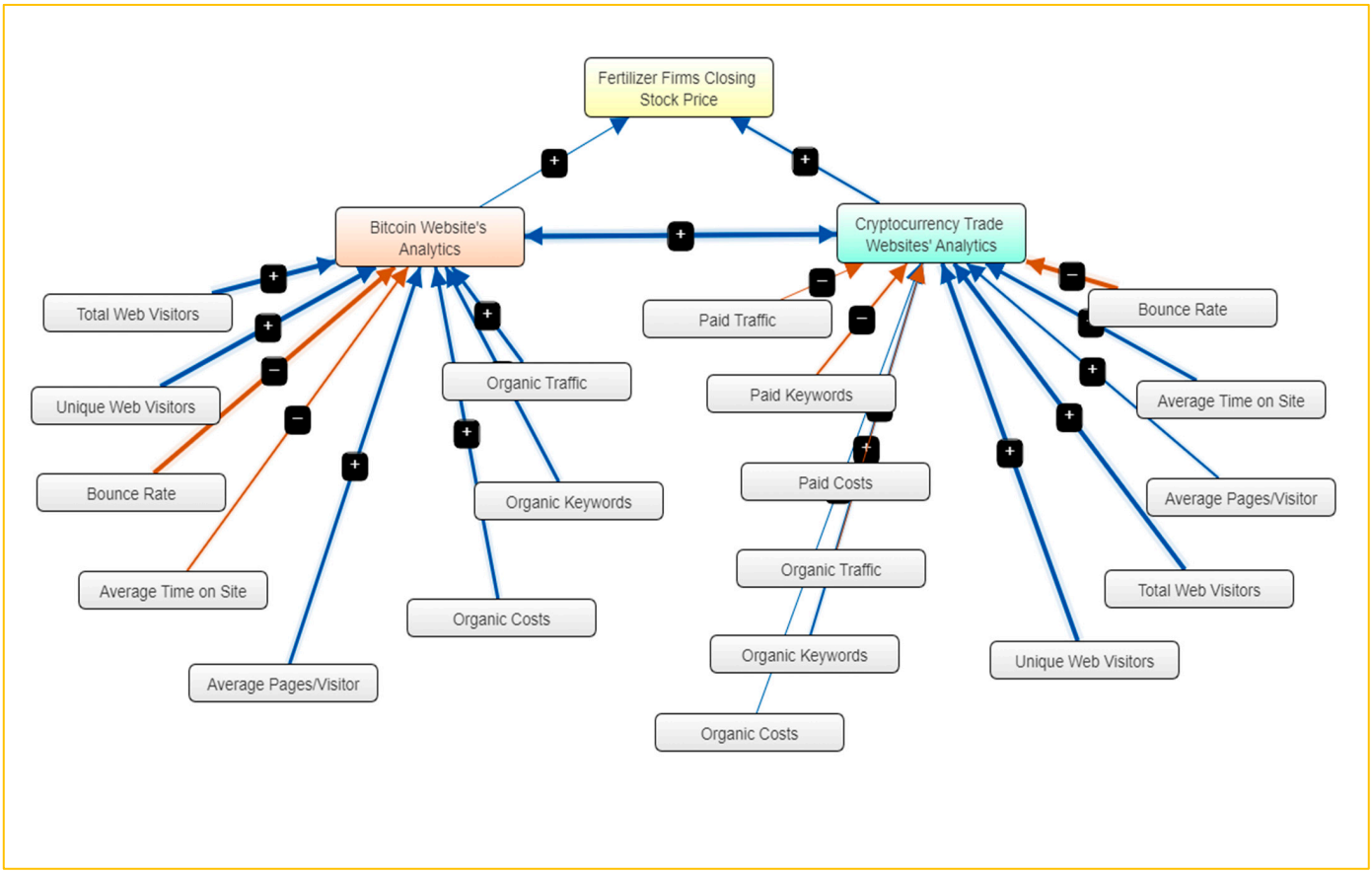

Figure 1. Fuzzy Cognitive Model Framework.

2.2. Simulation Model Development

The final stage of the paper's methodology focuses on the results that are deducted from the application of the simulation model. In this stage, the authors opted to deploy a Hybrid Model (HM) based on both Agent-Based (ABM) and Dynamic (DM) modeling processes (Anylogic 2022). For this reason, the significant correlations and linear regression coefficients of the data variables were used as input to the model. The purpose of the model's creation is to examine, in a 360-day simulation period, whether the variation of cryptocurrency trade organizations and Bitcoin website users' behavioral data (time on site, pages per visit, number of new visitors, organic and paid traffic costs, etc.) are capable of explaining the variation of supply chain firms in the fertilizer industry' stock price.

