Improving Operational Efficiency through Quality 4.0 Tool: Blockchain Implementation and Subsequent Market Reaction

DOI: 10.12776/QIP.V27I2.1877

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Received: 2023-06-21 Accepted: 2023-06-28 Published: 2023-07-31

ABSTRACT

Purpose: This article aims to observe and measure how modern and innovative blockchain technology improves the data quality and transparency and thus affect the stock prices of publicly traded companies after announcing its implementation in their operations. Additionally, the objective is to compare the results with control group of non-adopters.

Methodology/Approach: We selected 30 public companies across various sectors, obtained daily stock price data, identified peer companies, and employed an event study approach to examine the statistical impact of blockchain adoption announcements.

Findings: A significant negative reaction (-0.4%) was observed in stock prices the day following a blockchain adoption announcement, but overall, the market response was unsystematic, indicating no consistent reaction in stock prices post-announcement.

Research Limitation/Implication: The event study approach assumes that markets are always efficient. This methodology has some limitations because we live in a world that is not perfect, and stock prices do not necessarily fully reflect all available information.

Originality/Value of paper: Blockchain implementation is a current and intriguing subject that has attracted limited scholarly research. Each new study contributes valuable insights to the understanding of how this innovative technology impacts corporate operations. Furthermore, this research endeavours to draw comparisons between companies that have announced their adoption of blockchain and their non-adopters counterparts.

Category: Conceptual paper

Keywords: quality 4.0, blockchain; event studies; digitalisation

1 INTRODUCTION

According to Global Data Management Research organisations need to improve their data quality. Report shows that failing to improve the data can cause increased costs, unreliable analytics, negative impact on customer trust, experience and company reputation which lead to slow digital transformation. (Reno, 2022)

The American Society of Quality defines Quality 4.0 as the term which references "the future of quality and organisational excelence within the context of Industry 4.0" (American Society for Quality, n.d.). It is confirmed that quality management and Industry 4.0 directly influence performance (Nguyen et al., 2021). Technologies 4.0 such as Internet of Things, Artificial Inteligence or Blockchain are utilised to improve quality of products and services for the customer and at the same time increase value for shareholders. It is unquestionable that using Technologies 4.0 as part of Quality 4.0 "provides numerous benefits to quality management, including increased speed and transparency, increased adaptability to new situations and continual improvement across businesses plus increased awareness, skills and inteligence" (Mtotywa, 2022). It also enables early error detection and reduces downtime through anticipatory maintenance planning (Mtotywa, 2022).

Blockchain technology as one of the Quality 4.0 tools has substantially advanced since its inception, and companies across multiple industries have widely adopted it. While most of the attention surrounding blockchain relates to its use in cryptocurrency, recent literature and applications show its vast potential for various applications in many industries, especially within the finance sector and the supply chain. It is an innovative technology that brings significant optimisation and automatisation when implemented in the company's various operations. Blockchain as a quality toll can help company to perform better as it helps gaining operational excellence, and as a result, foster process innovation. "Moreover, new forms of collaboration and traceability, such as, block chain, are very important in this period, especially when factors affecting competitiveness can vary" (Santos et al., 2021). On the other hand, its adoption is complex and expensive, so exploring existing use cases is important for companies to help them in their strategic decision-making process whether to invest in this technology or not.

This paper focuses on observing and measuring how this Quality 4.0 tool affects the stock prices of publicly traded companies that announced its implementation in their operations. We conducted an event study analysis on 30 selected publicly traded companies from various areas and sectors which announced blockchain adoption and how this announcement as an event impacted the price development. We use SPSS software and market model to test the abnormal returns and their significance on 41 days, 20 days prior and 20 days after the announcement. Additionally, through the platform Infront Analytics, we searched for peer companies for each analysed firm from our sample to compare the

development during the event window. The objective is to determine whether and to what extent the market reacts to such announcements about blockchain implementations.

