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Contents

COVID-19 SHOCK: THE SHORT-TERM IMPACT ON THE EUROPEAN AND AMERICAN FINANCIAL MARKETS

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Abstract: *The new coronavirus has very seriously shaken the behavior of global financial markets. Globally, the COVID-19 shock is considered severe, even compared to the Great Financial Crisis that took place in 2007-2008. Considering the persistence of the virus, this study is designed to investigate the short-term impact of COVID-19 upon financial markets of Europe and the United States (US) in the entire year of 2020. In the research we used daily data from the period 1st January - 31st December 2020 and linear regression. The stock markets indices selected in the sample were: European stock indices DAX30, FTSE100 and CAC40 and the American stock indices DJI and S&P500. The study's results showed that there is a significant relationship between the number of new daily cases of COVID-19 and the considered stock market indices. But there is a much stronger correlation between oil prices and stock indices than between the number of COVID-19 new cases and stock indices. We conclude that the market has been intensely agitated at a terrible level. The American, London, French and German stock markets reacted negatively to the increase in confirmed cases of COVID-19 and to the price of oil. So, the market reaction with respect to the number of COVID-19 new daily cases is significant.*

Keywords: COVID-19 pandemic, European stock indices, US stock indices, oil prices, financial markets behaviour.
JEL classification: G01, G09, G14 and G41.

1. Introduction

The coronavirus disease (COVID-19) has affected the global economy and also, has led to massive losses on international capital markets: in the period of February 24th-28th, 2020, the FTSE100 index decreased by 13%, while the S&P500 and DJIA indices decreased by 11-12%, this being the largest decrease since the financial and economic crisis of 2007-2008 (Dias et al., 2020); also, important share indexes lost about 10% of their value in only one day (on Monday, March 9th, 2020), this being the highest daily loss since the terrorist attack of September 11th, 2001. The losses were not so large, even in the well-known financial market crisis and in Lehman's bankruptcy (Daube, 2020). UK stock markets have proved that short-term health management system deficiencies imperatively impact the London stock (Shehzad et al., 2020). Capital markets tend to have an overreaction to data

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and information accessed in the short term, and sometimes, the reactions are the result of the uncertainty heard by investors during a global outbreak (Dias et al., 2020).
Considering the rapid spread of COVID-19, changes in stock prices reflect market expectations of a number of effects, including changes in final demand (people buy more from some items and less from others), changes in intermediate demand and restrictions on supply (e.g. supply chain interruptions). As a result, the economic circle around the world has been disrupted. In particular, sales of online travel agencies (Online Travel Agencies), airlines and hotels fell unexpectedly (World Economic Forum, 2020). Due to the global financial system and the unstable political climate, oil price shocks are spreading rapidly in the capital markets. The pandemic has had a very negative influence on the global economy, as well as on the social and cultural life of people (Moore and Kolencik, 2020; Thompson, 2020).
This study examines the effect of the recent pandemic disease upon the stock markets, and, in particular, the COVID-19 effect upon the main stock markets in Germany, France, the United Kingdom and the United States. The implications of our study are important for the main players of the stock market to understand and predict the behavior of stock market returns during a pandemic disease. Stock markets data are available much faster than official data on, for example, unemployment, GDP growth or government debt. Indeed, they are updated second by second, as investors react instantly to the latest events, with stock exchanges being a valuable and timely source of information.
Our aim is to investigate the impact of COVID-19 upon financial markets through stock indices in Germany (DAX30), France (CAC40), Great Britain (FTSE100) and the USA (DJI and S&P500) for the period January 1st - December 31st, 2020, using an explanatory analysis and also an econometric analysis based on 252 daily values considered for each variable. Regarding the independent variables, we used the price of crude oil WTI (WTI) and the number of new global daily cases of COVID-19 (Cov).
To the existing literature in the field, this study will be very useful for the financial sector and is a support for investors in the capital markets. This paper adds a main contribution to the literature: together with the daily increase in confirmed cases of COVID-19, the evolution of the crude oil price as an independent variable was added, because the price of oil affects asymmetrically many crude oil companies and countries and, in our days, the price of oil has a significant influence on the inflation rate and, consequently, on the prices of goods and services in worldwide economy.
The study's results showed a significant connection between the number of COVID-19 new cases and the European and American stock indices DAX30, FTSE100, DJI and S&P500. But there is a much stronger correlation between oil prices and stock indices than between the number of COVID-19 new cases and stock indices.

2. Literature review

Stock indices react very quickly to various events. Previous studies have identified several major events that have affected stock markets, for example disasters (Kowalewski and Śpiewanowski, 2020, Lee and Chen, 2020), sports (Buhagiar et al., 2018), some news (Hussain and Ben Omrane, 2020, Li, 2018), environmental events (Alsaifi et al., 2020; Guo et al., 2020) and some political events (Bash and Alsaifi, 2019; Shanaev and Ghimire, 2019).
Stock market indices may also react to pandemic diseases. For example, the epidemic of severe acute respiratory syndrome (SARS) (Chen et al., 2007, 2009) and the epidemic of Ebola virus disease (EVD) (Ichev and Marinč, 2018).
Corbet et al. (2021) examines the associations between the indices of the Chinese stock market and Bitcoin yields during the time of the COVID-19 pandemic. Analysing all the shares of the firms included in the Hang Seng Index (HIS) and Shanghai Stock Exchange Composite Index (SHCOMP) during the pandemic COVID-19 (January 10th - March 16th,

2020), Al-Awadhi et al. (2020) found that this pandemic negatively interacts with stock market returns, i.e. stock returns are significantly negative as the number of confirmed daily cases increases. Their tests suggest that despite the pandemic, some sectors of the economy performed better than others during the COVID-19 outbreak, especially in the information technology and medicine production sectors.

Based on the GARCH model, Onali (2020), investigated the COVID-19 cases for the period April 8th, 2019 - April 9th, 2020 and their impact on the US stock market, selecting DJI and S&P500 indices. Their results suggest that changes in the number of COVID-19 cases in the US and other six countries severely affected by the COVID-19 crisis do not impact US stock market returns, apart from the number of cases reported for China.

Using daily data from 20th January to 20th May 2020 and ten industry groups in the United Kingdom, Sherif (2020) found a strong and statistically significant relationship of the COVID-19 pandemic with the performance of the conventional stock market index, and that the disease interacts negatively and insignificantly with the Dow Jones faith-based ethical (Islamic) index compared to its counterpart from UK.

Ruiz Estrada et al. (2020) investigated ten stock markets (S&P500, TWSE, SHE, Nikkei 225, DAX, HIS, UK-FTSE, KRX, SGX and Malaysia) and the impact of the pandemic on their performance, considering an epidemic period of 150 days, to assess the determinants of capital market behavior in the event of an infectious disease. Their results show that the epidemic could be disastrous for the economies of all countries and could cause damage similar to the 1929 crisis on the ten stock markets analyzed. Also, Chikri et al. (2020) proved that stock market values are very sensitive to the positive and negative shocks that occurred through COVID-19, and that the financial market has negative reactions related to the evolution of the epidemic.

A negative impact on US and European stock markets generated by the spread of COVID-19 was found in the results of He et al. (2020). Although the disease spread in China has gradually stabilized, it has begun to appear in other countries. During that global spread, China's stock market suffered a blow due to the spread effect. The impact of COVID-19 on the EU and US stock markets had a decreasing effect on the Asian stock markets, especially on the stock market of China.

Khan et al. (2020) investigated the impact upon stock markets of the COVID-19 pandemic, based on efficient market theory and intertemporal asset price theory, using pooled OLS, t-test and Mann-Whitney test. They found that the main stock market indices of the countries included in the study were negatively affected by COVID-19.

Zeren and Hizarci (2020) investigated the relationships between COVID-19 deaths and the number of daily COVID-19 illnesses versus investor behavior in the stock markets of China, South Korea, Italy, France, Germany and Spain. The study shows that the number of COVID-19 deaths affected all six markets analyzed, while the number of diseases did not affect the stock markets of Italy, France and Germany. Contrary to these, Sansa (2020) showed that there is a significant relationship between COVID-19 illnesses and financial markets from China and the USA (SHE and DJI) in the period March 1st - March 25th of 2020.

Arouri and Nguyen (2010) studied the impact of changes in oil prices on European shares and found that there is a significant connection between oil prices and European capital markets. Lee and Chiou (2011) developed a two-step methodology to examine the impact of oil shocks on stock markets and found that when there are registered significant fluctuations in oil prices (WTI), these unexpected asymmetric price changes lead to negative effects on S&P500 returns, but the results are not similar when there are lower oil price fluctuations. The stock markets have a strong reaction to the COVID-19 because of its potential to upset cross-border supply chains (Baker et al., 2020). Mazur et al. (2021) investigated the US stock market performance during the March 2020 collapse triggered by COVID-19 and found that stocks of companies from sectors such as natural gas, healthcare,

food and software registered high positive returns, while stocks of the companies acting in the oil, entertainment, hospitality and real estate sectors were reducing dramatically.
So, the main questions in this paper are:
1. Do the cases of COVID-19 diseases affect the indices of the European and American stock markets (DAX30, FTSE100 and CAC40, and respectively DJI and S&P500)?
2. Does the price of oil affect the indices of the European and American stock markets (DAX30, FTSE100 and CAC40, and respectively DJI and S&P500)?

3. Data and Methodology

In this study we used as dependent variables, the rates of the European FTSE100, DAX30, CAC40, and American DJI and S&P500 stock markets indices and, as independent variables the Crude Oil Price (WTI) and the number of global new daily COVID-19 cases (Cov). The explanatory and econometric analysis was based on the data from 1st of January to 31st of December 2020, in order to investigate the short-term relation between the stock market indices and the independent variables WTI and Cov. For each variable, 252 daily values were considered. The data used in the study were collected from https://www.cnbc.com and https://www.bloomberg.com/, and the statistical package EViews was used for econometric analysis. A summary of statistics for these variables is given in Table 1.

Table 1. Descriptive statistics for variables analysed

Variable	Mean	Std. Dev.	Min.	Max.
DAX30	12303,65	1227.33	8441.71	13789.00
FTSE100	6268.58	610.77	4993.89	7674.56
CAC40	5063	544.9	3754.84	6111.24
DJI	26779.68	2485.02	18591.92	30303.36
S&P500	3201.59	311.18	2237.39	3722.47
WTI	39.35	11.31	-37.63	63.27
Cov	215082	194637.57	0	729899

Source: Authors' analysis

Examining the data shown in Table 1 we found that the average rate of CAC40 is 5063, the minimum value being 3754.84. Related to the evolution of the crude oil price (WTI), we can see that it touched an historical minimum of -37.63. This happened on the date of April 20th (Figure 1). With an initial value of 0 cases, the new daily COVID-19 cases come to a maximum value of 729899 (Figure 2), with a daily average of 215082.

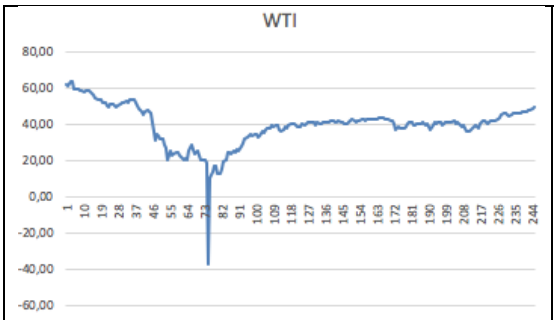


Figure 1: Evolution of the oil price for 2020
Source: Source: https://www.cnbc.com and https://www.bloomberg.com/

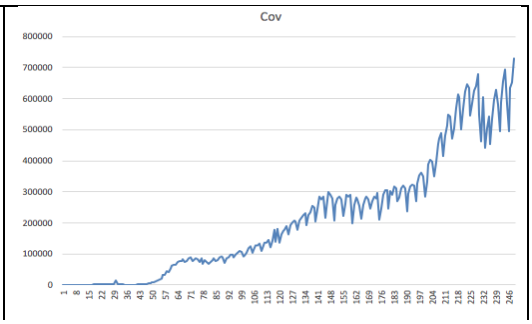


Figure 2: Evolution of the number of new daily cases of COVID-19 for 2020
Source: Source: https://www.cnbc.com and https://www.bloomberg.com/

A graphic representation of the stock indices evolution with 252 values (daily calculated starting at 1st of January until 31st of December 2020) is presented in Figure 3. As we observe, the trend is decreasing at the beginning, until April 20th, and increasing during the next eight months. This leads us to consider the possibility of a structural break in the evolution of these values.

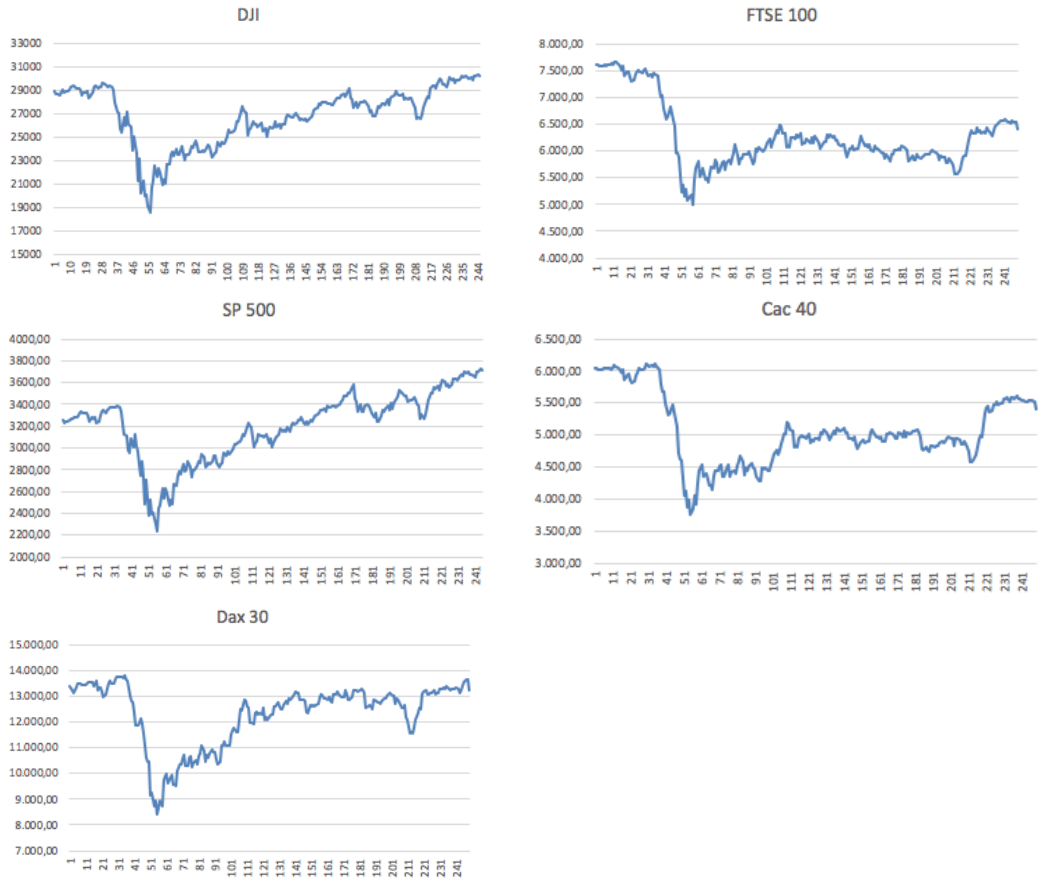


Figure 3: The indexes evolutions for the considered period
Source: https://www.cnbc.com and https://www.bloomberg.com/

In our study, we will consider three dummy variables in order to indicate the absence or presence of some categorical effect that may be expected to shift the outcome:
• the appearance of the pandemic: March 6-16 (D1);
• announcements regarding the discovery of the vaccine: November 2-9 (D2);
• consolidation of Joe Biden's victory in the US elections: November 23-24 (D3).
The selected model for examining the impact of chosen independent variables on stock market indices is multiple regression, expressed as a linear relationship:

$$y_i = \beta_1 x_{1i} + \beta_2 x_{2i} + \ldots + \beta_p x_{pi} + u_i, \quad (1)$$

where i=1,…,n, and y_i represents the values of the explained variable Y and x_{1i}, x_{2i},…,x_{pi} are the values of the independent variables X_1,…,X_p. The coefficients β_1, β_2,…, β_p are the parameters used in the regression model, and u_i are the residual variable values.

4. Results and discussions

4.1. Interpretation of the obtained results

In this section, we outlined the components of the multiple regression model, including key indicators and tests that assess the validity and quality of the associated equation. Following the creation of the group based on the previously discussed variables, we established the equation for the multiple regression model, incorporating the relevant values for each stock market index (FTSE, DAX, CAC40, DJI and S&P500) as dependent variables, and Crude Oil Price (WTI), the number of global new daily COVID-19 cases (Cov) and the dummy variables (D1, D2, D3) as independent variables, defining also the constant C, related to the effect of other external factors affecting the stock indices that were not included in this analysis. The parameter estimates in the regression model were determined using the least squares method.

The values obtained, which reflect both the coefficients of the variables in the regression model and the results from the tests, are shown in Table 2.

Table 2: Estimations results

Dependent Variable: DAX30				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	80.6167	3.6023	22.3793	0.0000
Cov	-0.0019	0.0002	-7.5102	0.0000
D1	-1448.9643	248.6901	-5.8264	0.0000
D2	389.0101	209.8603	1.8537	0.0650
D3	72.9149	457.6089	0.1593	0.8735
C	8796.8073	153.2374	57.4064	0.0000
R-squared	0.737880			
Adjusted R-squared	0.732396			
Prob(F-statistic)	0.000000			

Dependent Variable: FTSE100				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	41.3322	1.8949	21.8126	0.0000
Cov	-0.0014	0.0001	-10.4427	0.0000
D1	-566.9693	130.8158	-4.3341	0.0000
D2	278.6913	110.3905	2.5246	0.0122
D3	325.4571	240.7111	1.3521	0.1776
C	4926.9997	80.6058	61.1246	0.0000
R-squared	0.721169			
Adjusted R-squared	0.715126			
Prob(F-statistic)	0.000000			

Dependent Variable: CAC40				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	39.2237	1.7089	22.9530	0.0000
Cov	-0.0003	0.0001	-2.9536	0.0025
D1	-437.2471	117.9746	-3.7063	0.0003
D2	181.8965	99.5544	1.8271	0.0689

D3	385.2672	217.0824	1.7748	0.0772
C	3590.1150	72.6934	49.3871	0.0000
R-squared	0.712428			
Adjusted R-squared	0.706203			
Prob(F-statistic)	0.000000			

Dependent Variable: DJI				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	150.6651	6.9708	21.6139	0.0000
Cov	0.0051	0.0004	11.5345	0.0000
D1	-2342.2761	426.3921	-5.4932	0.0000
D2	268.7009	492.8633	0.5452	0.5861
D3	1020.3123	982.0743	1.0389	0.2999
C	19867.6219	294.5303	67.4553	0.0000
R-squared	0.762468			
Adjusted R-squared	0.757498			
Prob(F-statistic)	0.000000			

Dependent Variable: S&P500500				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	15.1740	0.7882	19.2510	0.0000
Cov	0.0010	0.0000	19.3910	0.0000
D1	-283.2743	48.2143	-5.8753	0.0000
D2	65.9206	55.7306	1.1828	0.2380
D3	104.5966	111.0481	0.9419	0.3472
C	2411.3758	33.3040	72.4049	0.0000
R-squared	0.806322			
Adjusted R-squared	0.802270			
Prob(F-statistic)	0.000000			

Source: Authors' analysis

One key assumption of any time series model is that the underlying process remains consistent across all observations in the sample. Therefore, it is essential to thoroughly analyze time series data that includes periods of significant change, as seen in the stock indices in Figure 3. A particularly useful tool for this analysis is the Chow test. The null hypothesis for this test posits that there is no break point, meaning the data can be represented by a single regression line. We assumed there was no structural break between the first four months and the last eight months of the period. However, upon applying the Chow test, we found that the null hypothesis is rejected, indicating that the regression is not stable across the examined data sets. Due to this structural break, we will proceed to estimate the model for January 1st – April 20th (section 4.3), respectively April 21st – December 31^{st,} 2020 (section 4.4).

4.2. An overview of the entire considered period

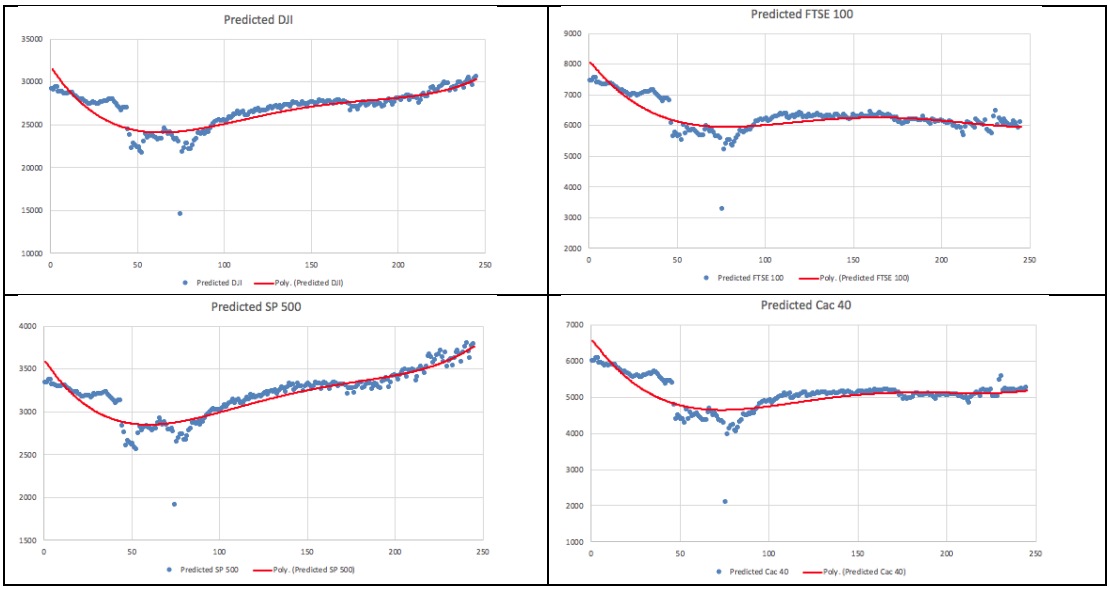
Table 2 reveals a linear relationship between each independent variable (FTSE, DAX, CAC40, DJI, and S&P500) and its explanatory factors, all statistically significant at the 1% significance level (Prob(F-statistic) = 0.000). The signs of WTI and Cov coefficients are the expected ones, the sign of WTI being positive for all the stock indices and the sign of Cov is negative in the case of European stock indices. This means that if the first component

increases, the stock market values will also increase. And if the Cov variable increases, the values of the European stock market indices will decrease. The signs of dummy variables are also those expected for all five variables, so we have mathematical confirmation that the appearance of the pandemic has led to a sharp decline in all stock indices. The presence of non-zero values of D2 and D3 leads, as expected, to an increase in the dependent variables. All these considered variables explain the level of each stock index in percentages between 71.24% (R-squared = 0.712428 for CAC40) and 80.63% (R-squared = 0.806322 for S&P500).

Thus, based on the values presented, we can conclude that the linear multiple regression model is appropriate for the correlation and the interdependence between the stock indices and the considered independent variables: WTI Crude Oil Price (WTI), the number of global new daily COVID-19 cases (Cov) and D1, D2, D3. However, as previously noted, this regression is not stable according to the Chow test. Therefore, we will divide the January-December period into two segments and analyse each part separately in the following subsections.

In Table 2, we can find the parameters estimated that measure the contribution of the independent variable to the dependent variable. Hence, the regression equations will be:

$$\begin{aligned}
DJI &= 150.66 * WTI + 0.0051 * Cov - 2342.27 * D_1 + 268.70 * D_2 + 1020.31 * D_3 \\
&\quad + 19867.62 \\
S\&P500 &= 15.17 * WTI + 0.0010 * Cov - 283.27 * D_1 + 65.92 * D_2 + 104.59 * D_3 \\
&\quad + 2411.37 \\
DAX30 &= 80.61 * WTI - 0.0019 * Cov - 1448.96 * D_1 + 389.01 * D_2 + 72.91 * D_3 \\
&\quad + 8796.80 \\
FTSE100 &= 41.33 * WTI - 0.0014 * Cov - 566.96 * D_1 + 278.69 * D_2 + 325.45 * D_3 \\
&\quad + 4926.99 \\
CAC40 &= 39.22 * WTI - 0.0003 * Cov - 437.24 * D_1 + 181.89 * D_2 + 385.26 * D_3 \\
&\quad + 3590.11
\end{aligned} \tag{2}$$



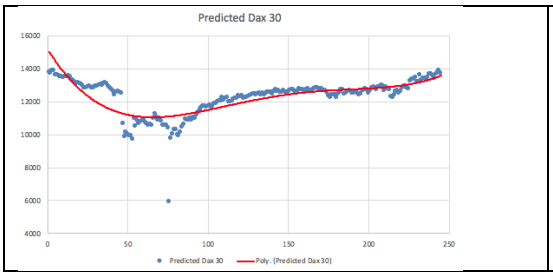


Figure 4: The graphic representations of the regression models for the year 2020
Source: Authors' analysis

As shown in Figure 4, the trend lines for the predicted stock index values do not follow a linear pattern. This observation supports the need for a separate analysis of each period January 1st – April 20th, respectively April 21st – December 31st, 2020.

4.3. The model for the January 1st – April 20th period

In Table 3 was presented the pairwise correlations of the stock indices (FTSE, DAX, CAC40, DJI and S&P500), Crude Oil Price (WTI) and the number of global new daily COVID-19 cases (Cov).