For the deployment of the model, 10,000 agents were used whose moving is based on basic commands (and, if, etc.) positioned throughout the models' statecharts and arrows (Retzlaff et al. 2021). The agents' movement depicts the route that a potential visitor of cryptocurrency trade and Bitcoin websites would follow while the dynamic variables show the flows of the organic and paid traffic costs. As said before, the simulation time was set to 360 days, and the observation procedure was through a one-time snapshot picture.

Moving to the Hybrid Model's configuration (Figure 2), its start is set at the Bitcoin potential website visitor statechart. From there, the agents could either enter Bitcoin's website as new or returning visitors (through these statecharts) or enter cryptocurrency trade organizations' websites also as new and returning visitors (through these statecharts) or abandon both the websites (crypto-trade and Bitcoin bounce rate statecharts). Moreover, the movement of the agents through statecharts activates the related dynamic variables that trigger the variation of specific variables, such as organic and paid costs for cryptocurrency and Bitcoin trade organizations. Bitcoin and cryptocurrency trade organizations' website users' behavioral data, such average time on site and average pages per visit, are depicted

via the parameter variables that follow the Normal distribution based on 6 months of collected data. The routine developed for the model's running can be seen in Table A1 in Appendix A.

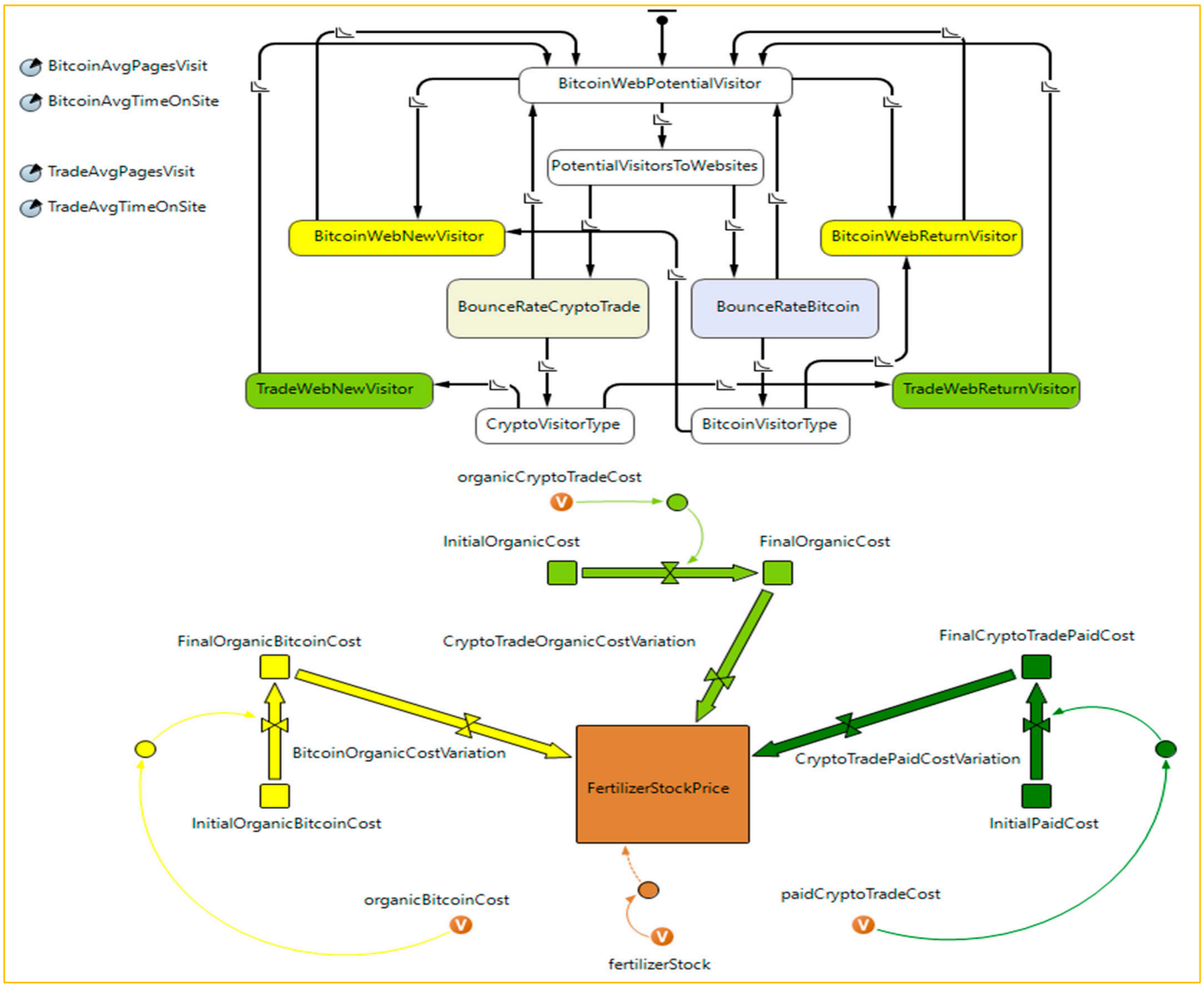

Figure 2. Hybrid Simulation Model Development.