2 LITERATURE REVIEW

It is worth analysing blockchain as a technology in the context of consequent market reactions after a new technology is announced. Such new technological changes could be e-commerce platforms (Subramani and Walden, 2001; Dehning et al., 2004), mobile apps (Boyd, Kannan and Slotegraaf, 2019) or ERP systems (Hendricks, Singhal and Stratman, 2006; Ranganathan and Brown, 2006).

A study conducted by Chen et al. (2022) shares similarities with our objectives but focuses exclusively on China and Chinese businesses. The researchers examined two categories of firms – those in high-tech industries and those outside- intending to embrace blockchain technology in the future. In total, 302 companies listed on the Shanghai and Shenzhen Stock Exchanges between 2016 and 2020 were chosen. The analysis was conducted over 41 and 11 trading days over two timeframes. The findings revealed that high-tech firms' blockchain announcements gained greater interest from investors, eliciting more significant stock price reactions as investors deemed these companies more trustworthy (Chen et al., 2022).

There is evidence that blockchain can potentially reduce costs. In the airspace industry, companies like Honeywell, Moog and Air New Zealand reported up to 30% savings by using blockchain to create secure digital marketplaces for 3D-printed aircraft parts (Tampi, 2020). In the IT sector, a positive relationship between technological initiatives and financial performance was observed (e.g., Bose and Man Leung, 2019; Bradley et al., 2018), where the emphasis was also placed on operational efficiency improvements, revenue generation and firms value (Bose and Man Leung, 2019; Melville, Kraemer and Gurbaxani, 2004). Additionally, blockchain has the potential to promote innovation in business models leading to cost reduction and providing new sources of revenue (Lacity, 2018).

Although studies on blockchain application announcements exist, companies' returns are often compared with Bitcoin returns (Cheng et al., 2019; Cahill et al., 2020). Only some consider the market value that can be created by implementing blockchain. In such cases, an event study methodology is usually used to assess the short-term value investors assign to recently revealed IT initiatives based on future cash flow anticipation (Boyd, Kannan and Slotegraaf, 2019).

The closest study to ours was published by Klockner, Schmidt and Wagner (2022), where 175 blockchain announcements from 100 companies were analysed. The study was well diversified in 11 industries and 15 countries, and data were additionally tested for robustness. Here, a positive market reaction was identified for announcements in the context of operations and supply chain

management. Furthermore, this sample confirmed a significant average abnormal return of 0.30% on the announcement day. However, when an external IT provider is used to implement blockchain, a significantly less positive reaction is observed. Klockner's research (2022) also provides a comprehensive summary of recent research which involves blockchain and its influence on cost-efficient processes. The researches include the following use cases: effect on supply chain and traceability, enhancement of data and knowledge sharing between supply chain participants, security and acceleration of inter-organisational payments and order processing (Klockner, Schmidt and Wagner, 2022)

An investigation of blockchain-related announcements was carried out by Cahill and colleagues in 2020 on a sample of 713 companies in year between 2016 and 2018 that explored the relationship between Bitcoin development and blockchain announcement. An average abnormal return of 5.3% was observed on announcement days, and smaller companies experienced greater abnormal returns than larger ones. Furthermore, lower returns occurred by non-speculative announcements than by speculative ones (Cahill et al., 2020).

Cheng et al. (2019) also explored the connection between 79 publicly traded companies' initial 8-K filings on blockchain activities and investors' reactions. They classified the activities detailed in these disclosures as either existing or speculative ("existing" were firms with a well-defined strategy for blockchain implementation, and "speculative" firms outlining ambiguous plans for blockchain). Their research showed that speculative information had 7.5% positive abnormal returns while existing disclosures experienced almost zero abnormal returns. These favourable responses are undone within a month, suggesting investor overreaction to speculative disclosures (Cheng et al., 2019).

Another event study looks at financial corporations that use blockchain and how their stocks performed during the COVID-19 pandemic. The common parameter is that high-tech companies, whether they are members of blockchain consortiums or have some technological advantage, have better positive stock development results, avoiding potential losses during pandemic-related announcements (Paul, Adhikari and Bose, 2022).