Table 3: Correlation matrixes between stock indices, oil prices and the number of cases of Covid

DJI					S&P500			
	DJI	*WTI*	*Cov*			*S&P500*	*WTI*	*Cov*
DJI	1				S&P500	1		
WTI	0,9076	1			WTI	0,8889	1	
Cov	-0,6603	-0,8408	1		Cov	-0,6408	-0,8408	1

DAX30					FTSE100			
	DAX30	*WTI*	*Cov*			*FTSE100*	*WTI*	*Cov*
DAX30	1				FTSE100	1		
WTI	0,9256	1			WTI	0,9560	1	
Cov	-0,6903	-0,8408	1		Cov	-0,7304	-0,8408	1

CAC40			
	CAC40	*WTI*	*Cov*
CAC40	1		
WTI	0,9482	1	
Cov	-0,7298	-0,8408	1

Source: Authors' analysis

We found strong correlations between the evolution of stock indices and the other two variables. Table 3 shows that there is a much stronger correlation between Crude Oil Price (WTI) and stock indices than between Cov and stock indices. Also, our calculations confirm a very close connection between the price of oil (WTI) and the evolution of the number of cases of COVID 19 (Cov), the correlation coefficient for these two variables being -0.8408.
As we can see in Figure 3, the values of all the five stock market indices considered had a downward trend between January and April. The regression model values for this period are presented in Table 4.

Table 4: Estimations results for January 1st – April 20th period

Dependent Variable: DJI				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	254.2652	24.4528	10.3982	0.0000
Cov	0.0282	0.0117	2.4190	0.0182
D1	-875.7105	599.9717	-1.4596	0.0989
C	14699.4546	1315.2814	11.1759	0.0000
R-squared	0.863743			
Adjusted R-squared	0.857903			
Prob(F-statistic)	0.000000			

Dependent Variable: S&P500				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	25.2955	2.7568	9.1757	0.0000
Cov	0.0028	0.0013	2.1052	0.0289
D1	-111.7313	67.6402	-1.6518	0.0830
C	1882.0809	148.2835	12.6924	0.0000
R-squared	0.835119			
Adjusted R-squared	0.828053			
Prob(F-statistic)	0.000000			

Dependent Variable: DAX30				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	131.1758	11.1530	11.7615	0.0000
Cov	0.0124	0.0053	2.3107	0.0238
D1	-526.8214	306.6831	-1.7178	0.0703
C	6117.1249	596.5856	10.2536	0.0000
R-squared	0.888796			
Adjusted R-squared	0.880738			
Prob(F-statistic)	0.000000			

Dependent Variable: FTSE100				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	68.5107	4.4093	15.5379	0.0000
Cov	0.0050	0.0021	2.3827	0.0199
D1	-270.7869	121.2449	-2.2334	0.0288
C	3679.9921	235.8557	15.6027	0.0000
R-squared	0.937345			
Adjusted R-squared	0.932805			
Prob(F-statistic)	0.000000			

Dependent Variable: CAC40				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	57.8697	4.3310	13.3618	0.0000
Cov	0.0035	0.0021	1.6666	0.0801
D1	-278.5859	119.0919	-2.3393	0.0222
C	2783.7940	231.6675	12.0163	0.0000

R-squared	0.921547			
Adjusted R-squared	0.915862			
Prob(F-statistic)	0.000000			

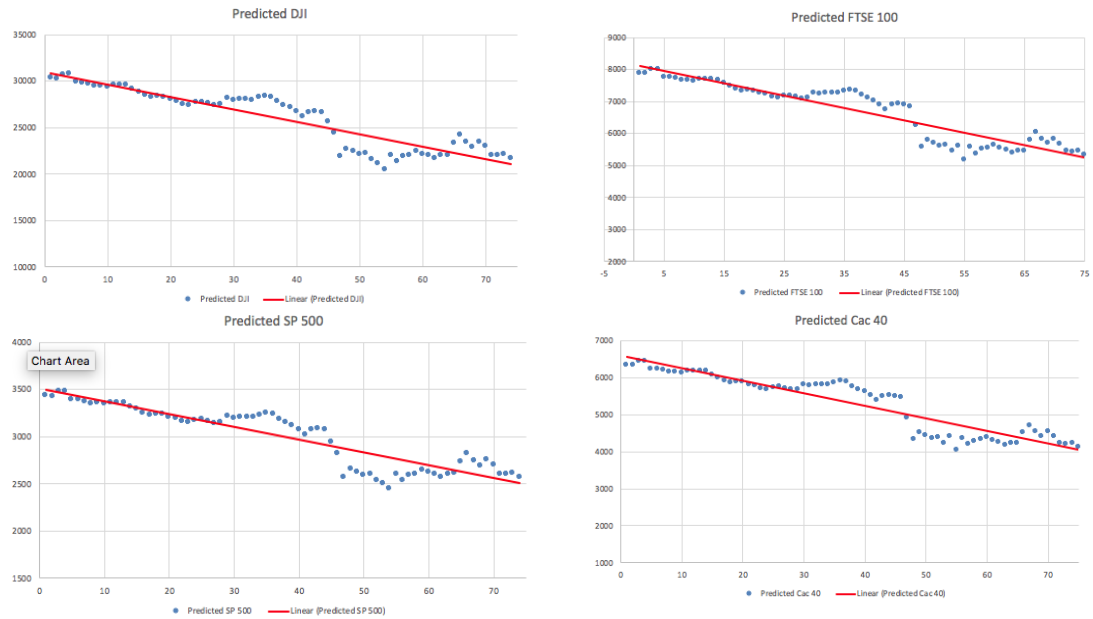
Source: Authors' analysis

Here, we present the components of the multiple regression models along with values for various indicators and tests that assess the reliability and quality of the equations associated with these models. Based on the results of these tests, we can conclude that the correlation and interdependence between the stock indices and the independent variables are effectively represented by linear multiple regression models. Also, we see here high values of R-squared, which means that the variables studied explain the level of each stock index in percentages between 83.51% (for S&P500) and 93.73% (for CAC40). The regression equation will be:

$$\begin{aligned} DJI &= 254.26 * WTI + 0.0282 * Cov - 875.71 * D_1 + 14699.45 \\ S\&P500 &= 25.29 * WTI + 0.0028 * Cov - 111.73 * D_1 + 1882.08 \\ DAX30 &= 131.17 * WTI + 0.0124 * Cov - 526.82 * D_1 + 6117.12 \\ FTSE100 &= 68.51 * WTI + 0.0050 * Cov - 270.78 * D_1 + 3679.99 \\ CAC40 &= 57.86 * WTI + 0.0035 * Cov - 278.58 * D_1 + 2783.79. \end{aligned} \quad (3)$$

We can say that an increase by one unit of WTI leads to an increase in stock indices between 25.29 units (for S&P500) and 254.26 units (for DJI). We can affirm that there was a correlation and interdependence between stock market indices and independent variables, which was also demonstrated by Sherif (2020) and Chikri et al. (2020). We also notice that the dummy variable D1 drastically influences negatively, as expected, the evolution of all stock indices.

Figure 3 illustrates the predicted stock index values based on equation (3) for 75 daily calculations from January 1 to April 20, 2020. In this figure, the trend line for each predicted index value shows a downward linear pattern.



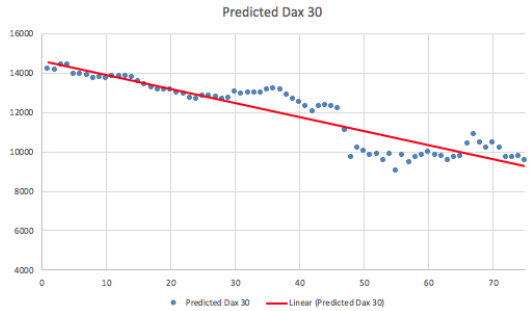


Figure 3: Graphic representations of the regression models for 1st of January until 20th of April 2020 period
Source: Authors' analysis

In order to strengthen and argue the evolution of the indices presented in Figure 3, we will give a synthesis of the events that took place worldwide between January 1st and April 20th, 2020. (Source: https://bfpg.co.uk/2020/04/covid-19-timeline and https://www.ecdc.europa.eu/en/covid-19/timeline-ecdc-response, https://www.economica.net):

- January 24th: In France was reported the first European case;
- January 28th: Germany also reported cases involving a person who visited China;
- January 30th: The initial outbreak of COVID-19 was designated a public health emergency of international concern by the World Health Organization (WHO) in 2020;
- February 22nd and in the next days: groups of cases were reported by the Italian authorities in several regions (Lombardy, Piedmont, Veneto, etc.). Over the next week, cases of COVID-19 were reported by several European countries.
- February 14th: The first coronavirus death in Europe was announced in France - a Chinese tourist of 80-year-old. This was the fourth death from the virus registered outside mainland China;
- February 24th: The Trump administration is requesting $1.25 billion from Congress for a coronavirus response, with 35 confirmed cases and no reported deaths in the US;
- March 8th: In the most affected regions, Italy issued a decree to install strict public health measures, including social distancing. On 11 March 2020, these measures were extended at national level. Then, similar public health measures were installed in Spain, France and many other European countries;
- March 11th: The US blocks travel from European countries other than the UK for 30 days, the WHO (2020) declares the virus a global pandemic and stock markets plunge;
- March 17th: France imposes a nationwide lockdown;
- April 8th: The expert opinion on the use of face masks in public by individuals who are not ill to reduce the transmission of COVID-19 was provided by the European Centre for Disease Prevention (ECDC). This opinion was translated into 26 languages;
- April 17th: US President Donald Trump announces that the US will be reopened in phases;
- April 20th: For the first time in history, oil prices fall below zero (negative) in US. The coronavirus pandemic has hit economic activity worldwide and reduced oil demand. Thus, a buyer ended up receiving money to buy oil. The WTI oil price, a benchmark for the US market, recorded a historic collapse of 305% on April 20th, 2020 and, for the first time in the history of statistics, turned negative.

4.4. The model for April 21st – December 31st 2020

We developed a multiple regression model using data from April 21 to December 31, during which stock index values showed an upward trend. This was done to assess whether the same independent variables exert a stronger influence on the stock market indices, akin to the previous model.

We will apply the same techniques mentioned earlier to analyse the specified period, and the same dependent and independent variables, measured in the statistical interval considered. Also, here are presented the dummy variables D2 representing the influence of the announcements regarding the discovery of the vaccine against COVID-19 (November 2-9), respectively D3 regarding the consolidation of Joe Biden's victory in the US elections (November 23-24).

By employing the same technique outlined earlier with EViews software, we obtained the coefficients for the model variables and the test results, which we present in Table 5. The R-squared statistic shows that between 77.42% (FTSE100) and 88.61% (S&P500) from the stock indices values is explained by the considered independent variables. Testing of the obtained models was realized by using the Fisher test, F-statistic, and its associated probability Prob(F-statistic). The econometric models of multiple regression using stock indices as dependent variables are correct and can be used in the analysis of Stock Market Index forecasts.

Table 5: Estimations results for April 21st – December 31st period

Dependent Variable: DJI				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	114.2322	10.2494	11.1452	0.0000
Cov	0.0063	0.0005	13.9958	0.0000
D2	567.8065	310.0999	1.8310	0.0689
D3	1262.1687	601.9709	2.0967	0.0375
C	20910.4130	333.1148	62.7724	0.0000
R-squared	0.841437			
Adjusted R-squared	0.837593			
Prob(F-statistic)	0.000000			

Dependent Variable: S&P500				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	14.6315	1.2382	11.8166	0.0000
Cov	0.0009	0.0001	16.1479	0.0000
D2	56.2838	37.4626	1.5024	0.1349
D3	103.7750	72.7230	1.4270	0.1555
C	2470.8809	40.2430	61.3990	0.0000
R-squared	0.868150			
Adjusted R-squared	0.864953			
Prob(F-statistic)	0.000000			

Dependent Variable: DAX30				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	91.5969	5.2785	17.3529	0.0000
Cov	0.0008	0.0002	3.2268	0.0015
D2	53.0574	130.9241	0.1691	0.2440

D3	43.0150	270.8267	0.1588	0.8740
C	8744.4466	169.3577	51.6330	0.0000
R-squared	0.798977			
Adjusted R-squared	0.794190			
Prob(F-statistic)	0.000000			

Dependent Variable: FTSE100				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	14.6731	2.7831	5.2722	0.0000
Cov	0.0002	0.0001	0.8481	0.1976
D2	84.3282	69.0313	1.2216	0.1236
D3	180.9965	142.7966	1.2675	0.1670
C	5502.1028	89.2958	61.6166	0.0000
R-squared	0.774287			
Adjusted R-squared	0.757008			
Prob(F-statistic)	0.000000			

Dependent Variable: CAC40				
Explanatory variable	Coefficient	Std. Error	t-Statistic	Prob.
WTI	20.7879	2.5232	8.2387	0.0000
Cov	0.0008	0.0001	7.2171	0.0000
D2	95.2342	62.5839	1.5217	0.1300
D3	269.5908	129.4597	2.0824	0.0388
C	3920.7866	80.9558	48.4312	0.0000
R-squared	0.785793			
Adjusted R-squared	0.778312			
Prob(F-statistic)	0.000000			

Source: Source: Authors' analysis

Therefore, based on the results of these tests, we can conclude that there is a correlation and the interdependence between the stock indices values and considered independent variables – Crude Oil Price (WTI), the number of global new daily COVID-19 cases (Cov) and the dummy D3 and D3 – is represented very well using the model of linear multiple regression. The regression equations will be:

$$\begin{aligned} DJI &= 114.23 * WTI + 0.0063 * Cov + 567.80 * D_2 + 1262.16 * D_3 + 20910.41 \\ S\&P500 &= 14.63 * WTI + 0.0009 * Cov + 56.28 * D_2 + 103.77 * D_3 + 2470.88 \\ DAX30 &= 91.59 * WTI + 0.0008 * Cov + 53.05 * D_2 + 43.01 * D_3 + 8744.44 \\ FTSE100 &= 14.67 * WTI + 0.0002 * Cov + 84.32 * D_2 + 180.99 * D_3 + 5502.10 \\ CAC40 &= 20.78 * WTI + 0.0008 * Cov + 95.23 * D_2 + 269.59 * D_3 + 3920.78 \end{aligned} \quad (4)$$

We observe that the signs of the coefficients are the same in this case. Hence, we can affirm that a growth with one unit of WTI leads to the growth of the DJI with 114.23 units and 10000 new COVID-19 cases lead to a growth of CAC40 with eight units.
An evaluation of these functions given by (4), obtained from the values of the independent variables of the analyzed period, is represented in Figure 4.

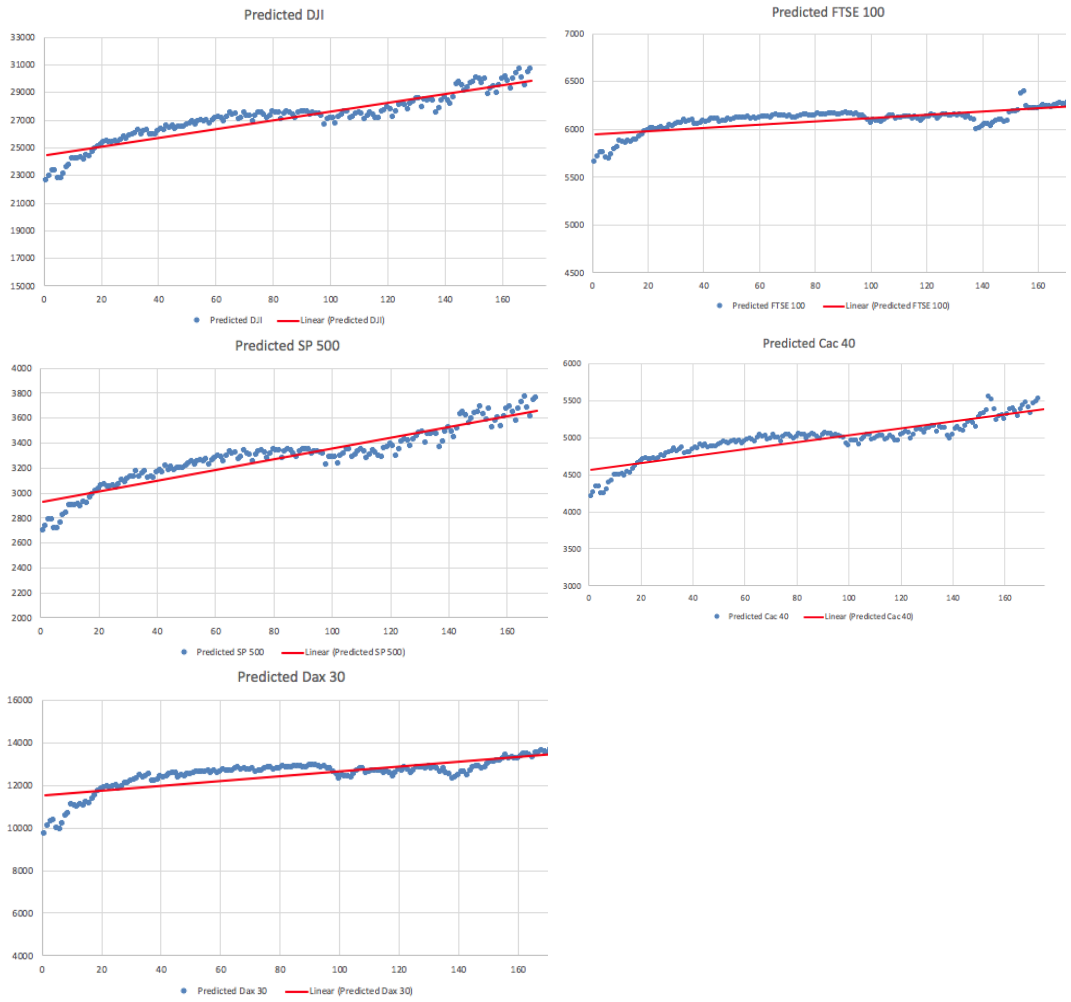


Figure 4: The graphic representation of the regression models for the April 21st –December 31st period
Source: Authors' analysis

The trend lines for predicted stock indices values are upward linear ones. Below we give the summary of events that took place worldwide between April 21st and December 31st, 2020 (Source: https://bfpg.co.uk/2020/04/covid-19-timeline and https://www.ecdc.europa.eu/en/covid-19/timeline-ecdc-response):

- April 22nd: UK human COVID-19 vaccine trials start;
- April 23rd: The United Nations Aviation agency reports that international air passenger traffic could decrease by up to 1.2 billion travelers, or two-thirds, by September 2020;
- June 17th: The European Commission introduced its strategy to expedite the development, manufacturing, and distribution of COVID-19 vaccines;
- June 29th: the number of confirmed cases of COVID-19 worldwide exceeded 10 million;
- July 24th: Cases in Europe, including France, Spain and Germany, rise sharply;

- October 19th: the number of confirmed COVID-19 cases worldwide exceeded 40 million;
- November 9th: Pfizer announces that its vaccine is 90% effective;
- November 16th: Moderna claims research shows that its vaccine is 94.5% effective;
- November 18th: New data show that the Pfizer vaccine to be 95% effective;
- December 1st: BioNTech/Pfizer and Moderna file for EU approval of the COVID-19 vaccine;
- December 30th: the number of confirmed COVID-19 cases worldwide exceeded 80 million.

5. Conclusions

With the emergence and spread of COVID-19 worldwide, uncertainty has increased. Depending on this situation, all countries were negatively affected in the first period by foreign investment outflows from stock exchanges, and the main stock market indices collapsed. COVID-19 uncertainty and related economic losses have made the market seriously volatile and impulsive.

In this study we tried to measure the impact of COVID-19 and the price of oil on the American, French, German and London stock exchanges, between January 1st, 2020 - December 31st, 2020, using the method of multiple regression.

We used, as dependent variables, the rates of the European stock indices DAX30, FTSE100 and CAC40 and the American DJI and S&P500. Regarding the independent variables, we have considered the price of crude oil (WTI) and the number of new global daily cases of COVID-19 (Cov). Also, three dummy variables (D1, D2, D3) were involved. The study used explanatory and econometric analysis based on the data from January 1st to December 31st 2020, in order to investigate the relation between the evolution of each of the five stock indices considered and those two independent variables.

Because the regression was not stable in the period analyzed, we divided the study into two periods: January 1st - April 20th, 2020 and April 21st - December 31st, 2020. Comparing the stock indices from the two periods, we conclude that all analysed indices (DJI, S&P500, DAX30, FTSE100 and CAC40) are strongly influenced by the price of oil (WTI) for both periods analysed. It is interesting to note the decrease in the impact on the evolution of stock market indices of the Cov variable. This finding leads to the idea that in the first period (January 1st - April 20th, 2020) the shock was so huge, and the countries were completely unprepared to manage the pandemic situation and the behaviour of investors on the stock markets was the same on both continents.

Starting with the second period (April 21st – December 31st, 2020), there is a comeback of stock market indices. This fact is also argued by the registration of a higher value for this period compared to the first period (January 1st – April 20th, 2020) of the constant variable C that measures the impact of other exogenous variables that influence the evolution of stock indices, variables that are not considered in this paper.

Regarding the dummy variables, D1 drastically negatively influences the evolution of the stock indices. At the opposite pole are the dummy variables D2 and D3, which positively influence the evolution of stock indices, but not with the same intensity as D1.

We conclude that the stock market was intensely agitated at a terrible level in 2020. The American, London, French and German stock markets reacted negatively to the increase in confirmed cases of COVID-19, but also to the price of oil. The market's reaction to the number of COVID-19 diseases is significant.

The main contribution of the paper to the existing literature in the field is the use of the evolution of the crude oil price as an independent variable, together with the daily increase in confirmed cases of COVID-19, because the price of oil has a significant influence on the inflation rate and, consequently, on the prices of the goods and services in worldwide

economy. Thus, the study is useful for the financial sector and is a support for investors in the capital markets.
Also, the relevance of this study for future economic and financial developments is given by the analysis of the effect of a pandemic disease on the stock markets. This paper analyzes the effect of COVID-19 on the main stock markets in Germany, France, the United Kingdom and the United States.
The results of this research are useful for the main players of the stock market, who can understand and predict the behavior of stock market returns during a pandemic disease. Stock markets data are updated second by second, and investors must react instantly to the latest events, the stock exchanges being a valuable and timely source of information, while macroeconomic official data affected by a pandemic disease, like unemployment, GDP growth or government debt, is available later.
However, there are some limitations when it comes to measuring the impact of the crisis. This study included data for only 6 stock market indices from Europe and US, and does not include small firms, non-listed firms, tertiary sector firms and even the public sector, which could be affected quite differently. This study considered only cases confirmed as COVID-19 variables and no deaths. In the future, researchers may consider other factors, in order to have a wide range of scenarios.

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Bio-note

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TRANSFORMING BUSINESS LANDSCAPES: STRATEGIES FOR SUSTAINABLE AND INNOVATIVE GROWTH IN THAILAND

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Abstract: *This article explores the innovative business models and strategies that Thai companies are embracing to enhance their competitiveness, foster sustainability, and adapt to the evolving market conditions. By drawing on the work of prominent scholars, the article provides a comprehensive understanding of the transformative processes shaping the future of Thai businesses. Key findings include the adoption of platform-based models, circular economy models, servitization models, collaborative and sharing-based models, and localized and resilient supply chain models. The article also highlights the synergistic framework that integrates digital transformation, sustainability, entrepreneurship, and supply chain resilience, driving sustainable and innovative growth for Thai businesses.*

Keywords: Business landscapes ,Sustainable growth ,Digital transformation, Circular economy, Supply chain resilience.

JEL codes: O30, O33, L26, Q56, M21

1. Introduction

Thailand's economy has undergone a remarkable transformation in recent decades, shifting from an agricultural base to one driven by manufacturing, services, and emerging technologies. This evolution presents both challenges and opportunities for Thai businesses navigating the complexities of the 21st-century marketplace. To remain competitive, Thai companies are increasingly adopting innovative strategies and business models that drive sustainable growth. The need for adaptation is underscored by rapid technological advancements, growing emphasis on sustainability, and the increasing importance of resilient supply chains. Digital technologies like artificial intelligence, big data analytics, and the Internet of Things have disrupted traditional business models, forcing Thai companies to rethink their operations and value propositions. Simultaneously, rising environmental concerns and social consciousness have prompted businesses to prioritize sustainability and corporate social responsibility. The COVID-19 pandemic has further highlighted the critical importance of supply chain resilience in the face of global disruptions. This article explores the innovative business models and strategies Thai companies are embracing to enhance competitiveness, foster sustainability, and adapt to evolving market conditions. Drawing on scholarly research, it analyzes platform-based, circular economy, servitization, collaborative, and resilient supply chain models. The study also presents a synergistic framework that integrates digital transformation, sustainability, entrepreneurship, and supply chain resilience to drive innovative growth. By synthesizing the literature and providing insights into these transformative processes, this article offers valuable guidance for both academics and practitioners on navigating the complexities of Thailand's modern business landscape.

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2. Literature Review

Scholars have identified several key trends in the transformation of Thai businesses, offering valuable insights into the changing landscape of the country's economy. Chotiya (2002) emphasizes the critical role of digital transformation in enabling Thai companies to disrupt traditional business models and gain a competitive edge in the market. The study highlights how businesses are leveraging technologies such as e-commerce, cloud computing, and data analytics to enhance their operations and customer experiences. This digital shift has allowed Thai companies to streamline processes, gain real-time insights into market trends, and respond more rapidly to changing consumer demands. In line with the growing global focus on sustainability, Thai businesses are increasingly aligning their operations with environmental and social responsibility. Noranarttakun & Pharino (2021) examine the adoption of circular economy principles among Thai companies, showcasing a significant shift towards more sustainable business practices. This approach emphasizes the reuse and recycling of products and materials to minimize waste generation and reduce environmental impact. By implementing circular economy practices, companies are not only contributing to environmental sustainability but also unlocking new opportunities for resource efficiency and cost savings. This trend reflects a growing awareness among Thai businesses of the importance of sustainable practices in ensuring long-term viability and meeting the expectations of increasingly environmentally conscious consumers.

Another notable trend in the transformation of Thai businesses is the shift towards servitization models, as highlighted by Kanignant (2020) in a study focused on the Thai chemical industry. Rather than solely focusing on product offerings, businesses are expanding their value proposition by providing integrated solutions and services alongside their traditional products. This approach allows companies to cater to evolving customer preferences and meet diverse needs more effectively. By adopting servitization models, businesses can enhance customer satisfaction, build long-term relationships, and differentiate themselves in an increasingly competitive market. These trends point to a broader transformation characterized by the integration of digital technologies, sustainability practices, and innovative business models. Successful Thai businesses have recognized that to achieve sustainable and innovative growth, an integrated approach is required, leveraging the synergies between digital transformation, sustainability, entrepreneurship, and supply chain resilience. This holistic framework acknowledges the interconnected nature of these elements and their collective impact on business success in the modern economy.