From the deployed Hybrid Model (HM), a simulation was performed over a period of 360 days. The outcomes of the simulation are presented in Figure 3. The variations of supply chain firms in the fertilizer industry's stock prices, Bitcoin's organic traffic costs and keywords, as well as cryptocurrency trade organizations' paid traffic costs are deployed. It can be discerned that the variation of supply chain firms in the fertilizer industry's stock prices throughout the 360 simulation days is very similar to the variations of cryptocurrency trade organizations' paid traffic costs, as well as the Bitcoin website's organic traffic costs and organic keywords. Supply chain firms in the fertilizer industry's stock prices are positively related to cryptocurrency trade organizations' paid traffic costs and the Bitcoin website's organic traffic costs, while it is negatively connected with the Bitcoin website's organic keywords. So, an increase in paid and organic traffic costs of cryptocurrency trade organizations and Bitcoin's websites would increase the value of supply chain firms in the fertilizer industry's stock prices, respectively, and an increase in Bitcoin website's organic keywords would decrease its value.

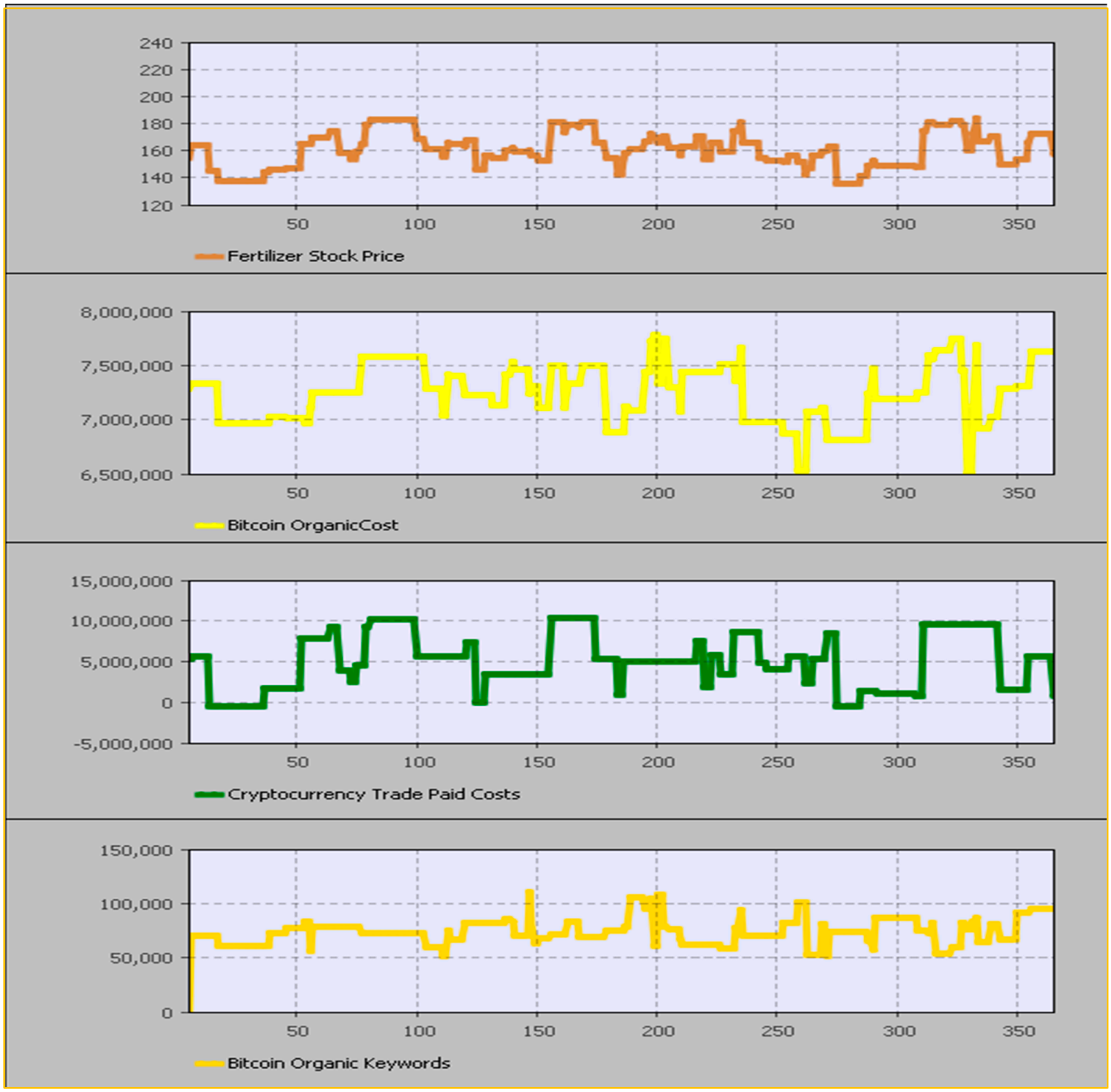

Figure 3. Simulation Model results.

3. Materials and Methods

3.1. Research Hypotheses

The increased usage of cryptocurrency applications clears the path for their capitalization from various firms and organizations. In our case, the interest of the study is shifted to the modeling and prediction factors of supply chain firms in the fertilizer industry's stock price. These firms' stock prices could be impacted by the variation of various cryptocurrency applications and websites, apart from other well-established factors (countries' financial performance indicators, etc.). For this reason, the authors sought to develop a simulation model that, based on significant regressions' outcomes, will predict the variation of supply chain firms in fertilizer industry's stock prices based on cryptocurrency applications and websites' big data. The referred big data would constitute users' and visitors' behavioral data, as well as organic and paid campaigns' performance

indicators. So, the purpose of the present research is to examine whether multiple cryptocurrency market entities and their users' behavioral data affect fertilizer stock prices. This could be a piece of important information for potential supply chain firms in the fertilizer industry investors.

The overall conceptual framework of the research hypotheses set below is seen in Figure 4. Below, the analysis of the research hypotheses is presented:

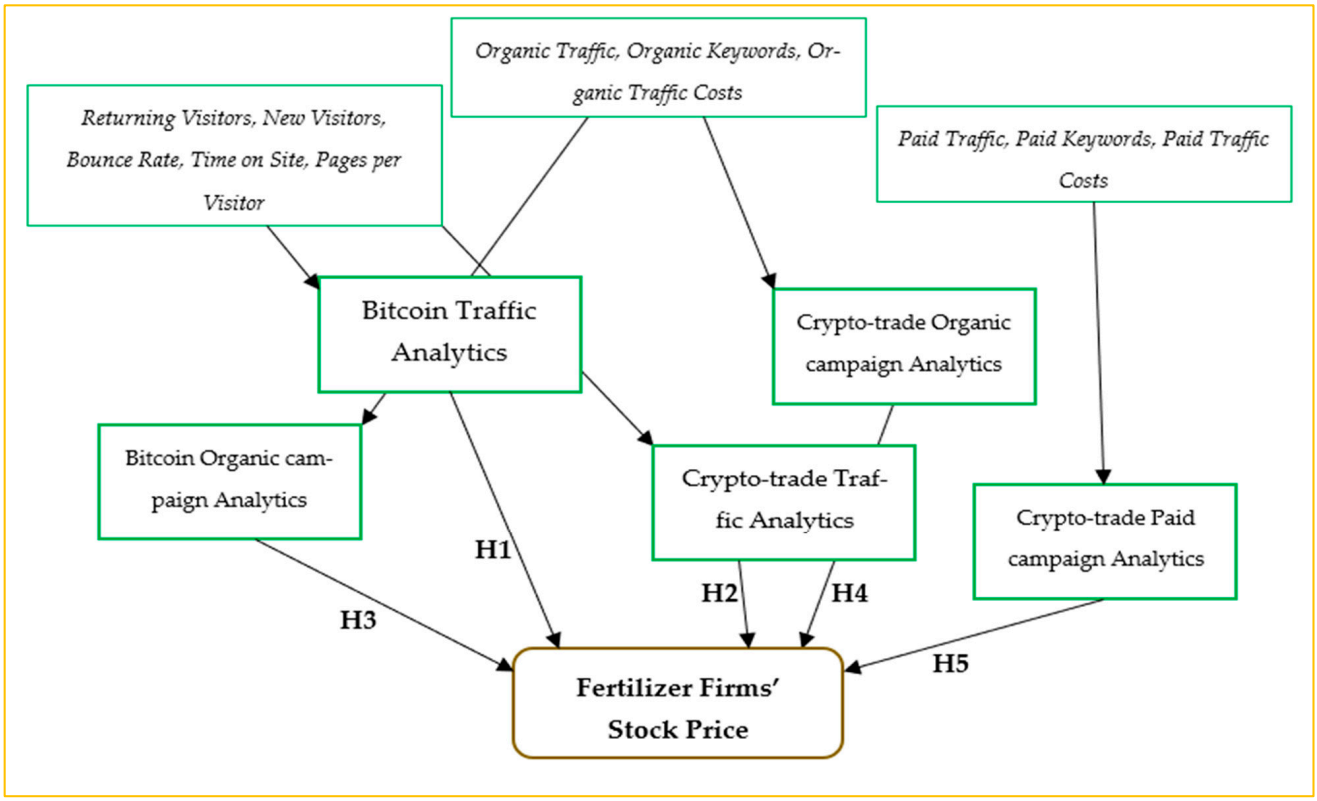

Figure 4. Conceptual Framework.

For the first research hypothesis, the authors opted to start with the examination of Bitcoin website user analytics' effect on supply chain firms in the fertilizer industry's stock prices. The fact that users that are interested in fertilizer stock prices are keen on investing in Bitcoin, could be proven a very fruitful insight. The behavior of users that invest in Bitcoin and visit its website, could indicate important variations in fertilizer stock prices.

Hypothesis 1 (H1): *The Analytics of Bitcoin's website traffic affect Supply chain firms in the fertilizer industry' Stock Price.*

Apart from Bitcoin's website user behavior, an important factor in determining supply chain firms in the fertilizer industry's stock prices could also be the behavioral analytic metrics of cryptocurrency trade website users. Again, an accurate prediction of supply chain firms in the fertilizer industry's stock price, based on cryptocurrency users' behavior should also focus on cryptocurrency trade websites' usage. Since more people are interested in cryptocurrency trading, it can be assumed that the interest in fertilizer stock prices will rise.

Hypothesis 2 (H2): *Cryptocurrency trade websites users' analytics impact the Price of Supply chain firms in the fertilizer industry' Stock.*

Having analyzed the impact of cryptocurrency applications and website user behavioral data, the effect of organic and paid campaigns' metrics should be assessed. Such an understanding could help potential investors in supply chain firms in the fertilizer industry choose when to invest. By monitoring the trajectory of Bitcoin's organic campaign metric, this particular choice of fertilizers for potential investors could become clearer.

Hypothesis 3 (H3): *Organic campaign Analytics of Bitcoin's website can cause Supply chain firms in the fertilizer industry Stock Price variation*.

This time, having examined the impact of Bitcoin's website organic campaign metrics, the interest in analyzing cryptocurrency trade organizations' organic campaign metrics' effect on fertilizer stock prices. On the same page, potential investors in supply chain firms in the fertilizer industry might look into cryptocurrency trade organizations' organic campaign metrics to extract information regarding fertilizer stock price variation.