Liu et al. (2022) examined market reactions to blockchain announcements, focusing on a company with 143 announcements. The researchers employed event study methodology and multivariate regression to analyse market responses and determine factors affecting these changes. They found a positive market reaction on announcement days and noted that strategic-level announcements elicited a stronger positive response from the market (Liu et al., 2022).

3 METHODOLOGY AND DATA

The event study methodology is gaining popularity in business and marketing disciplines to measure the impact of significant events at the firm. This technique can be used to assess the effect of some important event or corporate

announcement on a company's financial performance, profitability, and market valuation over a defined event window, ranging from a few days to a few years. The methodology is flexible and can be adapted to measure different events, making it useful for researchers in various fields (Ullah et al., 2021). Within our study, we aim to answer following research question (RQ) and thus we create the null hypothesis (H0):

RQ: Is there any reaction in stock prices after the company officially announces the application of blockchain technology in its operations?

H0: There is no reaction in stock prices after the company's announcement regarding blockchain implementation.

Within the null hypothesis, we will test abnormal returns of companies that announced blockchain and compare them to the peer group of similar companies that have not announced any blockchain application in the time around event window. The null hypothesis will be confirmed when abnormal returns are equal to zero, and we will reject the null hypothesis when abnormal returns are not equal to zero. We will also analyse whether the announcement of blockchain's adoption had a positive or negative impact on the stock price.

In order to test the hypothesis, we first gathered two main types of data, announcements of blockchain, which are publicly available, and stock prices. Then, based on Infront Analytics (2023), we created a control group of similar companies that had not publicly communicated any blockchain adoption in that time period. When the same company from the analysed group appeared as a peer to some other company (mostly in the case of industry car producers), we took the second or the third listed international company as peer (Infront Analytics, 2023).

We chose thirty globally active corporations from various industries and obtained daily stock close prices for the last ten years from the Yahoo.com platform. In addition, we chose the MSCI World Index to compare prices with general market performance. Because certain companies and indices representing benchmarks are traded in different countries, the problem of non-trading days arose, a common issue in event studies. To solve this, we follow the methodology mentioned by Campbell, Cowan and Salotti (2010), which completely omits non-trading days from the analysis.

Simultaneously during the phase of choosing the companies for our analysis, we searched for specific announcements regarding real blockchain implementation projects. We did not consider any press releases about exploring the technology, only the real adoption of blockchain in the company's operations. These announcements were set in our event study approach as event days (t0). In almost all cases, the t0 was between 2016 and 2020 except for a few early adopters who have worked on adoption since 2015, for instance, IBM and Microsoft. If the announcement was made during a non-trading day, as the event day (t0) we took the first following trading day.

Tab. 1 summarises our sample and corresponding announcement days and sources. Selected corporations come from the Automotive, Finance, Food & Beverages, Supply Chain and IT sector. For each of the selected companies, we found peer company and this group was also tested within our study (furthermore called as "blockchain group" and "control group").

Table 1 – Companies which Announced Blockchain Adoption and Their Peers

	Company	**Official Announcement**	**Peer company (Infront Analytics, 2023)**	**Sources of blockchain announcement**
1	Walmart	19 Oct 2016	Pan Pacific Int. Holding	Coindesk.com, Accenture, LedgerInsights.com, SAP.com, group-media.mercedes-benz.com, Volkswagen.com, Porsche.com, Microsoft.com, Hyperledger.com, Reuters.com, carrefour.com, Computerworld.com, prnewswire.com, bnnbloomberg.ca, Yahoo.com
2	Anheuser-Busch	14 March 2018	Boston Beer Company	
3	Allianz	07 Nov 2017	Unipol	
4	AT&T	26 Sept 2018	Verizon Communications	
5	SAP	16 May 2017	Oracle Corp	
6	Mercedes -Benz	28 June 2017	Stellantis	
7	Volkswagen	22 Apr 2019	Kia	
8	BMW	13 Feb 2019	Honda	
9	Porsche	22 Feb 2018	Renault	
10	Microsoft	09 Nov 2015	Adobe	
11	IBM	17 Dec 2015	HP	
12	Foxconn	06 March 2017	Pegatron	
13	Nestle	22 Aug 2017	Danone	
14	Carrefour	06 March 2018	Tesco PLC	
15	MasterCard	21 Oct 2016	Visa	
16	Honeywell International	17 Dec 2018	General Electric Company	
17	JPMorgan Chase & Co.	03 March 2016	Bank of America	
18	Tyson Foods	22 Aug 2017	Hormel Foods	
19	Wells Fargo	24 Oct 2016	Regions Financial Corp.	
20	Coca-Cola	05 Nov 2019	Keurig Dr. Pepper	
21	FedEx	14 May 2018	Deutsche Post	
22	Cisco Systems	11 July 2017	Ciena Corp	
23	HSBC Bank	3 Oct 2017	Credit Agricole	
24	Deutsche Bank	16 Sept 2019	Commerzbank	
25	UBS Bank	11 Dec 2017	BNP Paribas	
26	Maersk	16 Jan 2018	Hapag Lloyd	