The adoption of this integrated approach fosters a dynamic and adaptable ecosystem that serves as a foundation for sustainable and innovative growth in Thai businesses. By aligning digital transformation initiatives with sustainability practices, businesses can leverage technology to drive environmental and social responsibility while improving operational efficiency. This synergy allows companies to not only reduce their environmental footprint but also capitalize on new market opportunities arising from increased consumer demand for sustainable products and services. Collaboration between businesses, investors, and research institutions is another crucial aspect of this holistic approach. Such partnerships enhance the innovation ecosystem by facilitating knowledge sharing and the development of industry-specific solutions. This collaborative environment allows for the rapid dissemination of best practices and technological advancements across different sectors of the Thai economy.

By embracing these interconnected changes and adopting a holistic framework, Thai companies can drive sustainable and innovative growth, create long-term value, and make a positive societal impact. This approach not only enhances their competitiveness in the global market but also positions them as responsible corporate citizens contributing to

Thailand's economic development and environmental sustainability. As the business landscape continues to evolve, the ability to integrate these various elements will likely become increasingly crucial for the success and longevity of Thai businesses.

3. Methodology

This paper is a document analysis that examines the scholarly literature on the transformation of the Thai business landscape. The analysis delves into the key drivers and strategies enabling Thai companies to thrive in the dynamic 21st-century business environment. The authors reviewed and synthesized the work of prominent scholars to provide a comprehensive understanding of the innovative business models and the synergistic framework shaping the future of Thai businesses.

4. Objectives

4.1. Identifying and analyzing the key innovative business models being adopted by Thai companies across various sectors.

4.2. Examining how these models contribute to enhancing competitiveness, sustainability, and adaptability in the Thai business landscape.

4.3. Proposing a synergistic framework that integrates digital transformation, sustainability, entrepreneurship, and supply chain resilience for Thai businesses.

5. Analyzing Innovative Business Models

Innovative business models are transforming the Thai business landscape, driving sustainable growth and competitiveness. Thai companies are adopting various approaches to adapt to changing market dynamics and leverage emerging opportunities. This analysis explores several innovative business models that have gained traction in Thailand. Platform-based models, exemplified by companies like Robinhood and Grab Thailand (Ackaradejruangsri, 2015), have enabled small businesses to connect with customers and expand their market reach through digital ecosystems. Circular economy models have also gained prominence, with companies such as PTT Global Chemical (Phongpaichit & Baker, 2005) redesigning their processes to create closed-loop systems that minimize waste and promote sustainability. Servitization has emerged as another significant trend, with companies like Siam Cement Group and Thai Union Group shifting towards delivering integrated solutions, enhancing customer satisfaction, and creating additional revenue streams (Lay, 2014). Collaborative and sharing-based models, such as Smaart's car-sharing platform and Flexible's co-working spaces, have fostered innovation ecosystems that encourage collaboration and resource optimization among entrepreneurs. Lastly, localized and resilient supply chain models have been developed by companies like Betagro and Thai Union Group, who have prioritized building resilient supply chains through supplier diversification, technology investment, and strategic partnerships. These innovative models collectively enable Thai companies to adapt to evolving market trends, leverage digital technologies, promote sustainability, enhance customer satisfaction, foster entrepreneurship, and mitigate risks. By embracing these approaches, Thai businesses are positioning themselves at the forefront of industry transformation and contributing to the sustainable development of the economy.

Table 1: Innovative Business Models in Thailand

Business Model	Description	Examples
Platform-based models	Enable small businesses to connect with customers and expand market reach through digital platforms.	Robinhood, Grab Thailand
Circular economy models	Focus on recycling and reusing resources to minimize waste and environmental impact.	PTT Global Chemical
Servitization models	Shift focus from solely offering products to providing integrated solutions and value-added services.	Siam Cement Group, Thai Union Group
Collaborative models	Foster collaboration, knowledge sharing, and resource optimization among entrepreneurs.	Smaart, Flexible
Localized supply chains	Develop resilient supply chains by diversifying suppliers, investing in technology, and establishing strategic partnerships.	Betagro, Thai Union Group

These innovative business models in Thailand have the potential to transform industries, drive sustainable growth, and adapt to the next era of business. By embracing technological advancements, fostering collaboration, prioritizing sustainability, and enhancing customer experiences, Thai businesses can position themselves at the forefront of industry transformation and remain competitive in the evolving landscape.

5.1. The adoption and success of innovative business models

The adoption and success of innovative business models in Thailand can significantly impact the country's economy and influence policy development. As highlighted by Manyika et al. (2017), these models can drive economic growth by enhancing productivity, creating new business opportunities, and attracting investments. Platform-based and collaborative models, in particular, can foster entrepreneurship and expand market reach for small businesses. However, the emergence of these models also brings challenges. Niyawanont (2022) notes that while traditional sectors may experience disruptions leading to increased efficiency and competitiveness, there's a need for regulatory adjustments to ensure fair competition and protect consumer and labor rights. To support these innovative models, the OECD (2020) emphasizes the importance of developing robust digital infrastructure and technological capabilities. This includes investments in high-speed internet, data centers, cybersecurity, and digital skills development. The World Bank (2020) suggests that policymakers must adapt regulations to keep pace with technological advancements, balancing innovation promotion with public interest protection. This may involve updating policies on data privacy, consumer protection, competition, taxation, and labor rights. Finally, as the Ellen MacArthur Foundation (2019) points out, these innovative models can contribute to Thailand's sustainability goals by promoting circular economy practices and resource efficiency. By aligning policies with these objectives and providing appropriate incentives, policymakers can drive the transition towards a more sustainable and resilient economy while creating new economic opportunities.

5.2. Synergistic Framework for Sustainable and Innovative Growth

The transformation of Thai businesses requires an integrated approach that leverages synergies between digital transformation, sustainability, entrepreneurship, and supply chain resilience. Successful Thai companies have adopted a holistic framework aligning these key elements to foster a dynamic and adaptable ecosystem. Digital transformation, as highlighted by Kittikunchotiwut (2020), acts as an enabler, providing technological infrastructure for innovation and efficient operations. It includes the adoption of AI, big data analytics, and IoT to enhance decision-making and operational efficiency. Sustainability is central to this framework, with businesses integrating environmental and social responsibility into their core strategies to reduce ecological footprints and meet consumer expectations. Entrepreneurship, as emphasized by Driediger and Bhatiasevi (2019), drives innovative growth by fostering creativity, risk-taking, and continuous learning. Finally, supply chain resilience ensures businesses can anticipate and respond to disruptions in the global marketplace. The integration of these elements creates a powerful synergistic framework that enhances competitiveness and adaptability. For instance, a Thai food company might use digital technologies to streamline its supply chain while implementing sustainable practices and exploring new market opportunities through entrepreneurial initiatives. This holistic approach enables Thai businesses to navigate the complex landscape of the 21st century, staying agile and responsive to evolving stakeholder needs. By adopting this framework, Thai companies can drive sustainable development and contribute to the country's economic prosperity while maintaining a collaborative approach that draws on scholarly and industry expertise.

Table 2: Summarizing the key elements and their interactions

Element	Description	Interaction
Digital Transformation	Adoption of technologies like AI, big data, IoT to enhance operational efficiency, improve customer experiences, and unlock new revenue streams.	Enables innovation and efficient operations in the digital era. Provides the technological foundation for other elements to thrive.
Sustainability	Integrating environmental and social responsibility into core strategies and operations to reduce ecological footprint, address social challenges, and appeal to eco-conscious consumers.	Enhances long-term business viability by mitigating risks and ensuring resource availability. Contributes to sustainable development of the Thai economy.
Entrepreneurship	Fostering a culture of creativity, risk-taking, and continuous learning to drive innovation, seize emerging opportunities, and stay ahead of the competition.	Fuels the development of new business models, products, and services that contribute to sustainable and innovative growth.
Supply Chain Resilience	Building diversified, redundant, agile, and collaborative supply chains to anticipate and respond to disruptions, maintain operational continuity, and ensure reliable delivery.	Enhances the overall adaptability and responsiveness of Thai businesses to changing market conditions, ensuring the competitiveness and viability of their operations.

The synergistic framework, which integrates digital transformation, sustainability, entrepreneurship, and supply chain resilience, enables Thai businesses to navigate the complex and dynamic landscape of the 21st century. By leveraging the complementary nature of these elements, Thai companies can enhance their competitiveness, drive sustainable development, and contribute to the prosperity of the Thai economy. This holistic approach fosters a thriving ecosystem that supports sustainable and innovative growth, allowing Thai businesses to stay agile, adaptable, and responsive to the evolving needs of customers, stakeholders, and the broader community.

6.Policy Recommendations

The transformation of Thailand's business landscape offers valuable lessons for emerging economies worldwide, presenting a compelling case study of how developing nations can navigate the complexities of modern economic challenges. This study proposes a synergistic framework that integrates four key elements: digital transformation, sustainability, entrepreneurship, and supply chain resilience. By interweaving these crucial aspects, the framework provides a comprehensive approach to driving innovative growth in the context of an evolving global economy.

The research highlights several key recommendations for policymakers seeking to foster an environment conducive to business innovation and sustainable development. Firstly, investing in digital infrastructure and skills development emerges as a critical priority, as emphasized by the OECD (2020). This involves not only building the physical infrastructure necessary for high-speed connectivity but also ensuring that the workforce is equipped with the digital skills required to leverage these technological advancements effectively. Secondly, the study underscores the importance of promoting regulatory agility. As Gikis (2021) and the World Bank (2020) suggest, mechanisms like regulatory sandboxes can play a crucial role in allowing policymakers to test and refine regulations in real-time, ensuring that the regulatory environment keeps pace with rapid technological changes while maintaining necessary protections for consumers and businesses alike.T he third key recommendation focuses on incentivizing sustainable practices and circular economy models, drawing on insights from the Ellen MacArthur Foundation (2019). This approach not only aligns business activities with broader environmental goals but also opens up new avenues for innovation and efficiency, potentially creating competitive advantages for forward-thinking companies. Fostering entrepreneurship ecosystems emerges as the fourth critical element, as highlighted by Potjanajaruwit (2019). This involves creating supportive environments for startups and small businesses, including access to funding, mentorship programs, and collaborative spaces that encourage knowledge sharing and innovation. Finally, the study emphasizes the importance of facilitating supply chain resilience, drawing on research by Jitmaneeroj (2023). In an increasingly interconnected global economy, the ability to navigate disruptions and maintain operational continuity is crucial for long-term success and competitiveness.

Collectively, these insights provide a comprehensive roadmap for creating a competitive, sustainable, and resilient business ecosystem. They offer practical guidance for policymakers and business leaders seeking to navigate the complexities of economic development in the 21st century. While the framework proposed in this study has significant potential for replication in other emerging economies, it's important to note that implementation must be carefully tailored to each region's unique context. Factors such as existing infrastructure, cultural norms, regulatory environments, and economic priorities will all play a role in shaping how these principles are applied in different settings. The study makes substantial contributions both theoretically and practically to the field of business innovation in developing economies. On a theoretical level, it offers a novel approach to conceptualizing the interplay between various factors driving economic growth and

innovation. This integrated perspective provides a more nuanced understanding of how different elements of the business ecosystem interact and influence each other, potentially opening up new avenues for academic research. From a practical standpoint, the study provides actionable insights for policymakers, business leaders, and entrepreneurs. By offering a clear framework and specific recommendations, it serves as a valuable resource for those seeking to drive economic development and foster innovation in emerging economies. Looking ahead, there is significant potential for future research to build upon this work. Exploring the framework's applicability across diverse contexts could lead to the development of a more generalized model for driving innovation and sustainable development in emerging economies worldwide. This could involve comparative studies across different regions, longitudinal research tracking the impact of policy interventions over time, or in-depth case studies examining how specific elements of the framework are implemented in various settings.

7. Limitation

7.1. Limited generalizability: While the study focuses on Thailand, its findings may not be fully applicable to other emerging economies due to differences in economic, cultural, and regulatory contexts. The proposed framework requires further testing in diverse settings to establish its broader applicability.

7.2. Rapid technological changes: Given the fast-paced nature of technological advancements, some of the findings and recommendations may become outdated quickly. This necessitates ongoing research to keep pace with new developments and ensure the continued relevance of the proposed strategies for business innovation and economic development.

8. Conclusion

The transformation of Thai businesses is characterized by the adoption of innovative business models, including platform-based, circular economy, servitization, collaborative, and localized supply chain models. These models enable Thai companies to enhance their competitiveness, foster sustainability, and adapt to the evolving market conditions. Furthermore, the article highlights the importance of a synergistic framework that integrates digital transformation, sustainability, entrepreneurship, and supply chain resilience, creating a dynamic and adaptable ecosystem that supports sustainable and innovative growth in Thailand. By embracing this holistic approach, Thai businesses can position themselves at the forefront of industry transformation and contribute to the prosperity of the Thai economy.

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THE DIGITAL ENTERPRISE LANDSCAPE: HOW DESI METRICS SHAPE ECONOMIC GROWTH IN THE EU

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Abstract: *The European Union's (EU) economic growth is increasingly driven by digitalization across all areas, including the digital transformation of businesses. This paper explores how the digital transformation of enterprises could influence economic growth in the EU by analyzing data from the Digital Economy and Society Index (DESI) and economic metrics from Eurostat for the post-pandemic period (2021-2022). This paper uses econometric techniques like Panel Corrected Standard Errors (PCSEs) and Robust Regression with Huber Iteration (RRHI) to investigate the cause-and-effect relationships between digitalization and economic factors such as GDP growth rate and real GDP per capita growth. The results show that different digital strategies have varying effects on economic performance. The paper also emphasizes the critical role of real labor productivity in connecting digital transformation with economic performance. The implications of this paper highlight the need for nuanced policy strategies that foster digital skills, improve technological infrastructure and support the Small and Medium Enterprises (SMEs) in their digitalization efforts in order to achieve the ambitious objectives of the EUs Digital Decade. The results also propose a strategic focus on specific technologies that offer immediate economic advantages and enable a stronger incorporation of digital progress across various business operations in the member states.*

Keywords: digitalization, digital enterprises, digital policies, digital transformation, economic growth, econometric modelling**.**
JEL classification: I31, J24, O10, O30.

1. Introduction

The digital transformation of enterprises is increasingly recognized as a critical catalyst for economic growth and competitiveness within the EU (Ghazy et al., 2022; Dabbous et al., 2023). The Digital Economy and Society Index (DESI) serves as a measure of this transformation, tracking how EU member states are progressing in terms of digital transformation in four main directions: digital skills, digital infrastructure, digital transformation of businesses, and the digitalization of public services (EU, 2021). Given the EU's strategic commitment to achieving its Digital Decade objectives, it is essential to understand the relationship between DESI indicators and economic growth to adopt proper and effective policies and guide digital investments.

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This paper is based on recognizing that digital technologies have become essential for enterprises to maintain competitiveness in the changing global landscape. Those who effectively utilize social media, big data analytics, and e-commerce technologies can strengthen their market presence, enhance customer interactions, and stimulate economic growth. The main objective of this paper is to explore the relationship between DESI metrics on the digital transformation of enterprises and their impact on the economic growth in EU member states.

2. Theoretical background

Thompson and Garbacz (2007) explained the relationship between economic growth and information technology based on access to information, increased organizational efficiency and institutional functionality. Qu (2017) explores how digitalization drives economic growth, considering both productivity gains and the emergence of new economic opportunities as key factors, and demonstrates that digital technologies not only streamline business operations but also encourage innovation and entrepreneurial initiatives, which are crucial for sustainable economic development. Nambisan et al. (2019) illustrate how digital technologies are reshaping innovation and the entrepreneurial landscape. They argue that the digital transformation of enterprises has redefined value creation, empowering businesses to manage uncertainties more efficiently and expand their operations effectively. Other studies, such as the ones of Vu et al. (2020) and Fernández-Portillo et al. (2020), demonstrate the significant role of digitalization in fostering economic stability and growth. However, the authors argue that the main focus should be changed from highlighting the positive link between digital technologies and growth to a deeper exploration of the mechanisms by which these technologies could influence economic performance.

Recent studies highlight the pivotal role of digital transformation in driving performance at the enterprise level and, consequently, promoting further economic growth. Teng et al. (2022) highlight that the SMEs that embrace digital transformation experience higher operational efficiency, improved customer engagement, and overall growth in competitiveness. Liu (2022) shows the direct correlation between higher DESI scores and superior economic outcomes in the EU, arguing that nations with well-defined digital policies are better positioned. Marcysiak and Pleskacz (2021) studied the factors influencing digitalization in SMEs, highlighting the importance of skilled workforce availability, access to financial resources, and government support as critical enablers of digitalization. Furthermore, according to the OECD (2021) research, there is still a digital divide in many countries between SMEs and larger enterprises, even while digital technologies present new potential for SMEs to engage in the global economy. The European Union (EU, 2021) has set strategic and ambitious objectives for 2030 to enhance digital capabilities within small and medium-sized enterprises (at least 90% of SMEs). The recent data from DESI highlights the progress and disparities in these areas across EU member states, as they are correlated. The data reveals varying levels of skills and technology adoption among SMEs in different countries highlighting a digital gap that the EU aims to narrow through its policies. Figure 1 presents a detailed visualization of the relationship between basic digital skills and the digital intensity of SMEs across all EU member states.

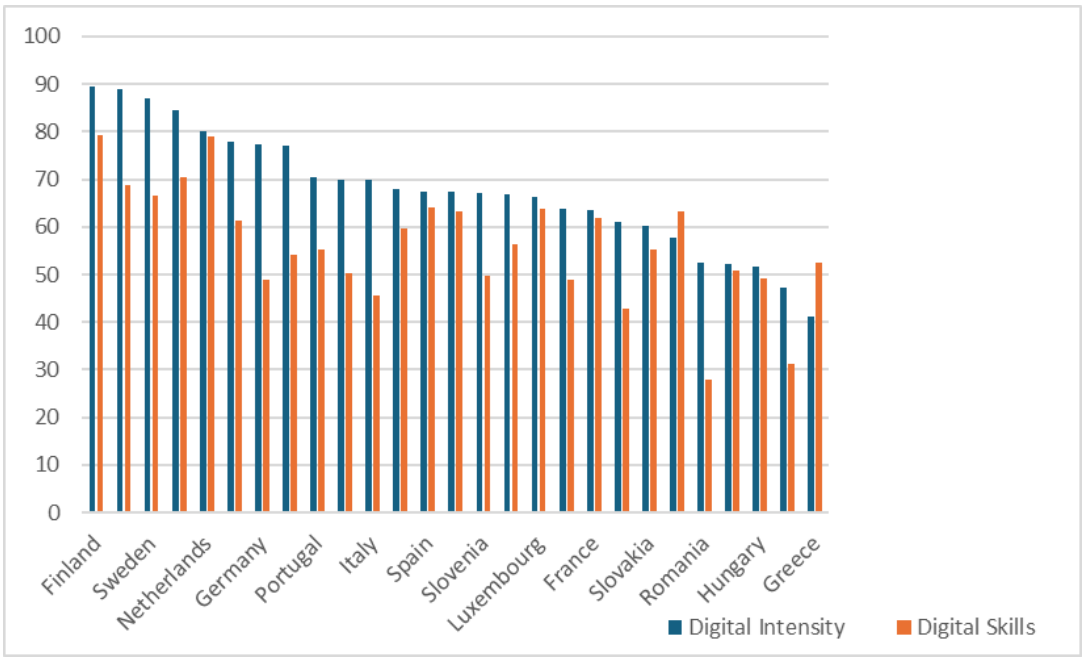

Figure 1: The relationship between the SMEs with basic digital intensity and the level of basic digital skills in EU
Source: Author's processing based on Eurostat data

While some countries have a high level of digital proficiency and integration, as shown in Figure 1, others are falling behind emphasizing the need for targeted measures to ensure equitable digital growth. According to DESI 2023 data, the average level of digital skills at EU level is 54%, with over 80% of the population from Finland, and Netherlands having at least basic digital skills, while countries as Romania and Bulgaria are lagging behind at a level of around 30%. In terms of digital intensity at SME level, the average is 69%, with top performers Finland, Denmark and Sweden very close to the target of 90%, while countries as Bulgaria, Romania and Hungary are reaching a level of approx. 50% of SMEs with a basic level of digitalization. These differences have impact on individual businesses competitiveness but also, they may influence broader economic dynamics within the EU affecting overall growth patterns and opportunities for innovation and progress in less digitally advanced markets. This bidirectional focus on improving digital skills and the digital technology integration could contribute to decreasing these disparities and to focus on the factors that might contribute to increased competitiveness and economic growth.

3. Modelling the impact of digital transformation of enterprises on economic growth

3.1. Data and methodology

Our research methodology is crafted to evaluate the impact of EU policies on economic growth, focusing on the "Digital transformation of businesses" section of DESI along with specific productivity metrics from Eurostat. Some of these variables (see Table 1) are measured at the EU level only after the pandemic, so in order to have continuity and relevant information, the analyzed period for all EU-27-member states is focused on the years 2021-2022. This period is crucial as it represents an effort toward achieving the EU-defined digital objectives, highlighting their importance in an increasingly digitized global context. The shift in terminology from "Integration of technology" to "Digitalisation of enterprises" within DESI

indicators, starting in 2021, signals a strategic change in focus and also emphasizes the need for a holistic approach to digital transformation. Table 1 presents all the indicators that are monitored in order to assess the digital performance of companies (from 3a1 to 3c3), serving as independent variables of our research. To these, we added real labor productivity, defined as GDP per person employed in all industries, a metric that provides insights into the productivity at national level.

Table 1: Variables used in the empirical analysis

Variables	Description	Unit of measure
3a1 SMEs with at least a basic level of digital intensity	Percentage of SMEs using at least 4 out of 12 selected digital technologies	% of SMEs
3b1 Electronic information sharing	Enterprises that use ERP (Enterprise Resource Planning) systems for internal information sharing	% of enterprises
3b2 Social media platforms	Enterprises using at least two social media platforms (e.g.social networks, blogs)	% of enterprises
3b3 Big data (large data volumes)	Enterprises that engage in analyzing large datasets from any source to extract valuable insights and drive business decisions.	% of enterprises
3b4 Cloud technology	Enterprises using cloud computing services for IT infrastructure and processes.	% of enterprises
3b5 AI (artificial intelligence)	Enterprises using AI for automation, customer experience or competitive advantage	% of enterprises
3b6 Electronic invoices	Enterprises issuing e-invoices that can be processed automatically	% of enterprises
3c1 SMEs selling online	SMEs generating at least 1% of their turnover from online sales.	% of SMEs
3c2 E-commerce turnover	Revenue generated by SMEs from e-commerce (electronic commerce) activities.	% of SMEs turnover
3c3 Cross-border online sales	SMEs making online sales to customers in other EU countries	% of SMEs
Real labour productivity	Gross domestic product (GDP) per employed person, reflecting national productivity	% change on previous year
Real GDP per capita	Real GDP per person, adjusted for population, year-on-year change	% change on previous year
GDP Growth Rate	GDP growth at market prices, year-on-year change	% change on previous year

Source: Author's processing based on Eurostat data

The variables selected as proxies in our empirical models are real GDP per capita and the GDP growth rate, commonly used indicators of economic growth. It is important to acknowledge that GDP may not fully capture societal welfare or long-term goals (Ward et al., 2016). Therefore, real GDP per capita and GDP growth rate are considered more

appropriate for evaluating economic development across various scenarios. In the context of the Digital Decade goals set by the EU, there are objectives aimed at significantly boosting the digital capabilities of businesses. These goals are connected with some of these monitored indicators, as 90% of SMEs are expected to attain a fundamental level of digital proficiency (3a1), 75% of the enterprises should adopt advanced technologies such as AI, Big Data and Cloud computing (3b3, 3b4, 3b5) and the number of “unicorn' companies” will double by 2030 (EU, 2021). The progress towards these targets is closely tracked through DESI, indicating a shift in policy emphasis from mere technological assimilation to a more comprehensive approach of digital transformation, within the enterprises.
In this paper, to understand how digitalization at the enterprises level might affect economic growth, we tested the data with a variety of panel methods, out of which the most relevant were the Panel Corrected Standard Errors (PCSEs) and the Robust Regression with Huber Iteration (RRHI) to ensure that our estimates are accurate and reliable. PCSEs are helpful for dealing with issues like heteroskedasticity and autocorrelation in panel data, especially when there are cross-sectional units but limited time periods. This method adjusts the errors in regression models to improve statistical conclusions, making it ideal for analyzing data that combines both time series and cross-sectional elements. It is commonly used in science and economics research to validate findings from panel data. On the other hand, RRHI focuses on minimizing the influence of outliers on regression results. By combining robust regression techniques, with processes based on the Huber loss function, this approach enhances the accuracy of parameter estimates. Using this method, we reduce the impact of outliers with differences in their data points on the model. Data patterns could be better captured and data points are prevented from having too much influence on the results. This continuous fine-tuning process improves the model’s ability to handle effects, making our economic analysis more reliable and robust.