Hypothesis 4 (H4): *The Stock Price of Supply chain firms in the fertilizer industry is impacted by the Organic campaign Analytics of Cryptocurrency trade websites*.

The last of the paper's hypotheses focus on cryptocurrency-paid campaign metrics' effect on fertilizer stock prices. Paid campaigns provide a variety of analytical metrics from organic campaigns, and are also considered valuable for potential supply chain firms in the fertilizer industry investors. Thus, such knowledge of the amount of paid traffic of paid costs of cryptocurrency trade websites might affect the stock price of supply chain firms in the fertilizer industry, and their potential investors would be interested in that information.

Hypothesis 5 (H5): *The variation of Supply chain firms in the fertilizer industry' Stock Price becomes affected by Cryptocurrency trade websites' Paid campaigns*.

3.2. Data Sample and Retrieval

An important aspect of this study is the retrieval of the necessary data from the selected representative sample. The sample consists of the 5 largest fertilizer companies in the world, based on their market capitalization (Akbar 2022), with their stock prices have been gathered for analysis. The authors also collected Web Analytic data from the websites of the 10 most well-known cryptocurrency trade websites (Powell and Curry 2023), as well as from Bitcoin's original website. The referred data concern paid and organic campaign analytic metrics and visitors' behavioral metrics. As for the selected firms, the following firms were summoned:

- Supply chain firms in the fertilizer industry: Nutrien (2023), Wesfarmers (2023), Industries Qatar (2023), Sociedad Quimica y Minera (2023), and CF Industries Holdings (2023).
- Cryptocurrency Trade organizations: Binance (2023b), Bitflyer (2023), Bitstamp (2023), Bittrex (2023), Coinbase (2023), Crypto (2023), Gate.io (2023), Gemini (2023), Kraken (2023), and Kucoin (2023).
- Bitcoin organization website (Bitcoin 2023).