	Company	Official Announcement	Peer company (Infront Analytics, 2023)	Sources of blockchain announcement
27	Northern Trust	22 Feb 2017	Key Corp	
28	Tata Motors	16 Dec 2020	Ashok Leyland	
29	Morgan Stanley	28 Nov 2018	State Street Corp	
30	Deutsche Telekom	24 June 2019	Telefonica DE	

In our analysis, we decided to explore an event window of 41 days in total (20 days prior to and after the event day). As an estimation window, we take 200 days, starting from 250 days before the announcement and ending 51 days before the event (Fig. 1).

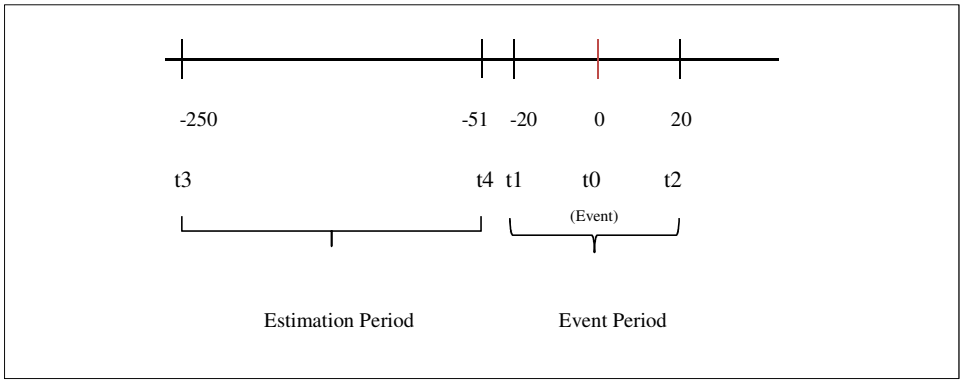

Figure 1 – Event Timeline – Estimation Period and Event Period

Furthermore, we conduct calculations of actual and expected returns of each company from blockchain and control group using the market model described by formulas below:

$$R_{i,t} = \ln\left(\frac{P_{it}}{P_{it-1}}\right) \quad (1)$$

$$E(R_{i,t}) = \alpha_i + \beta_i \cdot R_{mt} \quad (2)$$

$$AR_{i,t} = R_{i,t} - E(R_{i,t}) \quad (3)$$

$$CAR_{i,t} = \sum_{t=t1}^{t2} AR_{i,t} \quad (4)$$

Firstly, we calculate daily returns as natural logarithms (formula 1). The expected return of company *i* on day *t* is represented by $E(R_{i,t})$ (formula 2), and R_{mt} represents the return of the MSCI World, our benchmark index at time *t*.

The company's abnormal returns $AR_{i,t}$ (formula 3) re calculated as a difference between actual and expected returns. In the next step, cumulative abnormal return is calculated as a sum of previous abnormal returns during the event window between t1 and t2. We get the final CAR (formula 4) of all companies as the sum of average abnormal returns for each day in the event window.

4 RESULTS

Using the methodology described earlier, we created charts showing abnormal returns and cumulative abnormal returns of 30 observed blockchain companies and 30 companies belonging to the control group (Fig. 2 and Fig. 3).