3.2. Empirical findings

As an initial step in the analysis process, we assessed the quality of the data through the descriptive statistics presented in Table 2. There are significant variations in all the indicators regarding the state of digital transformation within enterprises. On average, about 61.54% of SMEs meet the basic level of digital intensity with a standard deviation of 15.66, but the range of digital intensity varies from a minimum of 22.23% to a maximum of 89.5%, suggesting a significant disparity in digital adoption among SMEs in the EU member states. The average adoption rate of electronic information-sharing technologies across enterprises is 36.68% at the EU level, with variations ranging from 16.8% to 57.23%. About 30.28% of enterprises engage with social media platforms, with the adoption rates oscillating between 11.68% and 50.7% as the country average. Enterprises using big data are at 13.91%, with a relatively lower standard deviation of 7.57, indicating a tighter spread in the use of big data technologies from 5.1% to 30.05%. Cloud technology adoption is, on average at 36.48% but spreads widely from 9.9% to 69.2%, highlighting the varied levels of cloud integration at the country level. AI (Artificial Intelligence) adoption is still emerging among enterprises, with an average of 8.11%. The usage of electronic invoices shows a broader variation with an average of 30.74% and a substantial standard deviation of 22.65%, pointing to a wide disparity in its adoption. A modest average of only 21.08% of SMEs engage in online selling, while the contribution of e-commerce to SME turnover averages at 11.94%, indicating a moderate uptake with the highest values at 26.2%. Relatively few SMEs engage in cross-border online sales, with an average of 9.48% and a maximum reach of 16.22%. The real labor productivity shows a modest increase on average by 3.26%, with the performance ranging widely from countries with a decrease of 4.8% to countries with an increase level of 11.8%. The average rise in both GDP per capita and GDP growth rate is over 5%, highlighting a potential economic impact of digital advancements in the EU landscape.

Table 2: Descriptive statistics

Variables	***Obs***	***Mean***	***Standard Deviation***	***Minimum***	***Maximum***
3a1 SMEs with at least a basic level of digital intensity	54	61.54262	15.66345	22.2299	89.5
3b1 Electronic information sharing	54	36.6816	10.45217	16.8	57.226
3b2 Social media platforms	54	30.27671	11.10419	11.6845	50.7
3b3 Big data (large data volumes)	54	13.90774	7.574256	5.0956	30.0468
3b4 Cloud technology	54	36.48379	16.30884	9.9	69.2
3b5 AI (artificial intelligence)	54	8.11113	5.275496	1.3826	23.9
3b6 Electronic invoices	52	30.73921	22.65018	10	94.9
3c1 SMEs selling online	54	21.07543	7.92022	8.2	37.5806
3c2 E-commerce turnover	49	11.93573	4.739518	4.0008	26.2
3c3 Cross-border online sales	54	9.478309	3.396824	3.6735	16.2187
Real labour productivity	54	3.259259	3.219898	-4.8	11.8
Real GDP per capita % change	54	5.285185	3.232816	-0.8	15.6
GDP Growth Rate	54	5.264815	2.896593	-1.3	13.6

Source: Author's analysis in Stata based on Eurostat data

We developed two-panel regression models with dependent variables, GDP growth rate, and real GDP per capita growth rate, in order to evaluate the relationships between the EU digital policies for enterprises impact economic growth. The explanatory variables are the EU-DESI indicators from the area "Digital transformation of enterprises," measures supporting the EU digital policy. These models were analyzed using PCSE and RRHI advanced econometric methods and the outcomes of the baseline regression data and GDP growth are outlined in Table 3.

Table 3: Regression results

Methods	***PCSEs***	***RRHI***	***PCSEs***	***RRHI***
Variables	GDP Growth Rate	GDP Growth Rate2	Real GDP per capita % change	Real GDP per capita % change2
3a1 SMEs with at least a basic level of digital intensity	0.0264	0.0218	-0.000661	0.0000615
	(0.0339)	(0.0434)	(0.0174)	(0.0307)
3b1 Electronic information sharing	-0.131***	-0.121*	-0.0672	-0.0648
	(0.0155)	(0.0453)	(0.0347)	(0.0320)
3b2 Social media platforms	0.106***	0.103	0.0295	0.0336
	(0.0170)	(0.0693)	(0.0406)	(0.0491)
3b3 Big data (large data volumes)	0.106***	0.117	0.0734***	0.0825
	(0.0309)	(0.0587)	(0.0060)	(0.0416)
3b4 Cloud technology	-0.122***	-0.121*	-0.0520*	-0.06
	(0.01500)	(0.0521)	(0.0205)	(0.0369)
3b5 AI (artificial intelligence)	0.0065	-0.00136	-0.0162	-0.0265
	(0.0149)	(0.0912)	(0.0402)	(0.0645)
3b6 Electronic invoices	0.0304**	0.0301	0.0266***	0.0294
	(0.0100)	(0.0207)	(0.0029)	(0.0146)
3c1 SMEs selling online	0.00835	0.00453	0.0613***	0.0637
	(0.0295)	(0.0714)	(0.0172)	(0.0505)
3c2 E-commerce turnover	0.185***	0.173	0.0426*	0.0357
	(0.0074)	(0.1070)	(0.0192)	(0.0757)
3c3 Cross-border online sales	0.102***	0.101	0.00351	-0.000737
	(0.0252)	(0.1430)	(0.0299)	(0.1010)
Real labour productivity	0.631***	0.665***	0.894***	0.892***
	(0.1100)	(0.1240)	(0.0839)	(0.0874)
_cons	1.9320	1.9750	2.3810	2.3700
	(1.8890)	(2.1410)	(1.3630)	(1.5150)
N	47	47	47	47
R^2	**0.736**	**0.675**	**0.888**	**0.856**

Note: Standard errors in parentheses, * p<0.05, ** p<0.01, *** p<0.001.
Source: Authors' research.

The analysis of the relationship between digital transformation measures at the enterprise level and economic growth offers insightful findings, as can be seen in Figure 2.

Figure 2: Regression Coefficients: Impact on GDP Growth and GDP per Capita
Source: Author's processing based on Eurostat data

Regarding the impact of SMEs with at least a basic level of digital intensity on GDP growth, the positive coefficients across both econometric models indicate a favourable connection. Still, the lack of statistical significance implies that the simple integration of new digital technologies within SMEs cannot have a robust effect on economic expansion. This outcome indicates the need for further investigation into whether more advanced digital capabilities or a more comprehensive range of adoption are required to achieve a more significant impact on macroeconomic performance. The negative and statistically significant correlation between electronic information sharing and GDP growth highlights the challenges of the digital transformation process. When companies introduce systems like ERP or CRM for sharing information, although these technologies are intended to improve internal processes and operational efficiency, the initial expenses and learning curves may cause interruptions, particularly during the early stages of implementation. Because of the complexities, inefficiencies, or transitional challenges that accompany the integration of such systems within businesses, they seem to have a negative impact on GDP growth. These findings suggest that although digital infrastructure is essential, the success of digital initiatives relies on effective implementation and organisational adjustment.

Enterprises benefit from utilizing social media platforms, as there is a positive and statistically significant impact on GDP growth. We can attribute this outcome to social media's role in enhancing marketing capabilities and fostering customers' engagement. This can stimulate economic growth by expanding the enterprise's market reach and enabling more direct consumer interactions. These results highlight the importance of digital marketing tools in improving competitiveness and promoting growth in an increasingly digital economy. However, the adoption of cloud technology is associated with a negative and statistically significant effect on GDP growth. This indicates that, despite the acknowledged long-term advantages of cloud solutions, the short-term disruptions or transitional costs may initially outweigh these benefits. The deployment of cloud infrastructure requires substantial investments, changes in business processes, and technical challenges, which could explain the negative impact for the studied period. Although cloud technologies enhance the digital transformation, managing the transition with caution is necessary to mitigate adverse effects on economic performance.

For the current analysis, AI usage does not show a statistically significant impact on economic growth. The zero coefficients imply that the adoption of AI technologies while promising, is not yet widespread or mature enough to influence economic performance on a

large scale among EU enterprises. The findings regarding electronic invoices demonstrate a positive and statistically significant impact on GDP growth. If done properly, digital invoicing can streamline financial procedures and reduce transaction costs, boosting operational efficiency.

Regarding the SMEs selling online, the coefficients are positive in both models, showing a positive relationship with economic growth, particularly when measured by changes in Real GDP per capita change. However, the relationship with the overall GDP Growth Rate is weaker and not statistically significant. While supporting SMEs in online sales appears beneficial, especially for per capita economic growth, the modest coefficients suggest that this should be part of a broader digital strategy rather than the sole focus. E-commerce turnover and cross-border online sales have a positive role in driving economic growth, as the analysis shows positive and statistically significant coefficients, highlighting the importance of digital sales channels in expanding market reach and boosting revenue generation. The global outreach facilitated by e-commerce particularly highlights the benefits of digital trade integration within the EU. The strong positive and highly significant coefficients underscore the continued importance of traditional economic factors in driving growth, even in the digital age. The analysis reveals that by incorporating advanced technology in enterprises, we can positively impact GDP growth and the change in real GDP per capita. However, some technologies or practices, such as data sharing and cloud adoption, show coefficients that point to possible drawbacks or inefficiency.

4. Conclusions

The importance of this paper lies in the analysis of DESI components in relation to GDP growth and GDP per capita, and the identification of important connections between digital adoption and macroeconomic performance. Our findings show that while certain aspects of digital transformation positively impact economic growth, others are challenging and need a strategic approach. The positive impact of social media usage, big data analytics, and e-commerce on GDP growth aligns with studies emphasising the significance of digital tools in improving competitiveness and market expansion (Nambisan et al., 2019; Teng et al., 2022). The strong positive correlation between e-commerce turnover and cross-border online sales with economic growth indicators highlights the potential of digital markets to foster economic integration within the EU, supporting the findings of (Goldman et al., 2021) on the positive effects of cross-border e-commerce.

However, the negative correlation between electronic information sharing and GDP growth, along with the initial negative impact of cloud technology adoption, proves the complexities of the digital transformation, supporting the observations of Acemoglu et al. (2014) on the potential short-term disruptions caused by technological changes. The simple adoption of basic digital technologies may be insufficient to drive strong economic growth, as proved by the lack of statistical significance in the relationship between basic digital intensity in SMEs and GDP growth, supporting the arguments of Gal et al. (2019) on the need for comprehensive digital strategies.

Our paper contributes to the growing body of literature on the digital economy by providing empirical evidence on how different digital technologies and practices at the enterprise level impact economic growth in the EU. It emphasises the need for nuanced policy approaches that consider both the advantages and the challenges of digital transformation. The findings hold implications for policymakers that should adapt the digital plans at national and EU level in order to enhance the digital adoption for progess towards the EU digital goals, focusing resources on areas with the strongest positive associations with growth: to harmonize e-commerce regulations across EU member states in order to reduce the barriers to cross-border digital trade, invest in digital infrastructure to support secure and efficient online transactions, provide targeted support for SMEs to develop e-commerce capabilities,

develop EU-wide standards for data-sharing and interoperability, create incentives for enterprises, especially SMEs, to adopt data analytics tools and invest in data-science education and training programs might be some examples of actions that could be done at EU level. While promoting digital adoption is crucial for economic competitiveness and resilience, proper strategies should also be tailored at enterprise level to maximise positive impacts while mitigating potential negative effects. The focus should be on fostering advanced digital skills and supporting the effective integration of digital technologies into business processes, rather than simply encouraging basic digital adoption.

This paper has some limitations because the analysis is based on aggregated data at the country level, so significant variations could not be observed at the industry or enterprise level. These will constitute our future research directions that will help guide the EU's transition to a competitive and inclusive digital economy in the coming years.

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RELATIONSHIP BETWEEN SUSTAINABLE DEVELOPMENT AND MANUFACTURING FIRMS PERFORMANCE IN EDO STATE, NIGERIA

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Abstract: *This study examines sustainable development in manufacturing firms' performance in Edo State, Nigeria. The purpose was to establish the association among social, economic and environmental developments on manufacturing firms in Edo State. The methodology utilized was the survey research proportions. The population comprised of top level employees of ten selected manufacturing firms registered with the Manufacturers Association of Nigeria (MAN) in Edo state, with international affiliation. A total of one hundred (100) employees of the ten selected manufacturing firms in the state, constituted the sample size. The purposive sampling technique was made use to choose ten (10) employees each from the designated manufacturing firms. Data analysis engaged was the descriptive and inferential statistics. The outcomes discovered that manufacturing firm's social and economic developments were significant predictors of sustainable development among the manufacturing firms, in the State, while environmental development was insignificant. The study recommended that manufacturing firms should exemplify social development program as core values, it is also recommended, that they formulate and implement economic development policies that will foster the growth of their firms, the study concluded that firms should take proactive measures to minimize their environmental approach by adopting eco-friendly initiatives.*

Keywords: Economic development, Environmental development, Manufacturing firms, Social development, Sustainable development

JEL Classification: M31, M38, L95, L20.

1. Introduction

Sustainable development has gained significant prominence within Nigeria's manufacturing industry in recent years. Agwu, Emeti and Nwobu (2018) explained that sustainable development embodies a development approach that addresses present needs while safeguarding the future generations' ability to fulfil their own requirements. Beginning from the manufacturing viewpoint, this translates into the adoption of practices that are socially reasonable, economically worthwhile and environmentally accountable.

One fundamental systematic procedure through which sustainable development is being tackled in Nigeria's manufacturing sector is through the adoption of green manufacturing practices. Green manufacturing entails the reduction of waste and emissions, utilization of

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renewable resources, and the design of products with recyclability in mind, as expounded by Akinlabi, Akinlabi and Akinlabi (2017). Oluyemi and Oluseyi (2019) opined that green manufacturing practices can substantially moderate the environmental effect of manufacturing operations, therefore contributing to sustainable development. Nevertheless, the growth of manufacturing firms in Nigeria has been obstructed by challenges such as deficiency of adequate infrastructures, contradictory policies, financial constraints and scarcities of skilled labour among others (Ogundipe & Urim, 2019). Though, sustainable development in Nigeria's manufacturing sector exceeds environmental issues; it also incorporates both social and economic issues. Adeoye, Adeoye and Agunbiade (2019) postulate that sustainable development within this sector should also centre on creating decent employment opportunities, promoting gender equality, enhancing the well-being of local communities and so forth. Attaining this inventiveness includes sourcing materials and labour locally, providing trainings/workshops for the workforce, adapting to modern technologies and providing adequate welfare packages among others. Sustainable development covers different dimensions, most outstandingly social, economic and environmental, all essential for the development of long-term social welfare, economic progression and environmental conservation. Starting from the social aspect of sustainable development it concentrates on augmenting fairness, equity, justice and all-encompassing. In the setting of Nigeria's manufacturing industry, there exists a necessity to investigate the social factors impacting sustainable development. Afolabi, Kuye and Babalola (2021) have observed that inadequate awareness among stakeholders constitutes a substantial barrier to achieving sustainability in the sector. The economic facet of sustainable development aims to promote enduring economic growth while ensuring equitable distribution of economic benefits throughout society. In the context of Nigeria's manufacturing sector, Abegunde, Aremu and Salawu (2019) have highlighted the sector's potential as an engine of sustainable economic growth, though it faces challenges like insufficient infrastructures and financial limitations affecting this sector among others. The environmental dimension of sustainable development emphasizes environmental preservation while ensuring that economic and social development remain uncompromised. In the Nigeria situation, numerous studies have analysed the environmental factors influencing sustainable development. Ogunbodede and Adeleke (2021) illustrated that insufficient infrastructure and weak institutional frameworks hinder sustainable development in the sector. Hence, the necessities to critically analyse the different dimensions and fill the gaps in order to empirically ascertain the correlation among sustainable development and manufacturing firms' performance in Edo state.

2. Review of Related Literature and Formulation of Hypotheses

2.1. Manufacturing Firms

Ahmed and Adelaja (2019) defined manufacturing firms as those businesses that are engaged in tangible goods production. In the Nigeria perspective it comprised firms actively involved in the transformation of raw materials or components into finished products through a systematic combination of human, physical and chemical processes among others. These firms primarily operate within diverse sectors such as food processing, textiles, chemicals, automobiles, electronics and so forth (Ibenta, 2017). The Nigerian government has acknowledged the pivotal role played by manufacturing firms in fostering economic growth, employment generation, diversification of exports and has therefore enacted policies aimed at bolstering the sector's development (Adesina, 2018).

Manufacturing firms exhibit varying dimensions in terms of size and operational scale, spanning from Small and Medium-scale Enterprises (SMEs) to massive transnational establishments (Ibenta, 2017). Thus, they distinguish themselves from other business categories, such as service-oriented or trading enterprises, by their central emphasis on the

tangible production of goods, as opposed to the provision of intangible services or the exchange of goods (Adesina, 2018).

Manufacturing enterprises in Nigeria can be characterized by their production capabilities, which encompass the judicious utilization of labour, capital and technology to yield value-added products (Ogundipe & Urim, 2019). These entities typically operate from physical facilities, such as factories or production plants, where the intricate manufacturing processes transpire (Adesina, 2018). Furthermore, they depend on a skilled workforce equipped with technical expertise to proficiently oversee and manage the production procedures (Ogundipe & Urim, 2019). The trajectory of the manufacturing sector in Nigeria has been shaped by a multitude of factors, including government policies, technological advancements, global economic trends and other related issues (Ibenta, 2017). Additionally, the functioning of manufacturing firms in Nigeria often necessitates substantial capital investments, channelled towards the acquisition of machinery, equipment and raw materials, in addition to funding Research and Development (R&D) endeavours (Ahmed & Adelaja, 2019).

2.2. Sustainable Development

Sustainability in the current government and business activities is generally acknowledged (Peattie, 2001). In 1987, the United Nations published the Brundtland Report which has comprehensively been accepted; describe sustainable development as a procedure of meeting the needs of the present without conceding the future generations their ability to meet their needs (United Nations, 1987). Sustainability takes an all-inclusive viewpoint by integrating the three dimensions of society, economy and environment. They are referred as the Triple Bottom Line (TBL) formulated by John Elkington. It is also known as the three-pillar model, which postulates that sustainable development entails the simultaneous quest of social, economic and environmental objectives. Hence, it underscores the necessity of harmonizing social, economic and environmental considerations in decision-making processes and recognizes the inherent interconnectedness and mutual reinforcement of these dimensions (Elkington, 1997). Sustainable development is an ever-evolving and dynamic concept shaped by various factors such as globalization, technological advancements, and shifting societal values (Lele, 2018).

2.3. Dimensions of Sustainable Development and Formation of Hypotheses

Social Development

Choi and Ng (2011) state that social sustainability revolves around the well-being of individuals and communities, serving as a form of non-economic wealth. Karpagam (2014) opined that the identical philosophies of justice and equality have been fundamentally linked to social dimension of sustainable development. Social sustainability complements human rights and human development, corporate power and environmental justice, global poverty and citizen action, responsible global citizenship relationships in an organize manner give the impression of easy matters of personal consumer or moral choice at the beginning (Brown & Bessnat, 2003).

> *H_{01}: Social development has no statistically significant association on manufacturing firms in, Edo State.*

Economic Development

Karpagam (2014) disclosed that the economic sustainability aspect necessitates that societies should follow growth path that create optimal flow of income, concurrently their elementary stock of manmade capital, human capital and natural capital is still being sustained. According to Caradonna (2014), economic sustainability demands the establishment of a system capable of consistently producing goods and services, avoiding excessive indebtedness and striking a balance among various sectors of the economy.

Sustainable companies during any period give assurance of sufficient cash flow so as to warrant liquidity while producing tenaciously to their shareholders above returns (Dyllick & Heckerts, 2002). Hence, economic sustainability focus on distribution of resources equitably so as achieve significant effect through the decrease of resource exploitation adverse magnitudes

> *H_{02}: Economic development has no statistically significant association on manufacturing firms in Edo State.*

Environmental Development

Environmental sustainability encompasses the prudent management of resources to minimize environmental harm and preserve biological diversity and natural heritage (Cozzio, 2019). Buyukozkan and Cifei (2010) indicated that the modern business environment would depend in their supply chains for their company existence on the grade at which companies accepts that aspects. Karpagam (2014) also stated that the environmental element similarly requires resourceful sustainable usage, efficient sink role and conservation of stock of capital that are natural, that is performance in the environment should be liking to its ability to demonstrate its three functions proficiently and continuously in order for the stability of the ecology and the resilience not to be disturbed.

> *H_{03}: Environmental development has no statistically significant association on manufacturing firms in Edo State.*

2.4. Underpinning Theory for the Study

Dowling and Pfeffer (1975) opined that organizational legitimacy led to the consequential introduction of legitimacy theory. It is the significance that exists between the larger social system and an entity that have similar value. In the event of disagreement among the value systems, there is a potential risk to the entity of legitimacy theory. Thus, the theory underlines the importance of organization to fulfil their social responsibility so as to sustain their growth. Burlea Şchiopoiu and Popa (2013) opined that legitimacy theory stimulates and encourages firms in formulating and executing their charitable environmental and social exposures, so that their objectives and social contracts will be accomplish which can guarantee their survival in times of crunch.

Legitimacy theory ensures to confirm that firms are seen to confine their activities in line with the standard of their host societies, which they will be, perceive as being legitimate by the outside societies. These limits and customs are well thought out as being stable, but dynamic. Henceforth, organizations need to be responsible and morally committable to their host environment through which they function (Deegan & Unerman, 2011).

Deegan (2002) stated precisely that firms existence might be endangered if its social contract is perceived that it has been break through by the society.

2.5. Conceptual Framework

A conceptual framework serves as a visual depiction elucidating the interplay between the independent variables and dependent variable. The ensuing diagram offers a graphical representation of this relationship:

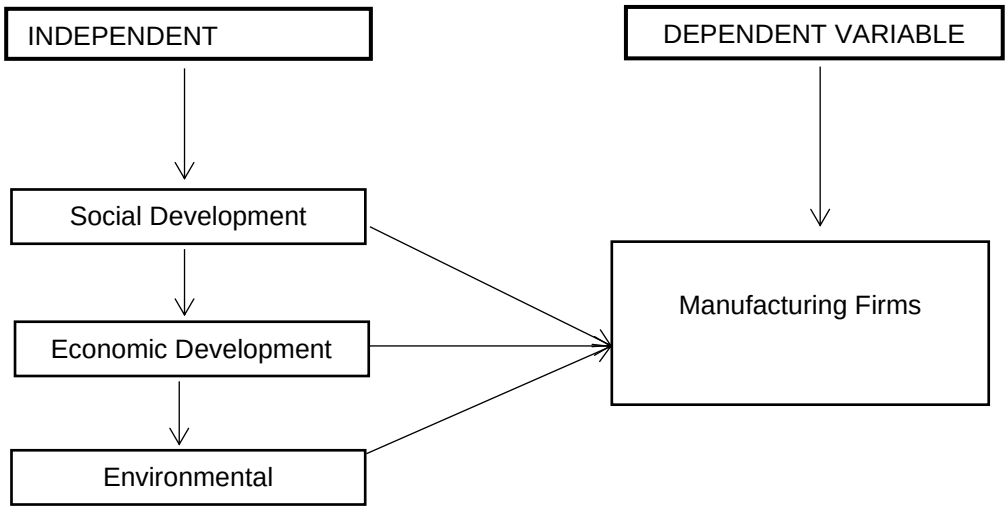

Figure 1: Conceptual Framework
Source: Researchers' construction (2024)

3. Methodology

The survey exploratory technique was utilized. Senior level employees of ten selected manufacturing firms in Edo state, located in the South-South geopolitical zone of Nigeria that are registered with the Manufacturers Association of Nigeria (MAN) with transnational association, within the three senatorial districts (Edo Central, Edo North, and Edo South constituencies) in the state, made up the population of the study. Ten respondents were systematic prudently chosen from each of the ten selected manufacturing firms using the purposive sampling approach. This method allows the researchers to decide the elements to be chosen intentionally which remain paramount (Kothari & Garg, 2016). Thus, the sample size comprised of one hundred (100) respondents. Primary source of data was employed, in order to administer the questionnaire and gather the necessary information from the selected manufacturing firms' employees who are the study respondents. To confirm the appropriateness of the hypotheses of the study professionals were consulted, also thirty (30) copies of the questionnaire were given to respondents in a pilot study for the research instrument to be experimented. The construct composite reliability co-efficient (Cronbach's alpha) was utilized to test the data from the assembled questionnaire with the aim of ascertaining the instrument internal consistency. The latent variable values for each items were above the recommended value of 0.80, which indicate that it is better if the reliability coefficient gets closer 1.0 better still acceptable if beyond 0.80 (Sekaran, 2003). The introduction letter of the questionnaire was used to inform the respondent the purpose of the study in order to enhance positive response rate and guaranteeing the confidentially of the information provided. The structure that made up the different categories of the questionnaire include (Section A and B). The demographic details of the respondents were in section A, while section B encompasses responses relating to dependent and independent variables. The dependent and independent variables were measured using the five-point Likert scale to evaluate the questionnaire which is the research instrument, accordingly rated as SD=1 for Strongly Disagree, D=2 for Disagree, UD=3 for Undecided, A=4 and SA=5 for Strongly Agree. To expedite the quick returns of the questionnaire it was administered manually and collected at a mutual agreed time from the respondents. The platforms for the descriptive and inferential statistics data analysis include the Statistical Package for Social Sciences (SPSS version 24.0) and Econometric Views (EViews 10.0) software which were used to analyse the coded data.

4. Results and Discussions

The study focus on a sample size comprising of one hundred (100) respondents (employees) of the selected manufacturing firms in Edo state. Correspondingly, the respondents were given out each copy of the questionnaire to fill. A remarkable response rate of 100% questionnaire copies were gathered and ascertained to be suitable was imputed into SPSS v 24.0 and EViews 10.0 software for the descriptive and inferential projected detailed statistical review.

Descriptive Statistics

This was employed to measure the profile of the study respondents:

Table 1: Respondents demographics data

Variable	**Category**	**Frequency (n=100)**	**Percentage (100%)**
Gender	Male	63	63.0
	Female	37	37.0
Marital status	Single	31	31.0
	Married	69	69.0
Age classification	22 - 26years	27	27.0
	27 - 31years	37	37.0
	32 years and above	36	36
Highest Educational qualification	SSCE/GCE	6	6.0
	ND/NCE	11	11.0
	HND/First Degree	27	27.0
	Master's Degree	51	51.0
	Ph.D.	5	5.0
Years of working Experience	1– 5	18	18.0
	6 – 10	24	24.0
	11 – 20	47	47.0
	21 and above	11	11.0

Note: GCE- General Certificate of Education, HND - Higher National Diploma, NCE- National Certificate of Education, ND - National Diploma Ph.D. - Doctor of Philosophy & SSCE - Senior Secondary Certificate of Education

Source: Researchers' field work (2024)

The tables exemplify the study respondents' profile. Gender revealed that 63 (63%) are males, while 37 (37.0%) are female. Marital status indicates 31(31.0%) are singles, while 69(69.0) are married. Furthermore, age classification shows that, 27(27%) are within 22-26 years; 37(37.7%) are between 27-31 years, 36(36.0%) are above 32 years. Educational qualification shows that 6(6.0%) had SSCE/GCE, 11(11.0%) represent HND/First degree, also 51(51.0%) acquired master's degree, while 5(5.0%) obtained Ph.D. Years of working experience, also demonstrate that 18(18.0%) had 1-5 years of experience, 6-10years represent 24 (24.0%), 47(47.0%) 11-20 years, lastly 11(11.0%) accounts for 21years and above.