Those Web Analytic metrics were collected by capitalizing on a website-based Decision Support System that enables data gathering, via proper payment, called Semrush (2023). Thus, the website Big Data was collected daily by observing the appropriate metrics, from 1 May 2021, until 30 November 2021. Through these 180 days, the metrics shown in Table 8, were gathered and analyzed.

Table 8. Web Analytic metrics of the analysis.

Metrics	Description of the Web Analytic Metrics
Organic Traffic	Organic traffic consists of visitors that enter a website from unpaid sources. Organic traffic sources refer to search engines like Google, Yahoo, or Bing (Insider 2023).
Organic Keywords	Targeted keywords, through organic campaigns, are used to attract free traffic through search engines.
Organic Traffic Costs	Organic traffic cost is the cost of traffic from all keywords that the target website/URL ranks for, during a month if paid via PPC instead of ranking organically (Ahrefs 2023).
Paid Traffic	Paid traffic is the opposite of organic traffic. This is the traffic that is generated from advertising systems and that businesses have to pay for (WillMarlow 2022).
Paid Keywords	Paid keywords are keywords websites bid for inside Google Ads.
Paid Traffic Costs	Paid traffic cost is calculated as the estimated cost of paid search traffic from all the keywords that a target website/URL ranks for via PPC, during a month (Ahrefs 2023).
Returning Visitors	Those that have entered a website before and return. After the passing of 2 years, they are considered New Visitors (DBS Interactive 2023).
New Visitors	They are entering a website for the first time from a specific device (DBS Interactive 2023).
Bounce Rate	Bounce Rate is known as the percentage of visitors that leave a website without interacting with it, like clicking on a link, etc. (Backlinko 2023).
Time on Site	The average amount of time visitors spend on a website.
Pages per Visitor	The average number of pages the visitors of a website open.

4. Discussion

The present research focuses on assessing the ability of cryptocurrency market users' behavioral data to predict the variation of supply chain firms in the fertilizer industry's stock price. Therefore, the paper aims to examine whether the cryptocurrency market's entities and their users' behavioral data are capable of predicting and modeling fertilizer stock prices. Such information could be beneficial for potential investors in supply chain firms in the fertilizer industry. The authors proceeded to extract web analytic data from cryptocurrency market organizations' websites, regarding their users' behavior. Then, performed correlation and regression analysis on this dataset, followed by the development of exploratory (FCM) and simulation (HM) modeling processes.

For processing the cryptocurrency market's user behavioral data, the variables of new and returning visitors, average time on site and pages per visit, as well as their website bounce rate were adopted. Moreover, to assess Bitcoin's and cryptocurrency trade organizations' digital marketing performance (Sakas et al. 2023a, 2023b), organic and paid traffic, keywords, and cost variables were also used. The effect of all these website analytical metrics was measured and evaluated for the variation they caused in supply chain firms in the fertilizer industry's stock price.

Regarding the verification of the research hypotheses settled in Section 2 of the present paper, the authors took into consideration the statistical significance of the produced linear regression models. There were produced 5 linear regression models to match the settled hypotheses. Research hypotheses H1 and H2 were not verified due to low R^2 and insignificant *p*-values (>a = 0.01 level of significance). On the contrary, research hypotheses H3, H4, and H5 were verified, based on high levels of R^2 and significant linear regression p-values (<a = 0.01 level of significance). Furthermore, the linear regressions referring to Bitcoin's organic traffic metrics, as well as cryptocurrency trade websites/apps' organic and paid traffic metrics were found to have a significant effect on supply chain firms in the fertilizer industry's stock price. The regressions that concern both Bitcoin and cryptocurrency trade user analytical metrics were not found to cause a significant variation in supply chain firms in the fertilizer industry's stock price. From the significant regressions, the analytical metrics that affect the stock price variation of fertilizers are organic keywords and traffic costs of the Bitcoin website and paid traffic costs of cryptocurrency trade websites/apps. The more organic and paid traffic costs to increase the more supply chain firms in the fertilizer industry' stock price rises, and while their stock price declines the more the Bitcoin website's organic keywords increase.

Furthermore, the applied Hybrid Modeling simulation produced important results regarding the relationship between the cryptocurrency market's analytical data and the stock price of supply chain firms in the fertilizer industry. It can be deduced that when organic and paid traffic costs of Bitcoin and cryptocurrency trade websites increase, the stock price of supply chain firms in the fertilizer industry also tends to increase. On the contrary, when the variation of Bitcoin's website organic keywords decreases, fertilizer stock prices increase. Such data aim to boost the knowledge of potential supply chain firms in the fertilizer industry's investors, and more specifically to address critical indicator metrics that can explain the variation of supply chain firms in the fertilizer industry's stock price.