Statistical tests were then conducted using SPSS Software. The following two tables display our results for the Blockchain group, indicating that returns on the event day t0 were slightly negative. Negative performance can also be observed for three days after the announcement. On the contrary, the control group performed on t0 positively but in a small magnitude of 0.00172. For the consequent four days, results change to negative, ranging from -0.00073 to -0.00318.

Before the announcement, only six out of 20 trading days recorded negative results. However, the development changed after the announcement when nine out of 20 trading days ended with negative returns.

As Tab. 3 presents, after the announcement, there was only one statistically significant day, and it was the day after the day of the announcement. A negative average abnormal return on the day t+1 (0.4%) can be interpreted as some fear or insecurity of investors about adopting new technology into a company's operations. According to the data, we could observe another three days, which showed statistical significance: days t-13, t-12 and t-11. Here the abnormal returns were positive, which can be interpreted as result of some insider information coming to the market before the announcement.

We tested statistical significance also in the case of the control group. Only the day t-5 was tested as significant on the 5% level of significance (average ARt-5 was +0.00622) and by 10% level of significance, there were another three days showing significance, t-13 (average ARt-13 was +0.00479) and t-10 (average ARt-10 was -0.00536).

In this event study analysis, we considered only blockchain announcements to be exclusive events that could affect the stock price, while other factors that may impact the stock price were not considered.

Table 2 – One-Sample Statistics – Blockchain Group

	N	Mean	Std. Deviation	Std. Error Mean		N	Mean	Std. Deviation	Std. Error Mean
t-20	30	0.0010	0.0159	0.0029	t+1	30	-0.0036	0.0094	0.0017
t-19	30	0.0037	0.0194	0.0035	t+2	30	-0.0018	0.0071	0.0013
t-18	30	0.0014	0.0104	0.0019	t+3	30	-0.0021	0.0180	0.0033
t-17	30	-0.0005	0.0086	0.0016	t+4	30	0.0008	0.0058	0.0011
t-16	30	0.0030	0.0104	0.0019	t+5	30	0.0013	0.0131	0.0024
t-15	30	-0.0016	0.0070	0.0013	t+6	30	0.0032	0.0155	0.0028
t-14	30	-0.0002	0.0104	0.0019	t+7	30	-0.0009	0.0129	0.0023
t-13	30	0.0075	0.0145	0.0026	t+8	30	-0.0018	0.0100	0.0018
t-12	30	0.0044	0.0093	0.0017	t+9	30	0.0009	0.0093	0.0017
t-11	30	0.0070	0.0188	0.0034	t+10	30	0.0020	0.0089	0.0016
t-10	30	0.0009	0.0125	0.0023	t+11	30	-0.0015	0.0101	0.0018
t-9	30	-0.0017	0.0111	0.0020	t+12	30	0.0022	0.0142	0.0026
t-8	30	0.0007	0.0087	0.0016	t+13	30	0.0030	0.0153	0.0028
t-7	30	-0.0027	0.0121	0.0022	t+14	30	-0.0002	0.0124	0.0023
t-6	30	0.0019	0.0112	0.0020	t+15	30	0.0029	0.0105	0.0019
t-5	30	-0.0008	0.0109	0.0020	t+16	30	-0.0014	0.0102	0.0019
t-4	30	0.0011	0.0137	0.0025	t+17	30	0.0018	0.0246	0.0045
t-3	30	-0.0027	0.0136	0.0025	t+18	30	0.0041	0.0187	0.0034
t-2	30	0.0000	0.0112	0.0020	t+19	30	0.0012	0.0102	0.0019
t-1	30	0.0014	0.0091	0.0017	t+20	30	-0.0013	0.0158	0.0029
t0	30	-0.0013	0.0091	0.0017					

Notes: N – Number of observations; Std. Deviation – Standard Deviation; Std. Error Mean – Standard Error Mean.