Inferential Statistics:

To scrutinize the gathered data and evaluate the level of multicollinearity, correlation analysis was used. Finally to test for the specified hypotheses the Ordinary Least Square (OLS) assessment technique was also utilized for the study.

Table 2: Correlation Analysis.

Variable	MF	SOD	ECD	END
MF	1.000000			
SOD	0.317601	1.000000		
ECD	0.191749	0.362571	1.000000	
END	0.191749	0.303557	0.375963	1.000000

Note: Significant at the 5% level, Manufacturing Firms (MS), Social Development (SOD), Economic Development (ECD) & Environmental Development (END)
Source: Researchers' computation (2024)

The table demonstrates the correlation analysis utilized to determine the variables of the study. When the correlation coefficient is 0.90 and exceeding, statistically multicollinearity among exogenous latent constructs is existing (Hair Jr., Black, Babin and Anderson, 2014). The dependent variable of manufacturing firms and the independent variables of social, economic and environmental development are positively with values of 0.317601, 0.191749 and 0.247008 Indicating that they are judiciously correlated, underneath the benchmark of 0.90. In conclusion it affirm that the issue of multicollinearity is not present

Table 3: Ordinary Least Square (OLS)

Variable	Coefficient	Standard Error	t-Statistic	Probability Value	Hypotheses
(Constant)	1.130894	0.373275	3.029656	0.0000	Significant
SOD	0.326750	0.068953	4.738724	0.0068	Significant
ECD	0.216078	0.079322	2.724046	0.5142	Insignificant
END	0.042989	0.065840	0.652933	0.0026	Significant
(SUMMARY STATISTICS) R-squared = 0.846384; Adjusted R-squared = 0.302111; F-statistic 33.72663 = Prob(F-statistic) = 0.000000; Durbin-Watson Stat = 1.894629					

Note: Significant at the 5% level, Manufacturing Firms (MS), Social Development (SOD), Economic Development (ECD) & Environmental Development (END)
Source: Researchers' computation (2024*)*

The table shows that the (R-squared) coefficient of determination having an evaluation on the selected manufacturing firms of 0.846384 which indicates analytically alterations of 85% in the dependent variable were accredited by influences in the independent variables, indicating the strength of the model. The error term accounted for the remaining 15% factors not included in the regression model. After the model has been adjusted for the degree of freedom, the R-square value of 0.302111was obtained. The model also revealed that 30% inequalities occur after adjusting the degree of freedom by the independent variables. The F-statistics of 33.72663 is significant at Prob (F-statistic) value of 0.000000 which is less than the significant level of 1%, 5% and 10%, which disclose that there is a linear significant association of between the dependent variable and independent variables. 1.894629 of the Durbin-Watson Statistics unveils the nonappearance of multicollinearity.

Test of Research Hypotheses

Hypothesis One

The table above shows that there is positive and significant relationship. This is affirmed by the t-statistic of 4.738724 and at *p*-value of 0.0068 which is lower than 5% level of significance. Based on the result, the formulated null hypothesis was rejected. Accordingly, Social development is statistically significant.

Hypothesis Two
The table also revealed that there is positive, but insignificant relationship. This is established by the t-statistic of 2.724046 and at *p*-value of 0.5142 which is higher than 5% level of significance. The specified null hypothesis was accepted. Consequently, economic development is statistically insignificant.

Hypothesis Three
Lastly the table proves that there is positive and significant relationship. This is asserted by the t-statistic of 0.652933 and at *p*-value of 0.0026 which is lesser than 5% level of significance. The decision was to reject the null hypothesis. In conclusion, environmental development is statistically significant.

Discussion of Findings
Firstly, it was discovered that social development is statistically significant. This result harmonized with Brown and Bessent (2003) who opined that justice and equity are equivalent ideologies upon which social component of sustainable development facet depends on. Secondly, the study also revealed that economic development is statistically insignificant. It contradicts the study of Caradonna (2014) that economic sustainability demands the establishment of a system capable of consistently producing goods and services, avoiding excessive indebtedness and striking a balance among various sectors of the economy. Lastly, the study exposed that environmental development is statistically significant. Accordingly, it validate the study Karpagam (2014) who ascertain that the module of the environment similarly requires the use of sustainable resources, functions that are efficiently sunk and the maintenance stock, including natural capital.

5. Conclusion
This study on sustainable development within manufacturing firms contributes significantly to our comprehension of the multi-dimensional impacts of development in the manufacturing industry. Comprehensively, this study proposes sustainable development and manufacturing firms, as a theoretical and empirical framework that identified the dimensions employed for the study. It reinforces the notion that social development plays a pivotal role in enhancing customer relationships and positively influencing manufacturing firms. Furthermore, notwithstanding the statistical insignificance, the positive influence of economic development on the manufacturing sector highlights the importance of economic stability and growth. In conclusion, the statistical significant and positive effect of environmental development underscores the need for on-going efforts in environmental sustainability.
This research underlines the interconnected nature of social, economic, and environmental factors in achieving sustainable development within manufacturing firms, offering valuable insights for policymakers and industry leaders striving to balance these dimensions effectively.

6. Recommendations
The following recommendations were suggested, based on our findings.
- Manufacturing firms should exemplify social development program as core values; this will necessitate the need to invest in staff welfare, engaging in Corporate Social Responsibility (CSR) activities.
- Also, they should formulate and implement economic development policies that will foster the growth of their firms, in turn enhance profitability.

- In conclusion, they should take proactive measures to minimize their environmental approach by adopting eco-friendly initiatives, embracing renewable energy sources and be committed sustainability development.

7. Further Studies

The followings were proposed for further studies.

- In order to augment a broader perspective, other researchers should embark on with additional representative of the sample size of respondents.
- Furthermore, the scope of study should be expanded to encompass a larger and more diverse sample of manufacturing firms thus, enhancing the generalizability of the findings.
- Lastly, other studies should be extended to other industries in relation to sustainable development dimensions.

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A CONTINGENCY APPROACH TO UNDERSTANDING FUNCTIONAL FLEXIBILITY FOR SUSTAINABLE ORGANISATIONAL EFFECTIVENESS: A STUDY OF MEDIUM-SCALE ENTERPRISES

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Abstract: *Pressure is increasing on medium-scale enterprises that operate in already volatile environments characterized by uncertainty, high business costs, intense competition, and instability. The perceived need for increasing flexibility in businesses necessitated this study which examined the extent to which functional flexibility affects organization effectiveness in medium scale enterprises in the north-central zone of Nigeria. To achieve this objective, the variables were operationalized and model specified. The study adopted descriptive survey research design. Data were gathered from primary source and the study hypothesis was tested using the Multiple Regression Technique. Functional flexibility was found to have significant effect on organizational effectiveness from the result of the regression analysis. Based on these findings, the study recommended that the leadership of business enterprises should adopt formal and coordinated approaches to modifications of work behavior.*

Key Words: Functional Flexibility, Skill Flexibility, Relational Flexibility, Behavioural Flexibility, Organisational Effectiveness.

JEL Classification: M10, M11

1.Introduction

Organizations are being forced by the current unstable economic environment to quickly adjust to both new and developing changes and discover practical and efficient ways to conduct business in unusual circumstances. One of the domains primarily affected by this instability is to the development of suitable organizational structures. Businesses are under more pressure than ever because of rivals' capacity to act swiftly and decisively to upend the status quo and because technology is changing faster than ever. In order to achieve a competitive edge in the current business landscape, organizations need to adapt to the opportunities and challenges presented by the unpredictability of business environment. As noted by Alpkan, Yilmaz, and Kaya (2007), several studies have highlighted the significance of flexibility as a means of gaining a competitive edge and as a tool for managing situations involving fast change that arise in the business environment. Organizations remain enmeshed in uncertain settings as a result of these shifts, which present both possibilities and challenges from the business environment. Eisenhardt and Martin (2000) opine that for organizations to survive in the ever-evolving and dynamic business climate, they must put the right strategies in place to protect their operations and provide the required outcomes.

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Because of their dismal performance and efficiency, particularly when it comes to sustainability, small and medium-sized businesses in Nigeria have long been the subject of criticism over their efficacy. Despite the government's institutional and policy support to strengthen the ability of small and medium-sized firms, there is still a deficiency in sustainable performance. The majority of the time, external variables that affect small and medium-sized businesses in Nigeria, like money, credit availability, physical and social infrastructure, government regulations, and formal education, have been blamed for their failures (Ogunro, 2014). It has become apparent, meanwhile, that these companies may face challenges beyond those that are widely recognized. It is important to highlight that these enterprises typically have rigid human resource practices because they depend on extensively on key players, whose absence can cause uncertainty, confusion, and sluggishness. This makes it more difficult for the organization to move quickly to accelerate activities on the critical path and make timely adjustments to maximize opportunities. According to (Adeleke, 2014 referenced in Oyedokun, Tomomewo, and Owolabi, 2019), these businesses eventually lose their value as a means of doing business until they are unable to continue operating. It is in the light of this that this study argues that a more enduring problem lies in the core of the management of the human resource process in entrepreneurial firms and therefore seeks to determine the extent to which functional flexibility affects organization effectiveness in the medium scale enterprises.

2. Literature Review and Hypothesis Development

2.1 Functional Flexibility

Functional flexibility refers to a company's capacity to adapt and enhance the abilities of its workforce across many domains, enabling them to execute a variety of jobs in response to shifts in demand, manufacturing techniques, or technological advancements (Veise et al., 2014). Functional flexibility is further defined by Cavagnoli (2008) as a company's capacity to effectively employ human resources for a range of tasks. It explains how employees are reassigned to different jobs in order to adjust for fluctuations in demand (Desombre, Kelliherw, Macfarlane and Ozbilginz, 2006). Goudswaard and Nanteuil (2000) define functional flexibility as the notion that employees need to be taught a variety of abilities in order to be able to perform additional tasks as needed. The unlimited creative and development potential of human resources allows them to react quickly and adaptably to unforeseen changes in the environment, which makes them indispensable (Liebowitz, 2008). It necessitates skill development because it calls for optimal application. Ramendran, Raman, Mohamed, Beleya, and Nodeson (2013) posit that Employees in today's flexible businesses should be able to switch between tasks as needed while yet maintaining or, better yet, increasing overall company performance and efficiency. Workers in dynamic contexts must be adaptable and able to function well in a variety of settings (Pulakos et al., 2000). According to Beltrán-Martín et al. (2009), the sub-dimensions of intrinsic, behavioral, skill, and relational flexibility describe functional flexibility. Intrinsic flexibility indicates that employees have a wide range of skills, functions, and talents, allowing the company to use them in a variety of settings (Van den Berg and Van der Velde, 2005). The ease and speed at which employees can pick up new skills and talents is known as skill flexibility. Bhattacharya, Gibson, and Doty (2005) posit that companies can promote skill flexibility by using project-based work systems, job rotation, and multifunctional teams. Ketkar and Sett (2009) identified a number of practices that allow the organization to expand, modify and/or transform its human capital to include development-focused training programmes, performance evaluation and reward systems, career development, job rotation and empowerment, and participation practices. Relational flexibility embodies the combination of the diverse employee's competencies. In order to create new types of

collective human capital, it relies on coordinating mechanisms. According to Beltrán-Martín et al. (2009), human capital cannot be changed in nature; instead, the relationships between resources can be changed to create richer combinations. Behavioral flexibility refers to non-repetitive behavior that is not predicated on fixed, predictable, or pre-established patterns (Beltrán-Martín et al., 2009). Employee contributions to company objectives vary. The survival of Organizations no longer relies on employees to perform identical, clearly defined duties with clear differences in each employee's position (Martin & Healy, 2009). By fostering diversity of viewpoints, organizations can be forced to steer clear of simplistic interpretations and engage in productive dialogue on the best course of action. (Gressgaٌrd and Kare, 2015).

2.2 Organizational Effectiveness

The ability of an organization to get necessary resources and accomplish goals using fundamental tactics is referred to as organisational effectiveness (Ashraf and Kadir, 2012). Organisational effectiveness illustrates the goal of an organisation by supplying crucial information for decision-making, emphasizing its resources, proving its influence, and raising accountability (Zook, 2015). It gauges how well a company accomplishes its objectives. An organization's system, culture, structure, and tactics are key components in achieving effectiveness, and they all represent the organization's purpose of reaching the maximum level of effectiveness. Effectiveness of an organization extends beyond its financial results. The relational dynamics fostered by leadership are a source of stakeholder confidence, as noted by Jiang and Liu (2015) and Nienaber and Svenson (2013). The likelihood of an organization becoming effective is therefore increased by comprehending the perspectives of various stakeholders and appreciating their contributions. Zheng (2010) argues that understanding the organisation's objectives is necessary for attaining organizational effectiveness. Customer impressions of the company, customer satisfaction, staff connections, business processes, and learning affect effectiveness of any organisation.

2.3 Functional Flexibility and Organization Effectiveness

Shiva and Suar (2010) aver that improving employees' attitudes toward the company from a lower to a higher level of maturity can lead to superior performance; as a result, human capital management should be closely bonded with the concept of effectiveness. Four ways are proposed by Ashraf and Kadir (2012) to comprehend organizational effectiveness- the process approach, the objective approach, the system resource approach, and the strategic constituency approach. Relevant in this context, the process approach is concerned with determining the amount to which resources are formally utilized in the production of goods or services while also taking into account the transformation process (Schermerhorn et al., 2004). Effectiveness defines the internal health and efficiency of the organization, the smooth operation of its internal processes and procedures, and the full participation of its members. In the opinion of Heilman and Kennedy-Philips (2011), organizational effectiveness is a useful tool for evaluating how well goals and missions are being fulfilled.

The interface between operations and human resource management offers multiple techniques in different aspects of a production system (Boudreau et al., 2003). Improving working conditions to enable employees to be more productive is its primary objective (Buzacott, 2002). As noted by Meyer and Herscovitch (2001), organizational commitment, workplace interaction, direction, adaptability, positive work environment, appropriate resource allocation policies, and a clearly defined organizational future perspective are all associated with organizational effectiveness (Bartuševičienė and Šakalyte (2013). The triple bottom line concept currently encompasses value created from sociological (people), environmental (planet), technological (innovation), and cultural (well-being) variables in addition to measurable financial (profit) performance. The new metrics are considered essential for tracking the efficacy of organizations (Jacobson and Anderson, 2015;

Mikelsone and Leila, 2016; Warren, 2016). When an organization increases its capability, significant transformations take place. It may entail developing brand-new procedures and frameworks for the workplace in order to facilitate completely new methods of working. Both managers and staff may need to adjust how they operate as a result. It might also call for upgraded technology or infrastructure. It will be challenging to achieve effectiveness in an organization with a high staff turnover rate, a vague vision, a lack of innovation, and subpar value creation. Based on the position of this study, the following hypothesis is made:

H_1: Functional flexibility has significant effect on organization effectiveness.

2.4 Theoretical Framework

Contingency theory suggests that in order to be effective, HRM must be consistent with other aspects of the organization and/or external environment.

This study anchors on Contingency Theory which holds that organization's ability to function effectively depends on how well its human resources meet the needs of both internal and external variables, including shifting market conditions, employee capabilities, organizational culture and structure, and customer preferences. The contextualization of human resource management is emphasized by the contingency approach (Allani et al., 2003). According to this method, human resource management techniques can only improve company performance if they are tailored to the management of the company and in line with its overarching plan. When human resource management procedures and policies are not adequately linked with the organization's strategic objective, the contingency approach to human resources makes the assumption that they are of no practical value to the company (Schuler, 1992). The contingency method is predicated on two fundamental tenets: first, that an organization can enhance its performance by aligning a particular strategy with human resource management practices; and second, that the company with the best match achieves the best outcomes. The ability to quickly adapt to shifting market conditions, grab opportunities, and neutralize dangers is made possible by flexible human resources.

2.5 Empirical Review

Pradhan, Kumari, and Kumar (2017) examined the influence of human resource flexibility on organisational effectiveness and the mediating role of organisational citizenship behaviour in India. Using structural equation modelling, the study revealed significant influence of in human resource flexibility on organisational effectiveness. The findings also reported that organisational citizenship behaviour has significant mediating effect on the relationship between human resource flexibility and organisational effectiveness. Ngo and Loi (2008) explored the relationships between human resource flexibility, organizational culture, and organizational performance in Hong Kong. The results of structural equation modelling (SEM) revealed the positive effects of employee behaviour flexibility and HR practice flexibility on adaptability culture. Employee skill flexibility was however found to exert no such effect. In order to determine whether resilience and perceived organizational support have predictive value for employee engagement in South Africa, Meintjes and Hofmeyr (2018) investigated the relationship between resilience, perceived organizational support, and employee engagement among pharmaceutical sales employees in a competitive sales environment. The method used was a cross-sectional, quantitative, exploratory survey. The study included a sample of 125 sales agents from a pharmaceutical company in South Africa. The Utrecht Work Engagement Scale (UWES), the Brief Resilience Scale (BRS), and the Perceived Organizational Support Scale (POS) were among the measuring tools. The study discovered that in a competitive sales environment, employee engagement was influenced by perceived organizational support but not resilience. This research examined the interaction between the functional flexibility factors and organization effectiveness, as a possible major role player in the sustainability of entrepreneurial firms in the north-central zone of Nigeria. Skills, behavioral, and relational flexibilities were adopted as operational

measures of functional flexibility. Sardana**,** Terziovski, & Gupta (2016), drawing on dynamic capabilities theory and a sample based on the Indian manufacturing industry, examined the influence of manufacturing operations' functioning, strategic alignment, and responsiveness to market need for customization on firm performance. A multi-variate regression method was applied using confirmatory factor analysis. Findings indicated that operations' strategic alignment to the firm's objectives is the single most key contributor to firm performance. The operations' capability to respond to market need for customization was also found to significantly contribute to firm performance. Plant technology capability was found to be essential to respond effectively to market need for customization, and is positively and significantly related to firm performance.

3. Research Method

3.1 Research Design and Population

This study adopted descriptive survey research design suitable for the collection and analysis of data for the purpose of discovering ideas and insight from an existing situation without subjecting it to any form of manipulation. The study population comprised the medium scale enterprises in North-Central Nigeria. According to SMEDAN and National Bureau of statistics collaborative survey (2021), the population of medium scale manufacturing firms is 243 across the six (6) states of the north-central zone of Nigeria, and the federal capital territory, as stated below:

Table 1: Population of the Study

States	Enterprises
Nasarawa	18
Niger	47
FCT	75
Kogi	16
Kwara	18
Benue	28
Plateau	41
Total	**243**

Source: SMEDAN and National Bureau of Statistics Survey, 2021

3.2 Instrument Validity, Reliability, and Method of Data Analysis

For instrument validity, Kaiser-Meyer-Olkin (KM0) measure of sampling adequacy was adopted for a post-field test conducted to examine the strength of the partial correlation between variables. The Kaiser-Meyer-Olkin measure of sampling adequacy values were 0.591, 0.672, 0.581, and 0.614. Also, this study adopted the use of Cronbach's Alpha coefficient for reliability test at 5% level of significance. The reliability test indicates that the instrument measured the characteristics and behaviour within the test at alpha values of 0.91, 0.77, 0.65, and 0.84. The hypothesis was tested using multiple regression analysis to measure extent of effect. The tool was also considered suitable as it did not measure the extent of effect in isolation from the determination of the correlation and fitness of model variables. A multiple regression model was specified, and the equation logged to allow for direct estimation and interpretation of coefficients.

3.3 Estimation of Study Variables

Variables of the objective are organizational effectiveness (Y) as the dependent variable and functional flexibility(X) as the independent variable captured by skills flexibility(X1), behavioural flexibility(X2), and relational flexibility(X3).

3.4 Model Specification

The following multiple regression model was specified, and the equation logged to allow for direct estimation and interpretation of the coefficients.

$Y = ao + \beta_1 X1 + \beta_2 X2 + \beta_3 X3 + \mu$

Where:

ao	= the intercept
$\beta_1 - \beta_5$	= the coefficient of independent variables
Y	= Organisational Effectiveness
X1	= Skills Flexibility
X2	= Behavioural Flexibility
X3	= Relational Flexibility
μ	= the error term.

4. Results and Discussion of Findings

4.1 Descriptive Analysis of Data

Table 2: Organizational Effectiveness

Items	5	4	3	2	1
The organization achieves its daily objectives	133(55.42)	68(28.33)	15(6.25)	10(4.17)	14(5.83)
Tasks assigned to workers are usually delivered within expected time frame	77(32.08)	123(51.25)	11(4.58)	13(5.42)	16(6.67)
Most units achieve their periodic objectives	76(31.67)	134(55.83)	6(2.50)	15(6.25)	9(3.75)
We produce at the least possible cost	107(44.58)	113(4.58)	7(2.92)	5(2.08)	9(3.75)

Source: Survey, 2021

Table 3 indicates that 55.42% of the respondents strongly agreed that the organization achieves its daily objectives. 28.33% of the respondents agreed that the organization achieves its daily objectives and 6.25% of the respondents were undecided. 4.17% of the respondents strongly disagreed that the organization achieves its daily objectives and 5.83% of the respondents disagreed that the organization achieves its daily objectives. It further indicates that 32.08% of the respondents strongly agreed that tasks assigned to workers are usually delivered within expected time frame. 51.25% of the respondents agreed that tasks assigned to workers are usually delivered within expected time frame and 4.58% of the respondents were undecided. 5.42% of the respondents strongly disagreed that tasks assigned to workers are usually delivered within expected time frame and 6.67% of the respondents disagreed that tasks assigned to workers are usually delivered within expected time frame. It also indicates that 31.67% of the respondents strongly agreed that most units achieve their periodic objectives. 55.83% of the respondents agreed that most units achieve their periodic objectives and 2.50% of the respondents were undecided. 6.25% of the respondents strongly disagreed that most units achieve their periodic objectives and 3.75% of the respondents disagreed that most units achieve their periodic objectives. Finally, the table indicates that 44.58% of the respondents strongly agreed that they produce at the lowest possible cost. 4.58% of the respondents agreed that they produce at the lowest possible cost and 2.92% of the respondents were undecided. 2.08% of the respondents

strongly disagreed that they produce at the lowest possible cost and 3.75% of the respondents disagreed that they produce at the lowest possible cost.

Table 3: Skill Flexibility

Items	5	4	3	2	1
Employees always make effort to update their skills	97(40.41)	114(47.50)	6(2.50)	12(5.00)	11(4.58)
Employees learn quickly how to perform tasks they were initially unable to perform	99(41.25)	100(41.67)	15(6.25)	13(5.42)	13(5.42)
Our workers are able to perform another job when needed to do so	72(30.00)	98(40.83)	20(8.33)	26(10.83)	24(10.00)
We periodically move our employees around to different units within the organization	18(7.50)	69(28.75)	22(9.17)	71(29.58)	60(25.00)

Source: Survey, 2021

Table 4 indicates that 40.41% of the respondents strongly agreed that employees always make effort to update their skills. 47.50% of the respondents agreed that employees always make effort to update their skills and 2.50% of the respondents were undecided. 5.00% of the respondents strongly disagreed that employees always make effort to update their skills and 4.58% of the respondents disagreed that employees always make effort to update their skills. It indicates that 41.25% of the respondents strongly agreed that employees learn quickly how to perform tasks they were initially unable to perform. 41.67% of the respondents agreed that employees learn quickly how to perform tasks they were initially unable to perform and 6.25% of the respondents were undecided. 5.42% of the respondents strongly disagreed that employees learn quickly how to perform tasks they were initially unable to perform and 5.42% of the respondents disagreed that employees learn quickly how to perform tasks they were initially unable to perform. The table indicates that 30.00% of the respondents strongly agreed that their workers are able to perform another job when needed to do so. 40.83% of the respondents agreed that their workers are able to perform another job when needed to do so and 8.33% of the respondents were undecided. 10.83% of the respondents strongly disagreed that their workers are able to perform another job when needed to do so and 10.00% of the respondents disagreed that their workers are able to perform another job when needed to do so. Finally, the table indicates that 7.50% of the respondents strongly agreed that they periodically move their employees around to different units within the organization. 28.75% of the respondents agreed that they periodically move their employees around to different units within the organization and 9.17% of the respondents were undecided. 29.58% of the respondents strongly disagreed that they periodically move their employees around to different units within the organization and 25.00% of the respondents disagreed that they periodically move their employees around to different units within the organization.

Table 4: Behavioural Flexibility

Items	5	4	3	2	1
I alter my behaviour in response to customer requirements	23(9.58)	60(25.00)	14(5.83)	78(32.50)	65(27.08)
Our employees find it easy to change their work habits for the organisation's success	16(6.67)	19(7.92)	13(5.42)	103(42.92)	89(37.08)
Employees' work habits are usually in line with the expectation of the organization	10(4.17)	20(8.33)	8(3.33)	111(46.25)	91(37.91)

Source: Survey, 2021

Table 5 indicates that 9.55% of the respondents strongly agreed that they alter their behaviour in response to customer requirements. 25.00% of the respondents agreed that they alter their behaviour in response to customer requirements and 5.83% of the respondents were undecided. 32.50% of the respondents strongly disagreed that they alter their behaviour in response to customer requirements and 27.08% of the respondents disagreed that they alter their behaviour in response to customer requirements. The table indicates that 6.67% of the respondents strongly agreed that their employees find it easy to change their work habits for the organisation's success. 7.92% of the respondents agreed that their employees find it easy to change their work habits for the organisation's success and 5.42% of the respondents were undecided. 42.9% of the respondents strongly disagreed that their employees find it easy to change their work habits for the organisation's success and 37.08% of the respondents disagreed that their employees find it easy to change their work habits for the organisation's success. The table indicates that 4.17% of the respondents strongly agreed that employees' work habits are usually in line with the expectation of the organization. 8.33% of the respondents agreed that employees' work habits are usually in line with the expectation of the organization and 3.33% of the respondents were undecided. 46.25% of the respondents strongly disagreed that employees' work habits are usually in line with the expectation of the organization and 37.91% of the respondents disagreed that employees' work habits are usually in line with the expectation of the organization.