5. Conclusions

5.1. Theoretical and Practical Implications

At this point of the paper, it becomes important to highlight the study's aim and the findings that emerged from the deployed methodology. Throughout this research, the authors focused on examining the effect of cryptocurrency market users and campaign metrics behavior on the variation of supply chain firms in the fertilizer industry's stock price. By doing so, a hybrid model was produced from the modeling and simulation process, based on these metrics' relationship with the stock price. The main finding indicates that the cryptocurrency market's analytical metrics, such as the Bitcoin website's organic keywords and organic traffic costs, as well as cryptocurrency trade websites/apps' paid traffic costs, are capable of predicting the trajectory of supply chain firms in the fertilizer industry' stock price. The exploitation of these metrics opens the way for an optimized modeling process of supply chain firms in the fertilizer industry's stock price.

Referring to the research's results and the insights that emerge, it is important to place the paper's findings among the existing literature. Therefore, the outcomes of our study come to terms with the study of Almeida et al. (2023), where the integration and applications of cryptocurrencies were examined. Almeida et al. (2023) stated that cryptocurrencies could potentially affect investors' behavior, albeit their integration is not affected by crises. Moreover, cryptocurrencies were found to cause an important effect on firms' decisions and operations, as well as the investors' motivation and behavior (Yen and Wang 2021). Giudici et al. (2020) are in favor of cryptocurrency utilization, based on their provided added value and information to potential stakeholders and investors.

In sum, the present research studied and analyzed the behavioral analytical metrics of cryptocurrency markets (cryptocurrency websites and trading platforms), to estimate their effect and prediction capability over the stock price of supply chain firms in the fertilizer industry. There has been found that behavioral and analytical data in cryptocurrency market websites/apps can successfully model and predict the stock price of supply chain firms in the fertilizer industry. Thus, cryptocurrencies and cryptocurrency market data provide a valuable database for potential investors in supply chain firms in the fertilizer industry to harvest (Sakas et al. 2023a, 2023b). Apart from the effect that cryptocurrency market analytical and behavioral data have on supply chain firms in the fertilizer industry's stock prices, other firms' stock prices could also be affected. Thus, the utilization of such data for the modeling and prediction of other firms' stock prices and revenues (like supply chains or technological ones) would be of much interest.

5.2. Limitations

The study's methodological framework considered the limited number of independent variables used to model to values of supply chain firms in the fertilizer industry's stock price. Moreover, those variables originated from Bitcoin's and cryptocurrency trade website users' behavioral data, meaning that utilization of additional sources of decentralized finance (DeFi) could increase the model's prediction accuracy. In this manner, a collection of more website analytical metrics from the cryptocurrency market users' behavior, apart from the ones collected by the present research, would assist in enhancing their prediction ability. To extract the required data for the simulation analysis, the authors opted to perform

the linear regression method. Since linear regression models are accompanied by some specific limitations, like the sensitivity to outliers, the requirement for data independence, and linear relationships, the authors acknowledge that the exploitation of other statistical methods (logistic regression) could potentially provide more significant results. Finally, the study's context and model were only tested in supply chain firms in the fertilizer industry's stock prices and an expansion of its application would be required in future research.

Author Contributions: Conceptualization, D.P.S. and N.T.G.; methodology, N.T.G.; software, N.T.G.; validation, M.M. and N.K.; formal analysis, M.M.; investigation, N.T.G. and M.M.; resources, M.M.; data curation, N.T.G. and N.K.; writing—original draft preparation, N.T.G.; writing—review and editing, N.T.G. and D.P.S.; visualization, D.P.S. and N.T.G.; supervision, D.P.S. and M.M.; project administration, D.P.S. and M.M.; funding acquisition, M.M. All authors have read and agreed to the published version of the manuscript.

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Conflicts of Interest: The authors declare no conflict of interest.

Appendix A

Table A1. The Java Coding Route of Supply chain firms in the fertilizer industry's Stock Price simulation.