Table 3 – One-Sample T-Test – Blockchain Group

	t	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
t-20	0.355	0.725	0.00103	-0.00492	0.00698
t-19	1.032	0.311	0.00366	-0.00360	0.01092
t-18	0.754	0.457	0.00144	-0.00246	0.00533

	t	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
t-17	-0.316	0.754	-0.00049	-0.00370	0.00271
t-16	1.572	0.127	0.00299	-0.00090	0.00689
t-15	-1.26	0.218	-0.00161	-0.00423	0.00101
t-14	-0.116	0.909	-0.00022	-0.00411	0.00367
t-13	2.843	0.008[a]	0.00753	0.00211	0.01295
t-12	2.607	0.014[a]	0.00443	0.00096	0.00791
t-11	2.054	0.049[a]	0.00705	0.00003	0.01406
t-10	0.413	0.683	0.00094	-0.00373	0.00561
t-9	-0.858	0.398	-0.00173	-0.00586	0.00240
t-8	0.445	0.659	0.00071	-0.00254	0.00396
t-7	-1.22	0.234	-0.00268	-0.00720	0.00183
t-6	0.916	0.367	0.00187	-0.00231	0.00606
t-5	-0.420	0.678	-0.00084	-0.00493	0.00325
t-4	0.423	0.675	0.00105	-0.00404	0.00615
t-3	-1.10	0.280	-0.00274	-0.00782	0.00235
t-2	0.011	0.991	0.00002	-0.00415	0.00420
t-1	0.827	0.415	0.00137	-0.00202	0.00476
t0	-0.781	0.441	-0.00130	-0.00472	0.00211
t+1	-2.081	0.046[a]	-0.00355	-0.00705	-0.00006
t+2	-1.400	0.172	-0.00180	-0.00444	0.00083
t+3	-0.636	0.530	-0.00209	-0.00881	0.00463
t+4	0.723	0.476	0.00076	-0.00140	0.00293
t+5	0.552	0.585	0.00132	-0.00356	0.00619
t+6	1.140	0.263	0.00322	-0.00255	0.00899
t+7	-0.392	0.698	-0.00092	-0.00573	0.00388
t+8	-0.980	0.335	-0.00179	-0.00552	0.00194
t+9	0.554	0.584	0.00094	-0.00252	0.00439
t+10	1.246	0.223	0.00203	-0.00130	0.00536
t+11	-0.814	0.422	-0.00150	-0.00528	0.00227
t+12	0.848	0.403	0.00219	-0.00310	0.00749
t+13	1.071	0.293	0.00299	-0.00272	0.00870

	t	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
				Lower	Upper
t+14	-0.097	0.923	-0.00022	-0.00486	0.00442
t+15	1.507	0.143	0.00289	-0.00103	0.00680
t+16	-0.743	0.464	-0.00138	-0.00519	0.00243
t+17	0.410	0.685	0.00184	-0.00735	0.01103
t+18	1.186	0.245	0.00406	-0.00294	0.01106
t+19	0.641	0.527	0.00120	-0.00263	0.00502
t+20	-0.463	0.647	-0.00133	-0.00722	0.00455

Notes: Test value – 0; a, b indicate the 5 and 10 percent significance levels; T – value of t-statistic; Sig. (2-tailed) – two-tailed significance.

The following figures demonstrate abnormal returns of both analysed groups of companies and cumulative abnormal returns. As seen in Fig. 2, the day of the announcement caused negative abnormal returns – according to our data, this occurred by 18 out of 30 companies, and this trend continued for the next three days. The biggest loss suffered by Volkswagen (abnormal return ARt0 was -2.56%, and the actual return on that day Rt0 was -1.92. The biggest decline abnormal on the day t+1 had Deutsche Bank (ARt+1 -2.69%) and Morgan Stanley (ARt+1 -2.15%)

For the selected sample of blockchain companies and the control group, the data in the selected period showed a similar direction of stock price movements. The only difference was the magnitude of abnormal returns.

In Figure 3, we can track the development of cumulative abnormal returns. We see that CAR was more or less positive during the event window, which is also similar to the general market development between 2015 and 2019, where we observed an increasing trend. Additionally, we can see outperformance between the blockchain-adopting companies and their peer companies between days t-16 and t0, which we can interpret as positive expectations of investors about coming announcements since insider information is common practice on the market.