Table 5: Relational Flexibility

Items	5	4	3	2	1
Our workers often exchange ideas with colleagues from other units	14(5.83)	12(5.00)	95(39.58)	91(37.92)	28(11.67)
Teams are made up of employees from different units	11(4.58)	15(6.25)	77(32.08)	73(30.42)	64(26.67)
Employees work hand-in-hand with other colleagues to ensure that we achieve our objectives	12(5.00)	14(5.83)	80(33.33)	74(30.83)	60(25.00)

Source: Survey, 2021

Table indicates that 5.83% of the respondents strongly agreed that their workers often exchange ideas with colleagues from other units. 5.00% of the respondents agreed that their workers often exchange ideas with colleagues from other units and 39.5% of the respondents were undecided. 37.92% of the respondents strongly disagreed that their workers often exchange ideas with colleagues from other units and 11.67% of the respondents disagreed that their workers often exchange ideas with colleagues from other units. The table indicates that 4.48% of the respondents strongly agreed that teams are made up of employees from different units. 6.25% of the respondents agreed that teams are made up of employees from different units and 32.08% of the respondents were undecided. 30.42% of the respondents strongly disagreed that teams are made up of employees from different units and 26.67% of the respondents disagreed that teams are made up of employees from different units. The table indicates that 5.00% of the respondents strongly agreed that employees work hand-in-hand with other colleagues to ensure that they achieve their objectives. 5.83% of the respondents agreed that employees work hand-in-hand with other colleagues to ensure that they achieve their objectives and 33.33% of the respondents were undecided. 30.83% of the respondents strongly disagreed that employees work hand-in-hand with other colleagues to ensure that they achieve their objectives and 25.00% of the respondents disagreed that employees work hand-in-hand with other colleagues to ensure that they achieve their objectives.
The mean and standard deviation of the model variables were computed.

Table 6: Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
Y	240	1.00	5.00	4.2333	1.12211
x1	240	1.00	5.00	3.9667	1.08957
x2	240	1.00	5.00	4.0542	.96442
x3	240	1.00	5.00	4.2875	.87543
Valid N (listwise)	240				

Source: SPSS version 20.00

The table 3 revealed that the result of descriptive statistics which indicated the mean and standard deviation as well as minimum and maximum value of the variables. The mean value of organizational effectiveness (y) is 4.23, the mean value of skills flexibility (X1) is 3.96, the mean value of behavioural flexibility (X2) is 4.05, the mean value of relational flexibility (X3) is 4.28. Standard deviation values of the variables were also indicated in the table.

4.2 Test of Hypothesis

Decision Rule: Accept the alternate hypothesis if p-value < 0.05

Regression Output on Functional Flexibility and Organizational Effectiveness

Dependent Variable: Organizational Effectiveness
Method: Ordinary Least Square

Table 7: Results of Organizational Effectiveness Equation

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-.057	.134	-.422	.673
Skills Flexibility	.908	.089	10.160	.000
Behavioural Flexibility	-.332	.110	-3.018	.003
Relational Flexibility	.474	.060	7.950	.000

Sources: Extract from SPSS Ver. 20
Adjusted R^2 = 0.877
Prob (F-Statistic) = 0.000

Result Summary:
The first model examined the extent to which human resource flexibility affects organizational effectiveness in medium scale enterprises in North- Central Nigeria. The regression analysis result reveals that the model is fit for the study as the f-statistics is significant at 0.000 level of significance. This implies that all the variables used in the model are fit and are correlated. The result of the regression analysis reveals significant relationships between the independent variables and the dependent variable. While, skills flexibility and Relational flexibility were found to be statistically significant with P-values of less than 5%, and having positive effect on organizational effectiveness, behavioural flexibility was found to have significant but negative effect on organizational effectiveness with P-value of less than 5%. Thus, we concluded that skills flexibility has positive and significant effect on organizational effectiveness, behavioural flexibility has negative but significant effect on organizational effectiveness, and relational flexibility has positive and significant effect on organizational effectiveness in medium scale firms in North- Central Nigeria. The Adjusted R-squared (R^2) value of 0.87 indicates that 87% variation in the dependent variable can be explained by variation in the independent variables and 13% can be explained by other factors not noted in the regression model but captured as the error term. The result indicates that the independent variables (human resource flexibility factors) put together have significant effect on the dependent variable (organizational effectiveness). Therefore, we reject the null hypothesis that human resource flexibility has no significant effect on organizational effectiveness and conclude that human resource flexibility has significant effect on organizational effectiveness in medium scale firms in North- Central Nigeria.

4.3 Discussion of Findings

Hypothesis one regressed organizational effectiveness on skills flexibility, behavioural flexibility, and relational flexibility. The result of the analysis indicates that human resource flexibility significantly affects organizational effectiveness in medium scale enterprises in North- Central Nigeria. In the model, organizational effectiveness was used as dependent variable while skills flexibility, behavioural flexibility, and relational flexibility were used as proxy for human resource flexibility as the independent variable. The result showed that skills flexibility and relational flexibility assume the positive sign and are statistically significant while behavioural flexibility although found to be statistically significant assumed a negative sign. These imply that human resource flexibility has significant effect on organizational effectiveness. This finding is in line with the views of Bhattacharya et al. (2005); García-Tenorio, Sanchez, and Holgado (2011); Pérez-López, Montes-Peón and Vázquez-Ordás (2006) who have emphasised that organisations need to implement practices specifically designed to increase human resource flexibility to facilitate the achievement of their goals. This finding is in line with the findings of Pradhan, Kumari, & Kumar (2017) which suggests that human resource flexibility is required for any organisation to deal with global business demands in a timely manner for maximum benefits. It is also consistent with the position of Hang-Yue & Raymond (2008) that human resource flexibility culture affects both human resource-related and market-related performance in a positive manner.
The coefficient of skills flexibility assumes a positive sign and is statistically significant. This shows that the organisations easily find new and better ways to create value to meet

changing market demands when their employees can quickly learn new procedures and update their skills, thus increasing the diversity of skills in such organisations. This is in line with the work of Wu (2011) who observed that firms with high level of skill flexibility will have broad, heterogeneous skills of the workforce which can be quickly redeployed, and that employees' multiple skills help firms to adapt effectively to changes in demand pattern for HR skills and companies can benefit from their capability of quickly redeploying their employees' skills. It is also in line with the view of Bhattacharya et al. (2005) that skills possessed by employees but not currently used may open up new opportunities of business for the firm.

The coefficient of behavioural flexibility has a negative sign and its P-value shows that it is statistically significant. The implication of this is that alterations in work behaviours inversely affect increase or decrease in organizational effectiveness. This is inconsistent with the findings in the study of Wu (2011) which posit that the extent to which employees possessed a wide range of repertoire of behavioral scripts that might be exhibited appropriately in different situations is advantageous to organisations. This finding is also inconsistent with the view of Hang-Yue & Raymond (2008) which indicates positive effect of employee behaviour flexibility on performance. This may imply that in the firms under study, alterations in work behaviours are not formally directed, controlled, or periodically reviewed against the organisations' goals to ensure that employees' work behaviours remain in line with the firms' expectations of them.

The coefficient of relational flexibility assumed a positive sign and its P-value is less than 0.05, showing that it is statistically significant to the dependent variable. This implies that increase in relational flexibility causes a corresponding increase in organizational effectiveness, and vice versa. This is line with the study of Bhattacharya et al. (2005) which argues that an organisation that has the ability to use human capital in various tasks or jobs and situations will be able to combine and reorganize their skills to a variety of situations, adapting the organization to external and internal changes. The ability of employees to come together as a team to take up responsibilities that cut across several units will increase the identification and implementation of new ideas regarding the performance of tasks, and thus enable better performance.

5. Conclusion

Following the findings, this research concludes that functional flexibility facilitates and sustains organizational effectiveness through the deployment of skills, behavioural, and relational flexibility. Functional flexibility significantly affects effectiveness, and thus any firm that fails to embrace this may not survive in the dynamic market environment because the possession of only stand-alone resources may no longer be sufficient to sustain performance. The leadership of business enterprises should increase focus on implementing practices specifically designed to increase human resource flexibility. Management should adopt formal and coordinated approaches to modifications of work behaviours when required. This can be achieved by having periodic reviews of individual employee's work behaviour against the organisations' goals to ensure that employees' work behaviours remain in line with the firms' expectations of them. Where there is misalignment, the management must create a practical presentation of the desired workplace behaviours as against the different situations requiring these behaviours.

6. Study Limitations and Suggestions for Further Studies

This study was geographically limited to the north-central zone of Nigeria and therefore, the application of its findings across other geopolitical zones should be done with utmost sensitivity. This study was originally designed to examine performance sustainability of medium scale enterprises using historical data. Historical data on the related variables were however unavailable/inaccessible. Based on the limitations identified and findings of the current research, this study proposes the following for future research undertakings:

1. This study adopted the use of questionnaire for data collection which is prone to response bias. To minimize the effect of response bias, future research undertakings may gather data from sources other than the primary source. Although this study was initially designed to capture historical performance data covering a long period of time, it was unable to do so as a result of unavailability of historical data. Therefore, to fully capture the extent to which resilience affects sustainable performance over time, future research may look into the consideration of historical performance data that will cover a period of time.
2. Future research in this area may seek to expand on geographical coverage to capture other geopolitical zones of Nigeria and their individual characteristics, as this study was geographically limited to the north-central zone of Nigeria.

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KNOWLEDGE SHARING IN BUSINESS AND COMPETITIVE INTELLIGENCE: A BIBLIOMETRIC ANALYSIS

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Abstract: *Over the past years, business intelligence and competitive intelligence practices achieved a significant importance in organizations, due to their capability of providing the necessary knowledge for the decision-makers, providing a significant advantage against market competitors or internal and external threats and vulnerabilities. Also, business intelligence and competitive intelligence have been under researcher's scope, the literature in those domains being continuously updated with new findings. Also, knowledge sharing is a process that helps organizations increase their employees understanding and expertise in certain fields, being highly recognized by both practitioners and researchers for its importance and efficiency. Therefore, the purpose of this research is to analyze the state of the literature in business intelligence and competitive intelligence, in correlation with knowledge sharing concept, in order to identify the connections between these domains. Also, this article aims to present an analysis that could provide a better understanding about the research interest in integrating knowledge sharing in business intelligence and competitive intelligence practices. In order to achieve the proposed objective, this research performs a bibliometric analysis using VOSViewer, a specialized software designed for creating visualizing maps that present networks between specific items. The information used for conducting this research was retrieved from Web of Science core collection and Scopus, world's largest index databases.*

Keywords: competitive intelligence, business intelligence, knowledge sharing, bibliometric analysis.

JEL classification: D83.

1. Introduction

Intelligence represents an important intangible asset, obtained through data gathering activities and complex analytic processes, having the main objective of obtaining necessary information and knowledge for enhancing the decision-making process (Johnson, 2010). As Kent (1949) and Spender (1996) considered, intelligence is more than knowledge, but depends on it. This complex and resourceful domain was developed by researchers from business field in two main directions: business intelligence and competitive intelligence (Krizan, 1999). The result of either business intelligence or competitive intelligence is considered to be a driving force for obtaining and maintaining a competitive advantage in a certain field, from a strategic perspective (Bratianu and Murakawa, 2004; Fleisher, 2001; Jourdan et al., 2008; McGonagle, 2016; Porter, 1985; Rajnoha et al., 2016; Søilen, 2017).
Another intangible asset that is indispensable for achieving competitive advantage is knowledge that is created, acquired, shared and exploited within an organization (Bratianu, 2007, 2022; Nonaka, 1994; Porter, 1985; Spender, 1996; Zack, 1999). Therefore, this study

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tries to understand the connections between business intelligence and competitive intelligence, on one hand, and knowledge sharing concept, on the other hand, by analyzing the existing literature and identifying the common points of interest between these research fields, using the specialized software VOSViewer (Van Eck and Waltman, 2020).
This research starts with a short introduction and literature review that conceptualize the purpose and motivation of this approach. After this, the study continues with the methodology presentation, followed by results and conclusions.

2. Literature review

According to Skyrius (2021, p.10), "business intelligence may be defined as the organizational practice that encompasses a coherent set of people, informing processes and conventions of using a comprehensive technology platform to satisfy business information needs that range from medium to high complexity".
Also, Watson and Wixom (2010, p. 96-97) stated that "business intelligence consists of business users and applications accessing data from the data warehouse to perform enterprise reporting, online analytical processing, querying, and predictive analytics".
Nevertheless, business intelligence has an important role in the strategic decision-making process by transforming non-relevant data and weak signs, gathered from inside the organization and using advanced analytic tools, into valuable information (Botos and Radu, 2017; Rouibah and Ould-ali, 2002). The main attribute of business intelligence is its orientation exclusively on the activities that take place inside the boundaries of the organization, such as value chain or interdepartmental activities (Alnoukaria and Hanano, 2017; Ivan, 2016).
Unlike business intelligence, competitive intelligence is oriented on producing valuable information about the external environment of the organization. According to Fleisher (2001, p.4), "competitive intelligence is the process by which organizations gather actionable information about competitors and the competitive environment and, ideally, apply it to their decision-making and planning processes in order to improve their performance." Martins (2001) saw competitive intelligence as a mandatory asset that could provide knowledge about possible future outcomes in a certain industry.
Therefore, competitive intelligence target specific objectives in the external environment, such as strengths and weaknesses of other business competitors that could be exploited (Botos and Radu, 2017; Bratianu, 2002), or opportunities and threats that could affect the organization (Alnoukaria and Hanano, 2017). McGonagle (2016) drew attention to the ethical and legal framework in which competitive intelligence must act in order to obtain the information that is needed about the competitive environment. Therefore, competitive intelligence is an ethical and legal activity, unlike business espionage which is condemned by law (Fleisher, 2001; Ivan, 2016).
As it was presented before, intelligence depends on knowledge (Kent, 1949; Spender, 1996). Business intelligence and competitive intelligence processes rely on the specific rational knowledge, emotional knowledge and spiritual knowledge that the organization and its employees possess. This triad of knowledge, as well as the knowledge dynamics model that implies rational knowledge, emotional knowledge and spiritual knowledge, were presented by Bratianu and Bejinaru (2019a, 2019b). Therefore, according to the theory of knowledge fields, rational knowledge represents the knowledge that could be expressed using symbolic or natural language, emotional knowledge refers to emotions and feelings and spiritual knowledge is composed by our meanings and values.
One process that affects the knowledge dynamics is knowledge sharing. This complex process includes the transfer of information, experience and knowledge between certain entities, either individuals or groups, without wanting, seeking or demanding any form of compensation (Bratianu and Bolisani, 2018; Massingham, 2020; Nonaka and Takeuchi,

1995). Knowledge sharing is greatly influenced by the organizational culture, which represents the spiritual knowledge of the organization. Based on the organizational culture, employees tend to be more competitive or cooperative, and, therefore, to be willing to share their knowledge or to try and hide it (Bratianu, 2022; Massingham, 2020; Nonaka and Takeuchi, 1995).

3. Methodology

This study tries to determine the state of the literature concerning the implications of knowledge sharing in business intelligence and competitive intelligence, based on a bibiliometric analysis conducted using the specialized software VOSViewer (Van Eck and Waltman, 2020). Therefore, this article has two main research questions:

- Are there any studies that encompass the knowledge sharing practices in business intelligence and competitive intelligence?
- What are the common points that connect knowledge sharing to business intelligence and competitive intelligence?

In order to respond to the proposed research questions, as well as to achieve its designated objective, this research will use data retrieved in 04 June 2024, from the world's leading literature databases, respectively Web of Science core collection and Scopus. The expressions used for searching throughout the mentioned databases were "business intelligence – knowledge sharing" and "competitive intelligence – knowledge sharing". The search engine for both Web of Science core collection and Scopus was used with "All fields" requirement, as well as all the time frame and all languages criteria. The results are presented in Table 1 and Table 2.

Table 1: Search results for "business intelligence – knowledge sharing"

	Web of Science core collection	**Scopus**
Total number of publications	51	2861
First year of publication	2005	1991
Document type	Article – 28 Proceeding paper – 23	Article – 1778 Conference paper – 523 Book chapter – 272 Book – 124 Others - 164
Subject area (leading 4 subject areas; one publication can have several subject areas)	Computer Science Information Systems – 13 Business – 12 Management – 11	Computer Science – 1402 Business, Management and Accounting – 1389 Social Sciences – 717 Decision Sciences- 559
Language	English – 51	English – 2821 Others – 40
Country	Australia – 13 USA – 11 China – 10 Germany - 4 Others - 13	USA – 435 China – 325 Australia – 219 India – 201 Others – 1681
Leading authors	Chang, E. – 6 Dillon, T – 4 Hai, D – 3	Kasemsap, K – 54 Chang, E. – 31 Wongthongtham, P. – 19

	Web of Science core collection	Scopus
	Hussain, F.K. – 3 Others – 35	Dillon, T. – 17 Others – 2740

Source: Author's analysis /processing based on own data

As it could be seen, Scopus database includes a significantly larger number of publications than Web of Science core collection. However, by analyzing the information presented in Table 1 it can be observed a resemblance in "Document type", "Subject area" and "Language" fields, as follows: both databases are mostly dominated by articles from Computer Sciences, Management and Business domains, written in English.

Table 2: Search results for "competitive intelligence – knowledge sharing"

	Web of Science core collection	Scopus
Total number of publications	19	1068
First year of publication	2003	1991
Document type	Article – 12 Proceeding paper – 5 Book chapter – 2	Article – 754 Conference paper – 136 Book chapter – 98 Book – 37 Others – 43
Subject Area (leading 4 subject areas; one publication can have several subject areas)	Business – 11 Management – 10 Economics – 3 Information science - 3	Business, management and accounting – 650 Computer science – 331 Social sciences – 284 Decision sciences – 188
Language	English - 19	English – 1039 Others - 29
Country	USA – 4 Australia – 3 Brazil – 2 France – 2 Others – 8	USA – 193 China – 129 United Kingdom – 89 India – 67 Others - 590
Leading authors	Capatina, A. – 2 Cekuls, A. – 2 De Almeida, F.C. – 1 Riccio, E.L. – 1 Others - 13	Tuan, L.T. – 17 Kasemsap, K – 14 Rothberg, H.N. – 14 Erickson, G.S. – 12 Others - 1011

Source: Author's analysis /processing based on own data

Just like for the previous search expression, Scopus database holds a considerably larger number of publications than Web of Science core collection. The resemblance identified for "business intelligence – knowledge sharing" expression could also be seen for "competitive intelligence – knowledge sharing" keywords, with article as the main document type, Business, Management and Computer Science as the leading subject areas and English as the dominant language.

After retrieving the databases needed for this study, the data was analyzed using the co-occurrence investigation procedure offered by VOSViewer (Van Eck and Waltman, 2020), in order to identify and visualize the similarities and connections between certain fields of interest, keywords and areas of research.

4. Results and discussions

The first database analyzed using VOSViewer was the one retrieved from Web of Science core collection for the expression "business intelligence – knowledge sharing", that contains a total number of 51 publications. From this database, VOSViewer identified a total number of 273 keywords, while 17 met the minimum threshold of 3 occurrences (Table 3). Those keywords were placed in 4 clusters, having a number of 75 links and total link strength of 119 (Figure 1).

Table 3: Keywords for Web of Science core collection "business intelligence – knowledge sharing" database

keyword	occurrences	total link strength	keyword	occurrences	total link strength
absorptive-capacity	3	12	innovation	3	7
analytics	3	11	knowledge	3	8
big data analytics	3	7	knowledge management	4	9
business intelligence	18	40	knowledge sharing	14	28
collaboration	3	7	management	9	26
firm performance	3	13	model	3	13
framework	3	7	performance	5	4
impact	6	24	strategy	3	15
supply chain	3	7			

Source: Author's analysis /processing based on own data

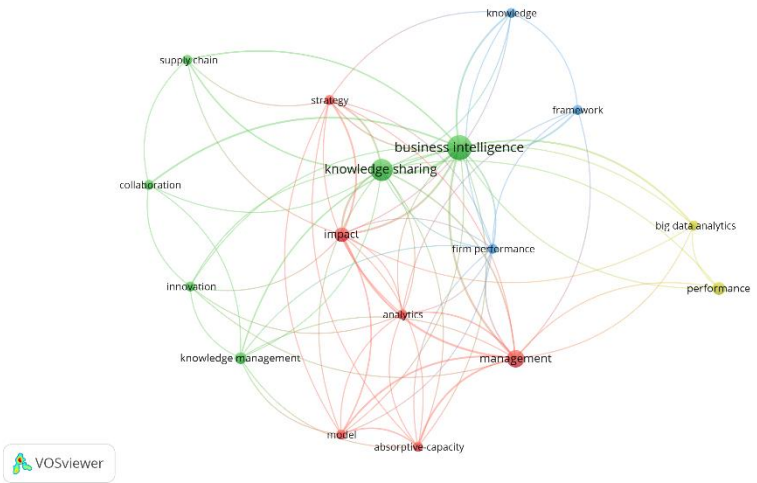

Figure 1: Co-occurrence map for "business intelligence – knowledge sharing" – Web of Science core collection

Source: Author's analysis /processing based on own data

The map generated by the specialized software is governed by "business intelligence" and "knowledge sharing" keywords, that are placed in the green cluster, in the center of the map, and connected through a link strength of 7, the highest in this case. This proves the fact that

these two fields are correlated and were the subject of research in the past, but the publications that cover this area are not varied. Nevertheless, this map shows some relevant common points of connection between “business intelligence” and “knowledge sharing”, both being linked with “management” (link strength 4, respectively 2), “strategy” (link strength 2, respectively 3) or “knowledge management” (link strength 2, respectively 1).
The second database for “business intelligence – knowledge sharing” expression was retrieved from Scopus and is formed by 2861 publications. Given the complexity of the database, VOSViewer found a total number of 11544 keywords. In order to enhance the relevance of this study and to obtain a clear and readable visualization map, the minimum number of occurrences was set to 21, with 131 keywords meeting the criteria. The first 20 keywords with the most occurrences are presented in Table 4. VOSViewer arranged those keywords in 6 clusters, being generated 4323 links with total link strength of 13188 (Figure 2).

Table 4: Keywords for Scopus “business intelligence – knowledge sharing” database

keyword	occurrences	total link strength	keyword	occurrences	total link strength
artificial intelligence	121	195	information management	146	315
big data	161	251	information systems	217	415
business intelligence	143	301	information use	113	252
competition	125	254	innovation	137	118
competitive intelligence	111	279	knowledge based systems	105	243
data analytics	86	168	knowledge management	536	755
data mining	95	190	knowledge sharing	132	245
decision making	190	407	knowledge-sharing	114	317
decision support systems	83	227	ontology	131	165
information analysis	100	254	social networking (online)	104	123

Source: Author’s analysis /processing based on own data

In this case, the most important keyword is “knowledge management”, placed in the blue cluster alongside both “knowledge sharing” and “knowledge-sharing” keywords that refer to the same concept. Both knowledge sharing constructs are linked with “business intelligence” (link strength 8), proving that the concepts are connected in the literature. Nevertheless, both knowledge sharing keywords, as well as “business intelligence”, are connected to similar keywords like “knowledge management” (link strength 90, 71 and 40) or “decision making” (link strength 16, 5 and 28). It is important to note that even if this analysis is oriented towards business intelligence, the keyword “competitive intelligence” is placed in the yellow cluster, connected to “business intelligence” (link strength 55), demonstrating the strong correlation

between the concepts. Also, “competitive intelligence” is connected to both knowledge sharing keywords (link strength 9), foreseeing the next phase of this research.

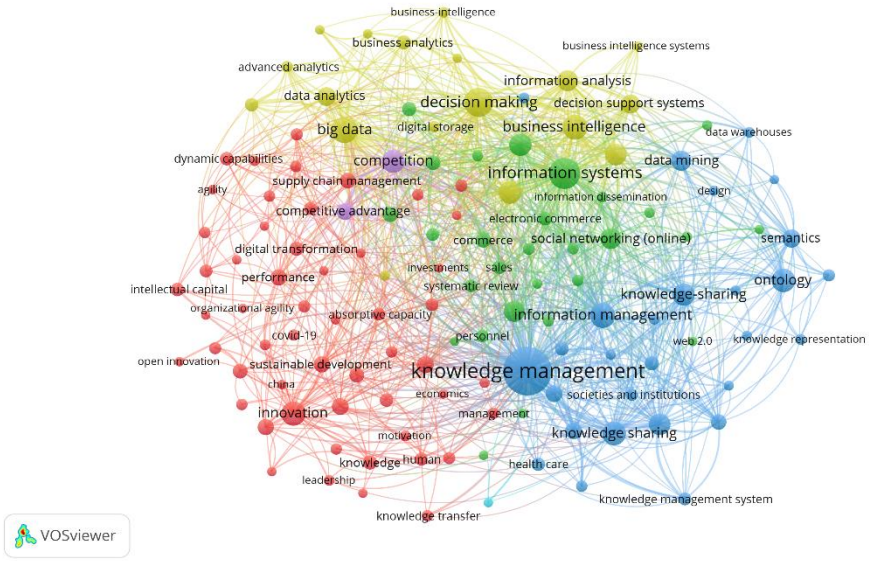

Figure 2: Co-occurrence map for “business intelligence – knowledge sharing” – Scopus
Source: Author’s analysis /processing based on own data

Going further to “competitive intelligence – knowledge sharing” expression, this study analyses the database retrieved from Web of Science core collection, formed by 19 publications. Out of 103 keywords, only 7 met the minimum threshold of 3 occurrences (Table 5), forming 2 clusters with 20 links and total link strength of 52 (Figure 3).