Java coding route of Anylogic

@Override
@AnyLogicInternalCodegenAPI
public void enterState(short _state, boolean _destination) {
switch(_state) {
case BitcoinWebPotentialVisitor: // (Simple state (not composite))
statechart.setActiveState_xjal(BitcoinWebPotentialVisitor);
{
bitcoinPotentialVisitors+0+;
;}
transition.start();
transition1.start();
transition15.start();
return;
case BitcoinWebNewVisitor: // (Simple state (not composite))
statechart.setActiveState_xjal(BitcoinWebNewVisitor);
{
bitcoinNewVisitors++;
bitcoinOrganicKeywords = normal(12895.440 , 74473.43);
bitcoinOrganicTraffic = bitcoinOrganicKeywords*(0.398);
BitcoinAvgPagesVisit = normal(0.297 , 2.79);
BitcoinAvgTimeOnSite = normal(4.99767 , 0.2788);
organicBitcoinCost = normal(271622.878 , 7287458.14);
fertilizerStock = paidCryptoTradeCost*(0.000003) + organicBitcoinCost*(0.000019) +
bitcoinOrganicKeywords*(0.000107)
;}

Table A1. *Cont.*

```
            transition8.start();
            return;
        case BitcoinWebReturnVisitor: // (Simple state (not composite))
            statechart.setActiveState_xjal( BitcoinWebReturnVisitor );
            {
bitcoinReturnVisitors++;
bitcoinOrganicKeywords = normal(12895.440 , 74473.43);
bitcoinOrganicTraffic = bitcoinOrganicKeywords*(0.398);
BitcoinAvgPagesVisit = normal(0.297 , 2.79);
BitcoinAvgTimeOnSite = normal(4.99767 , 0.2788);
organicBitcoinCost = normal(271622.878 , 7287458.14);
fertilizerStock = paidCryptoTradeCost*(0.000003) + organicBitcoinCost*(0.000019) +
bitcoinOrganicKeywords*(0.000107)
;}
            transition21.start();
            return;
        case PotentialVisitorsToWebsites: // (Simple state (not composite))
            statechart.setActiveState_xjal( PotentialVisitorsToWebsites );
            transition2.start();
            transition3.start();
            return;
        case BounceRateCryptoTrade: // (Simple state (not composite))
            statechart.setActiveState_xjal( BounceRateCryptoTrade );
            transition4.start();
            transition10.start();
            return;
        case CryptoVisitorType: // (Simple state (not composite))
            statechart.setActiveState_xjal( CryptoVisitorType );
            transition11.start();
            transition24.start();
            return;
        case TradeWebReturnVisitor: // (Simple state (not composite))
            statechart.setActiveState_xjal( TradeWebReturnVisitor );
            {
tradeReturnVisitors++;
tradeOrganicKeywords = tradeReturnVisitors*(-0.604);
tradePaidKeywords = tradeReturnVisitors*(-0.581);
tradeOrganicTraffic = tradeOrganicKeywords*(-0.435);
tradePaidTraffic = tradePaidKeywords*(0.928);
TradeAvgPagesVisit = normal(0.823 , 5.51);
TradeAvgTimeOnSite = normal(2.24975 , 20.2805);
organicCryptoTradeCost = normal(40358541.959 , 70830270.29);
paidCryptoTradeCost = normal(2927311.503 , 4964784.29);
fertilizerStock = paidCryptoTradeCost*(0.000003) + organicBitcoinCost*(0.000019) +
bitcoinOrganicKeywords*(0.000107)
;}
```

Table A1. *Cont.*

```
            transition20.start();
            return;
          case TradeWebNewVisitor: // (Simple state (not composite))
            statechart.setActiveState_xjal( TradeWebNewVisitor );
            {
tradeNewVisitors++;
tradeOrganicKeywords = tradeNewVisitors*(0.278);
tradePaidKeywords = tradeNewVisitors*(-0.154);
tradeOrganicTraffic = tradeOrganicKeywords*(-0.435);
tradePaidTraffic = tradePaidKeywords*(0.928);
TradeAvgPagesVisit = normal(0.823 , 5.51);
TradeAvgTimeOnSite = normal(2.24975 , 20.2805);
organicCryptoTradeCost = normal(40358541.959 , 70830270.29);
paidCryptoTradeCost = normal(2927311.503 , 4964784.29);
fertilizerStock = paidCryptoTradeCost*(0.000003) + organicBitcoinCost*(0.000019) +
bitcoinOrganicKeywords*(0.000107)
;}
            transition19.start();
            return;
          case BounceRateBitcoin: // (Simple state (not composite))
            statechart.setActiveState_xjal( BounceRateBitcoin );
            transition9.start();
            transition23.start();
            return;
          case BitcoinVisitorType: // (Simple state (not composite))
            statechart.setActiveState_xjal( BitcoinVisitorType );
            transition12.start();
            transition13.start();
            return;
          default:
            super.enterState( _state, _destination );
            return;
      } }
```

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