However, these results show that investors do not yet assign such an important role in this technology probably because they cannot estimate the long-term impact. Thus they approach this information rather more cautiously.

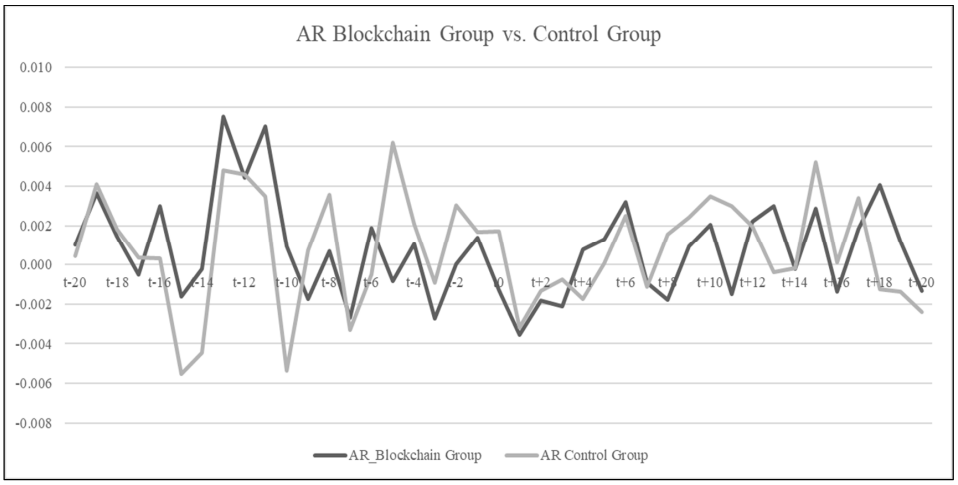

Figure 2 – Abnormal Returns

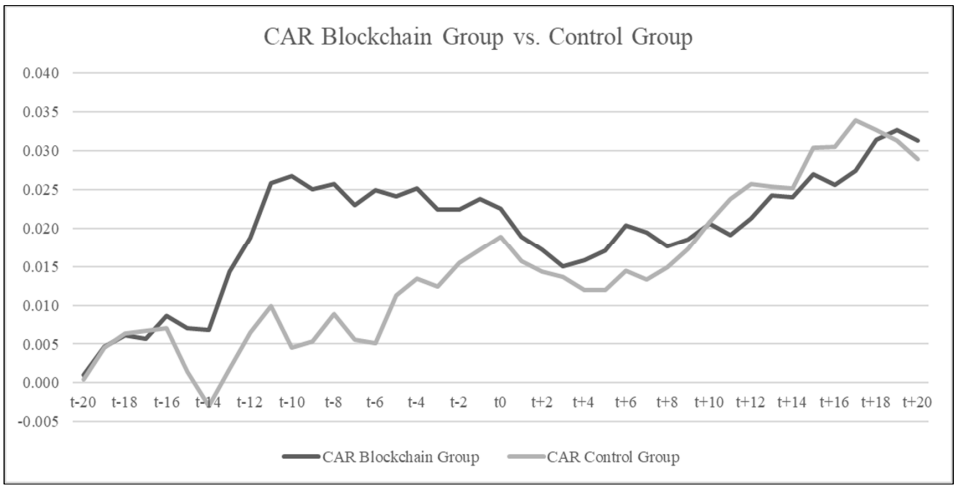

Figure 3 – Cumulative Abnormal Returns

To check the robustness of our data, we also calculated the cumulative abnormal returns of each company and tested different event windows to find out whether there were some statistically significant periods. Those observed intervals were <-20,+20>; <-15,+15>; <-10,+10>; <-5,+5>; <-2,+2>; <-1,+1>; <-5,+10>; <-5,+15>; <-5,+20>. Within the blockchain group, five out of nine intervals were slightly negative on average (Tab. 4), while the control group's results were slightly positive on average.