Table 5: Keywords for Web of Science core collection “competitive intelligence – knowledge sharing” database

keyword	occurrences	total link strength	keyword	occurrences	total link strength
competitive intelligence	10	22	management	5	11
impact	4	13	organizational culture	5	15
knowledge management	4	11	performance	8	14
knowledge sharing	6	18			

Source: Author’s analysis /processing based on own data

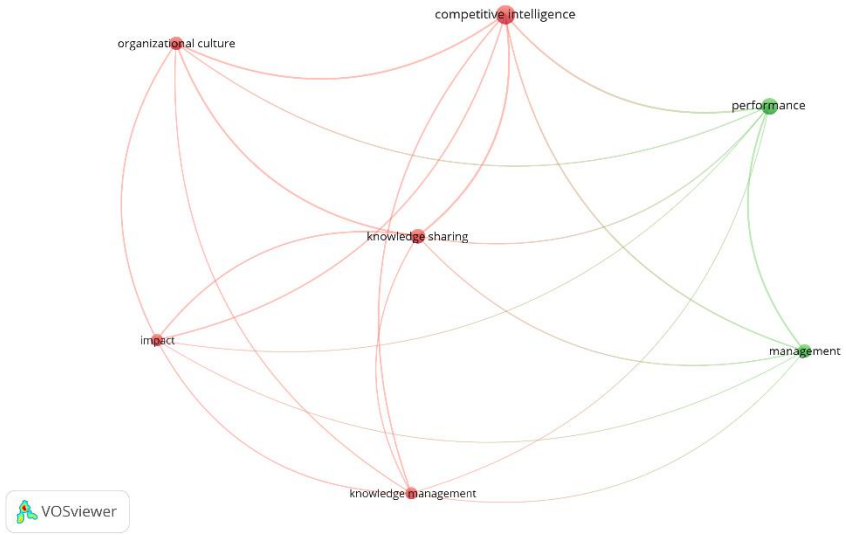

Figure 3: Co-occurrence map for "competitive intelligence – knowledge sharing" – Web of Science core collection
Source: Author's analysis /processing based on own data

By briefly analyzing Figure 3 it can be concluded that "competitive intelligence" and "knowledge sharing" are connected (link strength 5) and also linked to keywords like "knowledge management" (link strength 3, respectively 2) and "management" (link strength 3, respectively 2). This proves that, despite the relatively low number of publications indexed in Web of Science core collection for the searching expression, competitive intelligence and knowledge sharing are connected and have similar connections with other keyword.
The last database analyzed during this research is the one retrieved from Scopus for the expression "competitive intelligence – knowledge sharing", that contains 1068 publications. Out of these, VOSViewer determined 4416 keywords, and, using the same minimum number of occurrences as for "business intelligence – knowledge sharing" database, respectively 21, 32 keywords met the criteria (Table 6). VOSViewer placed the 32 keywords in 5 clusters, with 373 links and total link strength of 2035 (Figure 4).

Table 6: Keywords for Scopus "competitive intelligence – knowledge sharing" database

keyword	occurrences	total link strength	keyword	occurrences	total link strength
big data	40	79	knowledge acquisition	22	83
business intelligence	74	216	knowledge based systems	32	117
competition	77	250	knowledge management	237	546
competitive advantage	40	132	knowledge sharing	102	206
competitive intelligence	186	487	knowledge-sharing	45	156
decision making	61	196	motivation	24	52

keyword	occurrences	total link strength	keyword	occurrences	total link strength
design/ methodology/ approach	27	88	ontology	23	55
human resource management	26	90	organizational performance	29	66
industrial management	22	70	performance	23	36
information analysis	33	128	social media	45	82
information management	31	98	social networking (online)	25	65
information systems	42	127	societies and institutions	31	101
information technology	34	101	strategic planning	22	75
Innovation	71	116	surveys	30	96
intellectual capital	31	45	sustainable development	28	54
knowledge	31	48	vietnam	21	9

Source: Author's analysis /processing based on own data

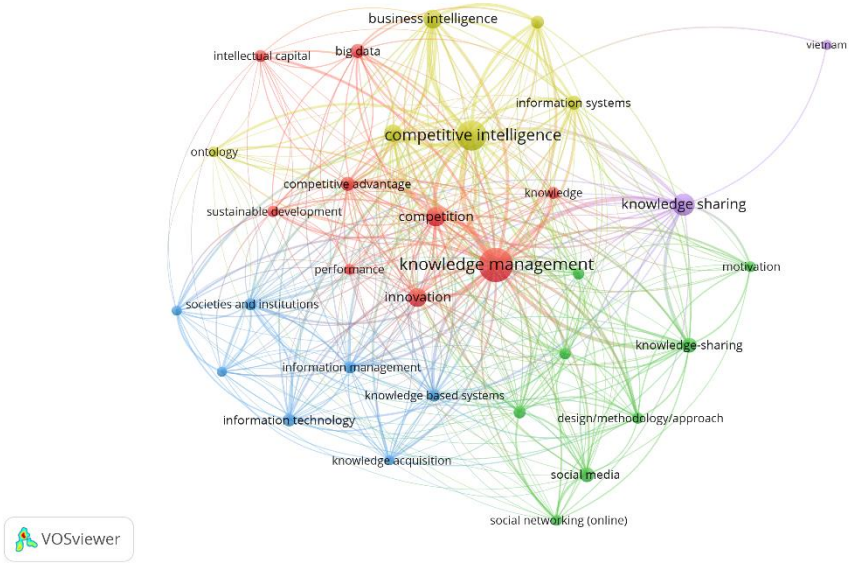

Figure 4: Co-occurrence map for "competitive intelligence – knowledge sharing" – Scopus
Source: Author's analysis /processing based on own data

In this map, "knowledge management" and "competitive intelligence" are both placed in the center of the map, in the red and yellow clusters. The two keywords are connected with the highest link strength, respectively 65. Just like in the 'business intelligence – knowledge sharing" co-occurrence map generated for the Scopus database, presented in Figure 2,

there are 2 keywords for knowledge sharing concept: “knowledge sharing” and “knowledge-sharing”. Both keywords are connected to “knowledge management” (link strength 45 and 37) and “competitive intelligence” (link strength 19 and 12). The strong correlation between “competitive intelligence” and “business intelligence” is proved again by the presence of the latter in this map, the two concepts being connected with a link strength of 55. Also, “business intelligence is connected with “knowledge management” (link strength 26) and both knowledge sharing keywords (link strength 5 and 3).

5. Conclusions

The bibliometric analysis conducted in this study tried to prove that, in the literature indexed in Web of Science core collection and Scopus, business intelligence, competitive intelligence and knowledge sharing are connected and were researched together. Nevertheless, this research identified the common areas of research for business intelligence and competitive intelligence, on one hand, and knowledge sharing, on the other hand, such as management, knowledge management and decision-making.

Also, based especially on the databases from Web of Science core collection, it can be stated that the connection between business intelligence/competitive intelligence and knowledge sharing has been researched for a while, but the state of the literature is still premature.

Therefore, understanding the correlation between business intelligence and competitive intelligence, using a knowledge-based framework and from a knowledge sharing point of view, should help both researchers and practitioners in analyzing and implementing these specific domains. This should be seen as the theoretical and practical utility of this paper, which aimed at closing a research gap between business intelligence, competitive intelligence and knowledge sharing.

By responding to the research questions formulated in this study naturally comes another direction for further research, such as the connections between knowledge sharing and other type of intelligence, respectively national security intelligence.

The fact that this study was based exclusively on the literature indexed in Web of Science core collection and Scopus and did not cover the publications from Google Scholar or the one that are not indexed in none of those represents the main limitation of this research. Another limitation represents the way VOSViewer is used by every researcher, accordingly with his general view and research objectives. Therefore, by setting the minimum number of occurrences to different values, VOSViewer generates different results, including or excluding relevant keywords. This limitation could be overcome by implementing different values for the minimum number of occurrences and analyzing the changes that occur in the maps generated by the specialized software, representing a possible research direction for future work.

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Bionote

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SUSTAINABLE ENTREPRENEURSIP AND ENVIRONMENTAL DYNAMISM OF SELECTED METER MANUFACTURING COMPANIES IN LAGOS STATE

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Abstract: *In the fields of business and environmental studies, sustainable entrepreneurship and environmental dynamism are inevitable concepts that drives the economy .Sustainable businesses may need to be especially inventive in highly dynamic circumstances, utilizing their knowledge of sustainability to foresee and adapt to changes.Therefore, the study was designed to investigate sustainable entrepreneurship and environmental dynamism of selected meter manufacturing companies in Lagos State. The study adopted a survey research design and the study relied on primary data through structural self-administered questionnaire. The targeted population of this study is 207 mid-level and top management level employees of MMCs in Lagos state. The list of MMCs was drawn from Directory of Certified Electricity Meters and Instruments Manufacturing /Assembling Companies and Nigerian Electricity Management Services Agency who served as a regulatory body to MMCs in Nigeria. Taro Yamane formula was used to choose 136 participants to which the questionnaires were administered and returned. Multiple regression and Pearson correlation method of analyses were used for hypotheses of the study. Findings revealed that social and economic sustainability are significant predictors of market dynamism of MMCs in Lagos State. The study concludes that both social sustainability and economic sustainability have a positive and significant influence on market dynamism. The study therefore, recommended that MMCs should always come up with both economic and social sustainability policy that can mitigate the effect of market dynamism and improve their operations.-*

Keywords: Economic, Sustainability, Environmental, Dynamism, Entrepreneurship and Longterm.
JEL codes: Q01, Q56, L25.

1. Introduction

Sustainable entrepreneurship describes the connection between sustainable development and entrepreneurship. Entrepreneurs aspire to create viable market solutions and intend to act as change agents who realize and exploit opportunities for sustainable development. As such, this chapter outlines three common conceptual views to approach the intersection of economic, social, and environmental sustainability (Farny, et al., 2021). In the Nigerian context, the rapidly urbanizing and populous Lagos State represents a significant hub for industrial activities and is home to several meter manufacturing companies (World Bank, 2020). These firms operate in an environment characterized by complex challenges and

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opportunities arising from the rapidly changing environmental landscape and governmental policies geared towards sustainability (Ajide et al., 2021).

Businesses all over the world have profited from the combined interactions of forces of product mix, location factors, and market advantages. MMCs play a key role in economic growth and industrial development and make vital contributions in improving the economic and social sectors of a country through stimulating medium and large scale employment, investment, development of indigenous skill and technology, promotion of entrepreneurship and innovativeness, enhancing exports, and also building an industrial base at different scales (Ajide et al., 2021).

Sustainable entrepreneurship brings a new approach for creating new products and services, business processes, management and control systems that ensure the face of changing (dynamic) business environment and consistently delivering superior value to its stakeholders. Critical factor militating against the sustainability of entrepreneurship in Nigeria are infrastructure deficit, lack of access to finance, policy inconsistencies and sustainability challenges, among others (Lawal, Worlu & Ayoade, 2016). An entrepreneurial undertaking is presumed to be sustainable if it sustains its past profit level and continue to grow without inhibiting its own ability or the ability of other bodies from achieving their corporate goals and objectives. An enterprise is running a sustainable venture, if it is able to meet its short-term financial obligations (Bansal & Desjardine, 2014).

The period from 2019 to 2023 has been marked by a remarkable surge in research and initiatives focused on sustainable entrepreneurship and environmental dynamism. The prevailing body of literature offers insights into diverse topics such as sustainable business practices, green innovation, circular economy, corporate social responsibility, and adaptive environmental management (Bocken et al., 2019; Mele et al., 2020; Sharma & Bhati, 2022). This seminar paper aims to contribute to this evolving discourse by investigating the sustainability practices and adaptive strategies adopted by selected meter manufacturing companies operating in Lagos State during the aforementioned period.

1.1 Statement of the Problem

The challenges posed by environmental dynamism and the urgency to adopt sustainable entrepreneurship practices raise concerns about the MMCs ability to strike a harmonious balance between economic growth and entrepreneurial sustainability which may result to instability changes in firm, unforeseen challenges, financial crises, policy restructuring, etc. that can militate against business performance without adequate managerial preparation against contingencies, consequently arising from environmental dynamism and disrupting actual entrepreneurial plans and implementations.

However, a company with a strong entrepreneurial orientation focuses its strategic planning on long-term firm performance. Long-term and sustainable growth factors, like increases in revenue, assets, and market share over several years, are often at the core of performance goals. Conversely, organizations that are more risk averse typically take a slow, incremental approach and prioritize short-term business performance as determined by productivity and profitability. Therefore, the primary problem addressed in this study is to examine the social and economic sustainability practices and strategies employed by meter manufacturing companies in Lagos State. The study also examined the key environmental challenges and dynamism factors affecting the meter manufacturing industry in Lagos State, and how these challenges impact the companies' operations, decision-making, and long-term viability. The study tends to examine the nexus between sustainable entrepreneurship and environmental dynamism among MMCs in Lagos State.

Objectives of the Study

The specific objectives in this study are to:

- Examine the relationship between social sustainability and market dynamism among MMCs in Lagos State;
- Investigate the nexus between economic sustainability and market dynamism among MMCs in Lagos State;
- Evaluate interaction effect of social and economic sustainability on market dynamism among MMCs in Lagos State

Research Questions

- What is the relationship between social sustainability and market dynamism among MMCs in Lagos State?
- How does economic sustainability relate with market dynamism among MMCs in Lagos State?
- What is the interaction effect of social and economic sustainability on market dynamism among MMCs in Lagos State

Research Hypotheses

H01: Social sustainability has no significant relationship with market dynamism among MMCs in Lagos State, Nigeria

H02: Economic sustainability has no significant association with market dynamism among MMCs in Lagos State, Nigeria

H03: There is no significant interaction effect of social and economic sustainability on market dynamism among MMCs in Lagos State

1.2 Scope of the Study

The scope of the study is limited to meter manufacturing companies in Lagos state, Nigeria, with empirical assessment on the importance of sustainable entrepreneurship proxies with social sustainability and economic sustainability and environmental dynamism proxy with market dynamism. The choice of Lagos is informed by the fact that Lagos is the hub of meter manufacturing companies in Nigeria and has the highest number of meter producers, compared to other states in Nigeria. The study is delimited to the variables under investigation, such as sustainable entrepreneurship dimension (social sustainability and economic sustainability) and environmental dynamism dimension (market dynamism).

2. Literature Review

2.1 Conceptual Review

2.1.1 Sustainable Entrepreneurship

Nambisan (2015), sustainable entrepreneurship is an entrepreneurial process that takes into account social, economic, and environmental issues that are important to both internal and external stakeholders. Hockerts and Wüstenhagen (2010) opined that sustainable entrepreneurship comes as a medium of making discovery and exploitation of economic opportunities which can be through the general disequilibrium in the market. It also helps in initiating and transforming the sectors to a socially and environmentally sustainable state. Nambisam (2015), sustainable entrepreneurship is regarded as the commitments that help in the going-concern of a business so as to make contributions to the economic development while not forgetting to improve the quality of life of workers.

2.1.2 Economic Sustainability

Economic sustainability refers to the ability of an economy to maintain stable growth and development over the long term without compromising the well-being of future generations (Barbier, 2019). It encompasses various dimensions, including the efficient allocation of resources, responsible fiscal and monetary policies, balanced trade, and inclusive economic growth. Achieving economic sustainability is essential for ensuring a prosperous and equitable society while safeguarding environmental and social aspects for future generations (Hossain& Kato, 2020). Embracing energy-efficient manufacturing methods, recycling materials, and exploring innovative business models can contribute to the industry's economic sustainability (Bocken et al., 2019).

2.1.3 Social Sustainability

The ability to meet the needs of the present generation without compromising the needs of future generations is the best way to define sustainability. While the environment is an important factor in sustainability, social sustainability is also vital to the longevity and well-being of a society (Schneider Electric, 2022). By taking into account what residents need and want from their homes and places of employment, social sustainability can be defined as a process for creating a vibrant, sustainable community that promotes wellness. Physical and social design, such as public spaces, civic engagement strategies, and social amenities, are all integrated into social sustainability. In order to facilitate social and cultural activities, it also has infrastructure (Schneider Electric, 2022).

2.1.4 Market Dynamism

Market dynamism refers to the degree of changes in the markets. There are some important factors that can be used to explain market dynamism, such as technological level, structure of the market, demand instability, unexpected fluctuations in the supply of materials and the market shocks. Market dynamism is naturally characterised by volatility and unpredictability (Ikhsan et. al., 2017).The successful business models must be clearly stated and market participants like competitors, customers and suppliers clearly identified. Most firms do have casualties from external uncertainty, which is caused by high dynamism in the market environment. Market dynamism also makes market situation more difficult for the organization to make predictions, planning of the resources and the feedback in accordance with their knowledge. (Ikhsan et. al., 2017).

2.2 Theoretical Framework

This study anchored on dynamic capabilities theory; as the perspective of the anchored theory focused on the objectives of this study.

2.2.1 Dynamic Capabilities View

Teece, Pisano and Shuen (1997), The theory of Dynamic Capabilities, a framework in strategic management, highlights an organization's capacity to combine, develop, and reorganize internal and external competencies in order to adapt quickly to changing surroundings. The development of dynamic capability as a theory received contributions from several other proponents (Eisenhardt & Martin, 2000; Helfatet al., 2007; Zollo & Winter, 2002). According to Teece (2007), operational capabilities support an organization's technical fitness in terms of ongoing operational sustainability and efficiency. Thus, the theory connects value creation and environmental dynamism with sustainable entrepreneurship. However, the dynamic capability theory underpinned the study.

2.3 Empirical Review

Syed (2021) empirically examine sustainable entrepreneurship and managerial strategies. Data were gathered from 486 entrepreneurs randomly chosen among SMEs in the Democratic Republic of the Using a self-administered questionnaire, Congo (DRC) textile industry participants were surveyed. The findings show that knowledge management techniques significantly and favorably affect both the adaptability of SMEs and the performance of sustainable entrepreneurship. Furthermore, opportunity awareness reinforces the relationship between the dynamic skills of SMEs and long-term entrepreneurial success.

Kanayo et al (2020) examined sustainable entrepreneurship in the services industry for SMEs in South Africa. The study revealed that how contextual variables and sustainable entrepreneurship are related. Using the test-retest reliability technique, the research instrument's reliability was examined, and the results produced an R-value of 0.70 and an internal consistency score of 0.875, as determined by the Cronbach Alpha index. The analysis employed Spearman Rank Correlation and the Binary Logistic method. Results show a correlation between sustainable entrepreneurship and qualities of a SME, government support, management skill, good employee-employer connection, and start-up capital.

Ogajuba, Naseer, Ogujiuba & Estelle (2021) examine the influence of the dynamics of contextual factors on sustainable entrepreneurship on the services sector in South Africa. The study identified the correlation between the contextual factors and sustainable entrepreneurship using binary logistics technique and spearmen rank correlation for the analysis. The study concluded that the contextual factors are correlated to sustainable entrepreneurship. It was recommended that the South African government and other developing countries needs to commit themselves to creating an environment that bolsters sustainability for entrepreneurship to thrive.

3. Research Methods

A descriptive research survey for efficient data gathering from MMCs operating in Lagos Statewas chosen to address the problem of the study. This survey method was chosen to provide the numeric description of some part of the population and explained the event as they were.The questionnaire was designed in a 5 Likert scale format and divided into sections. The population of the study was Nigerian Electricity Management Services Agency (NEMSA) is the association and also a central body that controls the activities of MMCs in Nigeria. However, from the database of NEMSA (2023), there are 18 MMCs currently in operation in Lagos State. Out of the 18 MMCs, only two (Mojec International Limited and Momas Systems Nigeria Limited) carry out actual manufacturing of meters in Lagos state. Hence, our target population is therefore, 207 mid-levels to top management level employees of the 2 MMCs (Mojec International Limited and Momas Systems Nigeria Limited), which actual carry out manufacturing of meters in Lagos state. The sample size was drawn from the population of the study using Taro Yamane statistical method which was formulated by Taro Yamane in 1967 (Adam, 2020).

The formula: $n = \frac{N}{1 + N*(e)\ 2}$

Where n = Corrected sample size
1= Constant
N= Population size
e= Acceptable margin of error

Note that:
N=207; and e=5% (0.05)
Therefore, n = 207
1+ 207 (0.05)2
n = 207
1.5175
n = 136.4
n = 136 (approximately).

The study's variables are genuinely measured by the questions if the KMO result is larger than 0.5. When assessing the variables under investigation, the Bartlett test of sphericity result at 0.000, or less than 5%, shows that there is a highly significant association among the variables. The results of the Bartlett test of sphericity, which is less than 5% and the KMO test, which is larger than 5%, respectively, in this study show that the statements that made up the research instruments for each variable were indeed measuring the desired things. Confirmatory factor analysis was utilized to further demonstrate the construct validity of the study instrument. Average Variance Extracted (AVE) greater than 0.5 were employed as an extra proof of construct validity of all variables in the research instrument. Table 1 displays the results of the Bartlett test of sphericity and the KMO.

Table 1: Pilot and Validity Results: Confirmatory Factor Analysis

S/N	Variables	No. of Items	AVE	KMO	Bartlett Test
1	Social sustainability	5	0.616	0.612	150.553
2	Economic sustainability	5	0.539	0.621	163.581
3	Market dynamism	5	0.507	0.596	106.218

Source: Field Survey (2023)

Table 2: Reliability Result: **Reliability: Internal Consistency Reliability Result**

S/N	Variables	No. of Items	Cronbach's Alpha Coefficient	Composite Reliability
1	Social sustainability	5	0.773	0.714
2	Economic sustainability	5	0.716	0.842
3	Market dynamism	5	0.748	0.748

Source: Field Survey (2023)

The Cronbach's Alpha coefficient for all the study variables were above 0.70, which suggests that the instrument used for evaluation was highly reliable. Hence, the researcher affirmed that the research instrument used was reliable.

4. Data Analysis, Result and Discussion of Findings

4.1 Response Rate

A total of 136 copies of the questionnaire were distributed to the top management and functional middle management of the chosen MMCs; 133 of the copies were correctly completed and returned. Given that Bryman and Bell (2011) suggested that a response rate of ≥50% is appropriate for analyzing the study's data, this indicated an overall successful response rate of 98%. Since a response rate of 95% for this study was deemed to be very good, the researcher moved forward with the data analysis.

Normality

The skewness and kurtosis statistics were used in the study, per Cunningham's (2008) recommendation, to verify normalcy. According to Table 3's results, each variable's skewness and kurtosis coefficients fell between -1.278 and -0 and -0.365 and 0.738, respectively. These values led to the conclusion that the data on market share, competitive advantage, price strategy, distribution channels, and new product design were normally distributed because they fell within Cunningham's suggested range (2008).

Table 3: Tests of Normality

Variables	Skewness		Kurtosis	
	Statistic	Std. Error	Statistic	Std. Error
Social sustainability	-1.131	.121	.233	.210
Economic sustainability	-.801	.121	-.365	.210
Market dynamism	-1.278	.121	.738	.210

Source: Field Survey Results (2023)

Multicollinearity

In this work, multicollinearity was tested using tolerance values and the variance inflation factor (VIF). A significant collinearity issue is indicated by a tolerance value less than 0.1. Per Pallant (2004), the maximum permissible tolerance value is 0.1, while the maximum value of the VIF is 10. According to Hair et al. (2010), multi-collinearity is present when the VIF value is greater than 10. The results of the tests of multicollinearity are presented in Table 4.

Table 4: Multicollinearity Test of Independent Variables

Model		Collinearity Statistics	
		Tolerance	VIF
1	Social sustainability	.183	3.215
	Economic sustainability	.128	2.343
a. Dependent Variable: Market dynamism			

Source: Field Survey Results, 2023

Table 4 reveals that the VIF for the variables ranges from 3.215 to 2.343 indicating absence of multicollinearity between the variables. The tolerance values were above 0.1 and ranged between 0.183 to 0.128, confirming the absence of multicollinearity.

Pearson Correlation for Hypotheses One and Two

The assumption of linearity was measured using Pearson correlation coefficient. The results are shown in Table 5.Linearity of the dependent (Market Dynamism) variables and independent variables (social sustainability and economic sustainability) was assessed by Pearson Product-Moment Correlation. The Pearson Product-Moment Correlation linearity test in Table 5 revealed that there were strong and positive correlations between market dynamism, social sustainability and economic sustainability which were statistically

significant (r = 0.780, n = 133, p = .001; r = 0.811, n = 133, p = .001; r = 0.814, n = 133, p = .001; and r=0.798, n= 133, p= .00) respectively as shown on Table 5.

Table 5: Linearity Test

		Market Dynamism	Social Sustainability	Economic Sustainability
Market Dynamism	Pearson Correlation	1	.780**	.811**
	Sig. (2-tailed)		.000	.000
	N	133	133	133
Social Sustainability	Pearson Correlation	.780**	1	.798**
	Sig. (2-tailed)	.000		.000
	N	133	133	133
Economic Sustainability	Pearson Correlation	.811**	.798**	1
	Sig. (2-tailed)	.000	.000	
	N	133	133	133

**** Correlation is significant at the 0.01 level (2-tailed)**
*** Correlation is significant at the 0.05 level (2-tailed)**
Source: Field Survey Results, 2023

The Pearson's correlation coefficient test between the variables under investigation is shown in Table 5. The dependent and independent variables showed a substantial association, according to the correlation results, demonstrating the apparent linearity of the variables. Additionally, the high correlation value between the independent and dependent variables suggests that the model satisfies the regression analysis's linearity assumption. This showed a strong and significant correlation between the market dynamism of MMCs in Lagos State and social and economic sustainability. Thus, this study rejected null hypotheses one and two that social sustainability and economic sustainability do not associate with market dynamism in MMCs Lagos State, Nigeria.