Shorter periods around the event day, mostly between t-10 and t+10, were negative. However, longer intervals above ten days prior to and after the event showed positive results of abnormal returns.

As presented in Tab. 5, no interval showed statistical significance. The same procedure we have done with the control group. After performing statistical tests in SPSS software, results showed that no event window was statistically significant.

Table 4 – One-Sample Statistics – Various Event Windows – Blockchain Group

	N	Mean	Std. Deviation	Std. Error Mean
<-20,+20>	30	0.031321	0.118237	0.021587
<-15,+15>	30	0.018313	0.073109	0.013348
<-10,+10>	30	-0.005217	0.049348	0.009010
<-5,+5>	30	-0.007796	0.035402	0.006464
<-2,+2>	30	-0.005267	0.018841	0.003440
<-1,+1>	30	-0.003487	0.014663	0.002677
<-5,+10>	30	-0.004325	0.037792	0.006900
<-5,+15>	30	0.002025	0.054756	0.009997
<-5,+20>	30	0.006407	0.077646	0.014176

Notes: N – Number of observations; Std. Deviation – Standard Deviation; Std. Error Mean – Standard Error Mean.

Table 5 – One-Sample T-Test – Various Event Windows – Blockchain Group

	Test Value = 0	df	Sig. (2-tailed)	Mean Difference	95% Confidence Interval of the Difference	
	T				Lower	Upper
<-20.+20>	1.451	29	0.158	0.031321	-0.012829	0.075472
<-15.+15>	1.372	29	0.181	0.018313	-0.008987	0.045612
<-10.+10>	-0.579	29	0.567	-0.005217	-0.023644	0.013210
<-5.+5>	-1.206	29	0.238	-0.007796	-0.021015	0.005423
<-2.+2>	-1.531	29	0.137	-0.005267	-0.012302	0.001768
<-1.+1>	-1.303	29	0.203	-0.003487	-0.008962	0.001988
<-5.+10>	-0.627	29	0.536	-0.004325	-0.018436	0.009787
<-5.+15>	0.203	29	0.841	0.002025	-0.018421	0.022472
<-5.+20>	0.452	29	0.655	0.006407	-0.022587	0.035400

Notes: Test value – 0; T – value of t-statistic; Sig. (2-tailed) – two-tailed significance.

5 CONCLUSIONS

The popularity of blockchain as one of the Quality 4.0 instruments has grown rapidly in business and academic communities. It has the potential to enhance the data transparency and quality which optimises company operations and thus increase value for shareholders. This paper aimed to analyse the impact of blockchain announcements on selected international companies using an event study approach. Our objective was to answer the following research question set at the beginning of our analysis.

RQ: Is there any reaction in stock prices after the company officially announces the application of blockchain technology in its operations?

H0: There has been no reaction in stock prices after the company's announcement regarding blockchain implementation.

Using the event study approach and SPSS software we analysed our data sample consisting of two groups of sixty companies in total. Within the blockchain group. three days before the event were statistically significant with positive results (t-13. t-12 and t-11). which can be interpreted as some insider information or signals spread on the market about planned announcements. However, after the event only the first day after the announcement (t+1) was tested as statistically significant with a negative reaction (-0.4%). This can be connected to cautious investors on the market when talking about some new technology as blockchain. where current knowledge is probably not sufficient yet. and the technology needs to be explored more.

According to our data. there was no reaction on the market after the announcement. and the significance of t+1 day was rather random as systematic. Thus we do not reject the null hypothesis. and we can summarise that there has been no reaction in stock prices after the company's announcement regarding blockchain implementation.

The importance and maturity of blockchain will rise in the next years. and thus every additional study around this topic will be important to extend the pool of knowledge. Once it is properly established in the market. evaluating its long-term impact on companies will be interesting. Therefore. we hereby encourage researchers to analyse in the future the results on a long-term basis to conclude whether the blockchain positively influences companies' operations and whether this technology is worth investment of such considerable financial resources.

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CONFLICTS OF INTEREST

The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection. analyses. or interpretation of data; in the writing of the manuscript. or in the decision to publish the results.