Table 6 : Summary Results of Interaction of Social Sustainability and Economic Sustainability on Market Dynamism

Model	*B*	*T-Stat*	*Sig.*	*F*(2,130)	R^2	Adj. R^2	F(Sig)
(Constant)	4.246	5.370	.000	139.129	0.594	0.591	0.000
Social Sustainability	.418	4.677	.021				
Economic Sustainability	.849	3.873	.001				

a. Dependent Variable: Market Dynamism
b. Predictors: (Constant), Social Sustainability and Economic Sustainability
Source: Researcher's Field Survey, 2023

Table 6, presented the multiple regression results for the interaction effect of sustainable entrepreneurship measures (Social Sustainability and Economic Sustainability)on market dynamism of MMCs in Lagos State. The results revealed that Social Sustainability (β = 0.418, t-stat = 4.967, p = 0.021), and Economic Sustainability (β = 0.849, t-stat = 3.873, p = 0.000), have a positive and significant interaction effect on market dynamism of MMCs in

Lagos State. The results implied that social sustainability and economic sustainability are significant predictors of market dynamism of MMCs in Lagos State.

The results further revealed that social sustainability and economic sustainability affect market dynamism explained 59.1% of the variation in market dynamism of MMCs in Lagos State (Adj. R^2 = 0.591). The fact that the model was unable to account for 40.9% of the variation in the market dynamism of MMCs in Lagos State suggests that market dynamism is influenced by additional factors. Additionally, 139.129 with 2,130 degrees of freedom and a p-value of 0.000, which was less than 0.05, were the findings of the Analysis of Variance (ANOVA) for the regression coefficients used to test the overall significance of the regression model (F(2,130) = 139.129, p= 0.000). This suggests that the model as a whole was important in forecasting the market dynamism of MMCs in the state of Lagos. That is, market dynamism is affected by Social Sustainability and Economic Sustainability) and the F value standing at 139.129. Thus, the model is well fitted and significantly explained how sustainable entrepreneurship measures (social sustainability and economic sustainability) affected market dynamism. Therefore, the null hypothesis three (H_{03}) which states that there is no significant interaction influence of social sustainability and economic sustainability on market dynamism of MMCs in Lagos State is hereby rejected.

5. Conclusion and Recommendations

5.1 Conclusion

The findings demonstrated a positive and significant influence of social and economic sustainability on the market dynamism among of MMCs in Lagos State and they play a crucial role in determining and achieving market dynamism solution for MMCs in Lagos State Therefore, the null hypothesis one and hypothesis two are rejected and the alternate hypotheses is accepted. The ANOVA result for hypothesis three shows that there is no significant interaction influence of social sustainability and economic sustainability on market dynamism of MMCs in Lagos State, hence this hypothesis is hereby rejected. The study's conclusions are in line with those of Adriana and Amalia-Elena (2019), who discovered that greater levels of market dynamism among MMCs in Lagos State are connected with social and economic sustainability. The study discovered that MMCs with social and economic sustainability capabilities were more likely to achieve and sustain their business over their rivals.

The positive influence of sustainable entrepreneurship on MMCs' market dynamism aligns with studies that have emphasized the importance of environmental dynamism and differentiation in gaining a market dynamism solution. Ikhsan, Almahendra, and Budiarto (2017) demonstrated that MMCs with a focus on social sustainability would be more likely to outperform their competitors and achieve business sustainability. Additionally, social sustainability in any emerging country is negatively impacted by unemployment, fast urbanization, rising economic disparity, and population density. Urbanization does, however, have a favorable impact on social sustainability in underdeveloped nations. Also, it is interesting to highlight from the study that sustainability is not a predetermined endpoint that can be recognized; rather, it is a property of dynamic systems that sustain themselves through time. Environmental sustainability in the context of developing human societies refers to both the long-term preservation of priceless environmental resources and commercial dynamism.

5.2 Recommendations

This study has revealed the impact of Sustainable Entrepreneurship dimensions of economic sustainability and social sustainability on MMCs market dynamism. However, it is therefore recommended that:

i. MMCs should continuously manage the social responsibility associated with their business such that the social challenges will be resolved and solutions to market dynamism are implemented.
ii. MMCs should make sure they improve economically to take care of various challenges associated with economic performance for their business to tackle the problem of market dynamism.
iii. MMCs shouldn't consider their substandard environmental effect as a factor, and they shouldn't use their lack of economic growth in their country as an excuse either since, when it comes to meeting fundamental survival needs in market dynamism which is prioritised in many developing nations, having a sustainable policies and strategies adopted from developed and industrialized countries.

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Bio-note

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REVIEW OF THE PANDEMIC PERIOD, REORGANIZATION OF THE SZEKLERLAND'S TOURISM OFFER

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Abstract: *The study seeks to answer the question of how the counties of Szeklerland, Harghita, Covasna and Mureș in Romania have changed in recent years, primarily between 2017 and 2022, in the middle of which period the pandemic which began in 2020, triggered various difficulties. Data from the Romanian National Statistical Institute were used in the research, providing insights into the changes in tourism in Romania and Szeklerland. The data include yearly changes, such as changes in the number of accommodation establishments, their occupancy rates or the number of guests arriving at the establishments, as well as monthly breakdowns, which are mainly necessary for the analysis of seasonality. The results obtained from the secondary data analysis used in the study reflect the nature of the difficulties faced by the tourism sector during the pandemic period and the trends in the efficiency of tourism supply in the period preceding and following the pandemic. The 2010s have clearly been a year of step-by-step development and minor successes in tourism, culminating in 2019 in terms of the turnover of accommodation in Szeklerland. During this period, a number of new tourist units opened their doors, with 35,889 new beds added in Transylvania between 2012 and 2022 and 2,427 new beds added in Szeklerland between 2012 and 2022. After a good period for the sector, a slight change in trend started in 2020, mainly due to the fact that tourists started to prefer trips that require less personal contact with other tourists, but also due to a significant change in their accommodation needs, with an increase in both the number of accommodation units and the number of beds for higher quality accommodation types, while the opposite is observed for lower quality accommodation types.*

Keywords: *Transylvania, Szeklerland, Covid-19, Tourism, Tourism supply*
JEL Classification: H12, Z30, Z31, Z32

1. Introduction

Tourism in the historical region of *Szeklerland*, in the counties of Harghita, Covasna and Mureș, as well as in the region of Transylvania and Romania, has undergone a significant transformation in recent years. The development of tourism has a number of positive effects for the economic development of the country, which can be reflected in the employment of the workforce and an increase in the quality of life (Brătucu et al., 2017). The large-scale development of the tourism industry has resulted in it becoming one of the country's most significant and dynamic economic sectors by the end of the 2010s. This process is also due to the increased attention paid to the condition and development of both natural and anthropogenic tourist attractions in the country. Optimal marketing of these attractions still leaves a lot to be desired, although sustainable development is also becoming increasingly

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important for tourism operators in Transylvania and is an essential part of the implementation of new tourism activities. Despite the diversity and complexity of Romania's natural and anthropogenic tourism, tourism is not well developed (Mitrică et al., 2021). Looking at the region of *Szeklerland*, nowadays, the main elements that make people want to travel are the cultural heritage and the various traditional events associated with it, while mountain tourism provides a wide range of activities based on natural attractions.
Although the 2010s were a period of gradual development in the tourism market, the end of the period saw the emergence of forced changes that in many cases were unimaginable. The year 2019 was one of the most outstanding periods for tourism in Romania, and therefore in *Szeklerland*, which unfortunately was changed at its roots by the following year. This phenomenon has had a negative impact on the tourism sector, which has been considered its greatest asset. This present is nothing other than globalization itself. The impact of the epidemic on the tourism sector indicates that virtually any kind of external influence and the actions that result from it have risk factors for the industry, and that joint cooperation by both businesses and the government sector is of paramount importance to avoid them (Charlyn et al., 2022).

2. Literature review

As a region, Szeklerland comprises eighteen towns, one hundred and thirty-four villages and their villages, covering an area of approximately 12 thousand square kilometers. According to the Romanian National Institute of Statistics (2023), it has a population of more than 1.13 million people, from which 222,474 live in Covasna County, 326,758 live in Harghita County and 583,628 live in Mureș County in 2022 (INSSE, 2023). The main attraction of tourism in *Szeklerland* is currently the landscape itself, the natural resources, the quiet and peaceful environment, but also the *Szeklerland* hospitality, the combination of Hungarian and Romanian food specialties and flavors, the rural and folk motives also attract a large number of tourists (Tőzsér, 2019).
One of the attractions of rural tourism is that it gives visiting tourists an insight into everyday life in the countryside, often accompanied by delicious gastronomy and a friendly welcome. In many municipalities, rural tourism is a form of supplementary income for residents, and its impact is strongly felt in Zetea, Lupeni and Corund. There is a wide variation in the quality of the services provided, with almost all types of accommodation ranging from farmhouses to modern guesthouses, which are often considered to be outdated (Avram, 2022).
The disadvantages of the unlimited availability of information were also felt in tourism and other sectors of the economy during the pandemic. In addition to the fact that people wishing to travel began to shy away from the possibility of mass contact, the administrations of the countries concerned had to put in place a number of measures, the effects of which they had no prior information on (Dobrescu and Mazilu, 2020). As a result, restrictions have been placed on cross-border tourism, and the free movement of individuals within the country has been regulated. Many businesses and organizations have had to take measures that have reduced their capacity. In addition to capacity reductions, a negative factor was the restriction on the movement of persons, which led to a further reduction in their turnover, forcing them to temporarily suspend their activities and subsequently to dismiss their employees (Herman et al., 2022). The measures taken to halt the spread of the epidemic in 2020 have contributed to the marginalization of mass tourism destinations and the replacement of less visited areas with alternative tourism, thus helping travelers to develop a more direct relationship with their environment (Muhmut et al., 2021).
In the period before the pandemic, particularly in the 2010s, the tourism sector was experiencing strong growth, both internationally and locally. Globalization and technological developments have made cross-border travel by air and road available to almost anyone. As a result of this positive impact, the number of tourists arriving in destinations has

increased year by year over the last decade, which has also been observed locally in the Szekler counties (Anestis et al., 2021). This gradual development has led to the tourism sector reaching its best performance in 2019, with a strong increase in the turnover of accommodation establishments, and an increasing focus on hotels offering higher quality and better services to tourists.
As a result of the Covid-19 pandemic, the introduction of restrictions from March 2020 onwards has had a negative impact on the hospitality industry (Nyikes and Vámosi, 2021). The precautionary measures taken to contain the pandemic have resulted in a growing number of employees in industries such as tourism, where there are significant labour shortages, having to be laid off following a reduction in activity. This phenomenon has ultimately put operators in the tourism sector at a disadvantage, damaging their role and competition in the market. (Oncioiu et al., 2022). The above-mentioned assumption also has a worrying effect in the context of the economic area, as the human resources providing the services have in fact had to take up jobs in other areas. In the critical year 2020, the tourism sector was characterized by a high degree of uncertainty, which led to a dramatic change in the professional attitude of workers (Scutariu and Scutariu, 2023). Organizations and businesses in the sector have tried to find creative solutions at international level to reduce the impact of the pandemic, while at the same time seeking, where possible, to maintain their operations (Popescu and Plesoianu, 2021). In the aftermath of the Covid-19 pandemic, there has been a growing focus on tourism services based on proximity to nature. As the epidemic had a greater negative impact on tourism than on other economic activities, it will be a long process and a major transformation before tourism facilities return to their pre-pandemic levels (Erfan et al., 2022).

3. Material and Methods

The research will be based on two pillars: the analysis of the literature and its results, and the analysis of data relevant to tourism in the region. For the data analysis, figures relevant to Romania, Transylvania and Szeklerland will be used, extracted from the database of the Romanian National Statistical Institute (INSSE).
The research focuses on the process of tourism transformation in Romania, including Transylvania and Szeklerland, between 2017 and 2022. The study focuses on the impact of the Covid-19 epidemic on the tourism sector in the region. In relation to the database analysis, mainly annual data for the years 2017-2022 are used, but for indicators where a monthly breakdown of the data is relevant, such as for the analysis of seasonality, different data sets are used, broken down by month. Data from the National Statistical Institute of Romania were used to analyses the change in the number of accommodation establishments in the country and in the region, the change in the number of accommodation places, the change in the number of arrivals and nights, the change in the composition of accommodation types, the change in the average length of stay, the analysis of the capacity utilization of accommodation establishments and various other data relevant to tourism.
The examination of these figures has led to the formulation of various research questions that may be relevant to the study of tourism in the region:
Q1: What impact did the widespread global pandemic in 2020 have on the capacity of accommodation facilities in Szeklerland?
Q2: Did the number of tourists arriving at accommodation facilities in Szeklerland reach the level of guest arrivals before the epidemic in 2021?
Q3: What types of accommodations are preferred by tourists arriving in the region during the post-epidemic period?

4. Results of the research

Both the region of Szeklerland and the national tourism activity have undergone a significant development in recent years, mainly due to the fact that the guests staying in the region are looking for tourist facilities offering higher quality services. (Popescu, 2018). Thanks to the mountainous terrain, tourists are also increasingly arriving in winter, but the seasonality is mainly concentrated in the summer months, mainly in July and August.

Looking at the country's accommodation facilities, the number of establishments suitable for hosting guests has steadily increased. There was a significant increase between 2012 and 2018, with 2,632 new accommodation establishments in Romania, of which almost 56% opened their doors to tourists in the Transylvanian region. In 2018, 16.5% of the new accommodation establishments in the Transylvanian region were realized in the different counties of Szeklerland. Between 2012 and 2018, 90 new tourist accommodation establishments were added in Harghita County, 148 in Mureș County and 5 in Covasna County (INSSE, 2023) In 2019, there was a slight decrease in the number of accommodation establishments, but thereafter the number of accommodation establishments gradually increased until 2022, with 9,120 accommodation establishments in Romania by 2022, of which 4,682 are located in Transylvania, and the Szeklerland accommodation market represents almost 19% of the accommodation establishments in Transylvania, as shown in Figure 1.

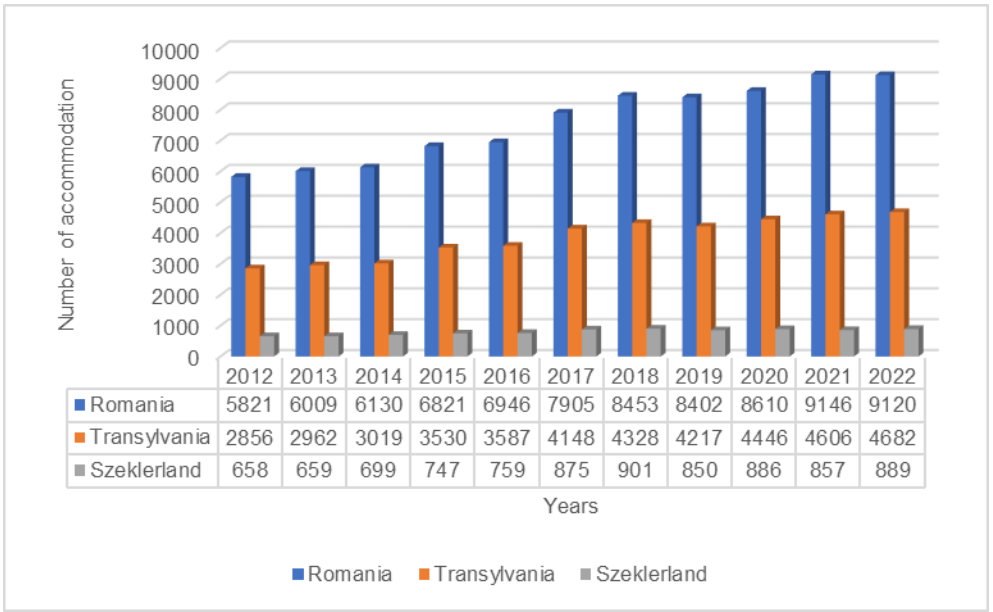

Figure 1: Change in the number of accommodation places in Romania, Transylvania and Szeklerland between 2012 and 2022
Source: Own editing based on INSSE (2023)

For the Szeklerland counties, according to INSSE (2023) data, 889 accommodation establishments were registered in the region in 2022, of which 342 establishments were in Mureș County, 105 in Covasna County and 442 in Harghita county. In Mureș County, 39.14% (348 accommodation) of the accommodation establishments are in Sovata, 18.11% (161 accommodation) in Sighișoara and only 13.72% (122 accommodation) in Târgu Mureș, the county seat, in 2022. The remainder is distributed among the 47 other municipalities in the county. In relation to Harghita County, the distribution of accommodation is not as centralised as in Mureș County. In the Harghita County, in 2022, Praid had the highest

number of accommodation establishments, 14.48% (64 accommodation) of the county's accommodation establishments, followed by Zetea with 9.5% (42 accommodation), Borsec spa town with 9.28% (41 accommodation), Gheorgheni with 7% (31 accommodation), Băile Tușnad with 5.66% (25 accommodation). Only 5.2% of accommodation (23 accommodation) is in the county capital, Miercurea Ciuc. The share of accommodation units remaining in the county is distributed in 45 other municipalities. In Covasna County, 17.14% of the 105 accommodation units are in Sfântu Gheorghe, 16.19% (17 accommodation) in the spa town of Covasna, 8.57% (9 accommodation) in Turia and 7.62% (8 accommodation) in Târgu Secuiesc. The data shows that in this case, the county seat, Sfântu Gheorghe, has the highest number of accommodation establishments, with only 18 establishments. The remaining accommodation establishments are distributed among the 27 other municipalities in the county (INSSE, 2023).

Looking at the number of accommodation places in Transylvania, there has been an explosion between 2012 and 2022. Over the ten years, more than 35,000 new bed places were added in Transylvanian accommodation establishments, from 110,554 in 2012 to 146,443 in 2022 (INSSE, 2023). In the Transylvanian region, the most significant development was between 2014 and 2018, when the number of tourist places increased by more than 26,000. In the region of Szeklerland, only 2,427 new beds were created in the ten years under review, with the greatest increase in the period 2012-2015. In terms of the historical region, the year 2021 was the year with the highest number of places, with 25,447 in the last ten years, as shown in Figure 2 (INSSE, 2023).

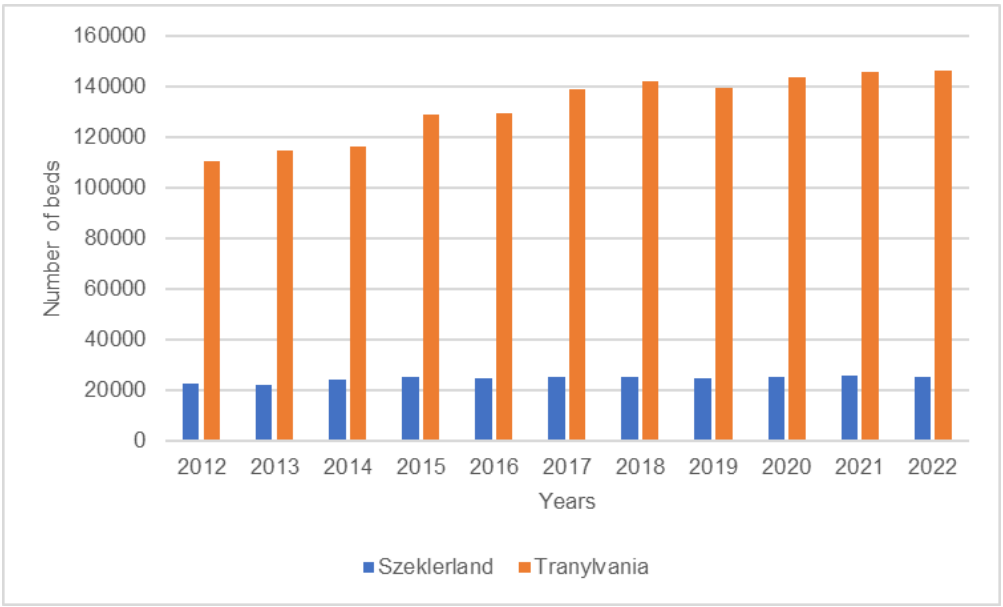

Figure 2: Change in the number of beds in Transylvania and Szeklerland between 2012 and 2022
Source: Own editing based on INSSE (2023)

In the case of accommodation facilities relevant to the Szeklerland region, such as tourist pensions, agrotourism pensions, hotels, campsites, and key houses, there was not only an increase in the number of beds, as there were facilities with a large decrease in capacity, such as campsites, student camps and tourist villas. In numerical terms, the largest increase in the number of places was in agrotourism pensions in the Szeklerland region, with 1,474 new places created for this type of accommodation. This was followed by hotels with 930

new beds and tourist pensions with 819 new beds, as shown in Figure 3. The largest decrease was in the number of places in campsites, with 1,375 places disappearing in the region, representing a decrease of 80.69% by 2022 compared to 2012 (INSSE, 2023). The change in accommodation types suggests that tourists arriving in the region are increasingly looking for accommodation with more comfort and a higher level of service.

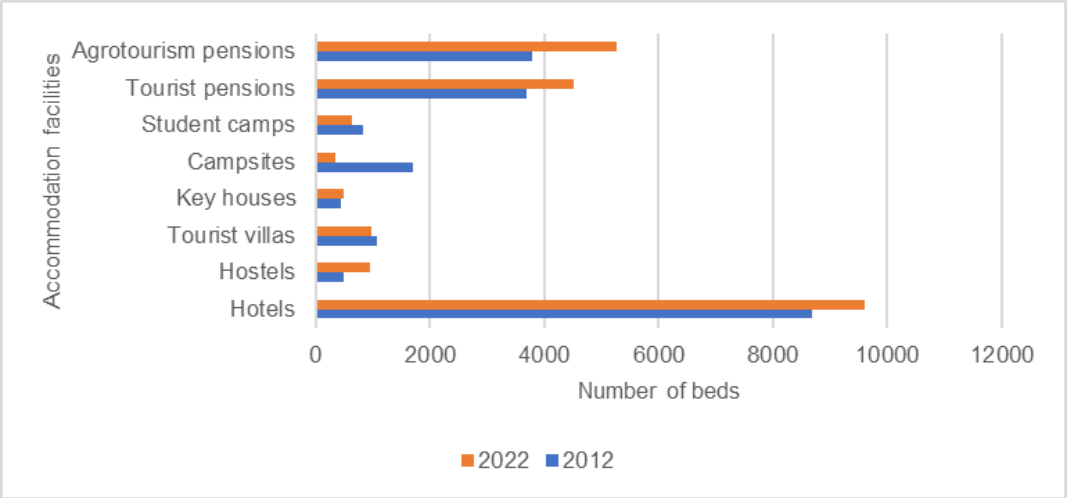

Figure 3: Changes in accommodation places in Szeklerland in 2012 and 2022
Source: Own editing based on INSSE (2023) data

According to data from the Romanian National Statistical Institute (2023), in 2012, nearly 7.7 million tourists stayed in different types of accommodation in the country. In that year, 41.4% of tourists chose accommodations in Transylvania and 16.84% of the national arrivals came from the Szeklerland counties. The number of arrivals gradually increased until 2019, when the number of tourists staying in the country reached 13,374,943, of which 10,597,048 were domestic tourists. In that year, 6,011,221 of the country's tourist arrivals were accommodated in establishments in Transylvanian, of which 4,960,068 were domestic tourists. In 2019, 973,864 tourists arrived in the counties of Szeklerland, of which 814,745 were domestic tourists. In 2020, the number of tourists arriving at accommodation establishments decreased, significantly due to the restrictions imposed to contain the Covid-19 pandemic. In 2020, there was a 52.16% decrease in the number of tourists arriving in the country's accommodation facilities, with 6,398,642 tourists arriving in the country in that year. At the same time, there was a similar decline in the number of arrivals in both Transylvanian and Szeklerland accommodation establishments. Only 2,805,092 tourists arrived at accommodations in Transylvania, of which 426,554 stayed in the Szekler region. In 2021, thanks to the easing of restrictions, the number of tourist arrivals began to increase again, with a 46.44% increase for the country (9,370,232 tourist arrivals in 2021), a 49.79% increase for Transylvania (4,201,838 tourist arrivals in 2021), and a 50.83% increase for Szeklerland (643,393 tourist arrivals in 2021), as shown in Figure 4. (INSSE, 2023).

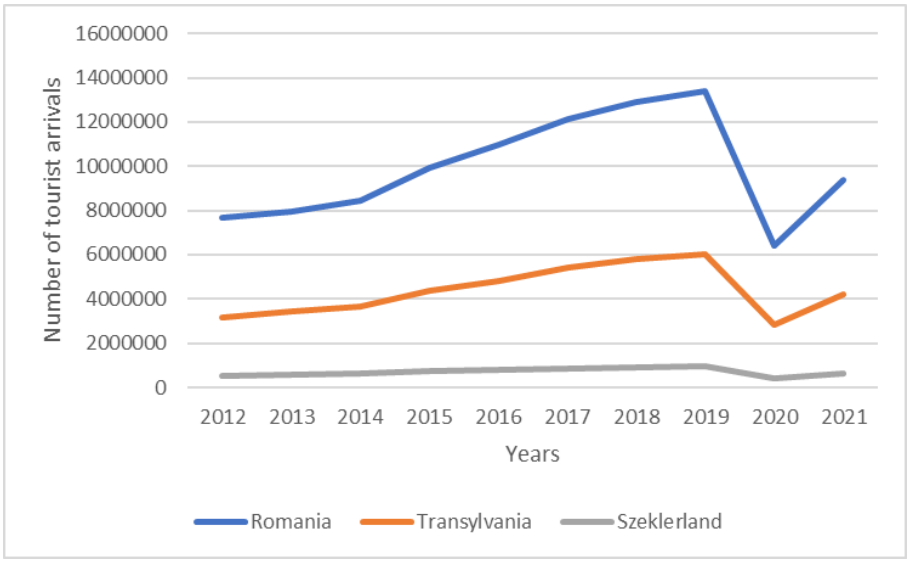

Figure 4: Change in the number of tourist arrivals in Romania, Transylvania and Szeklerland between 2012 and 2021
Source: Own editing based on INSSE (2023)

In 2020, cross-border travel was restricted by the countries' leaders in an effort to curb the spread of the Covid-19 virus, the impact of which was also felt in tourism. In that year, the share of tourists arriving from abroad was only 7.2% compared to the national figures, but a similar phenomenon was observed in both Transylvania and Szeklerland, with 5.9% of tourists arriving in Transylvania and 4.1% of tourists arriving in Szeklerland coming from outside the country. In 2021 and 2022, the authorization of cross-border travel not only led to an increase in the turnover of accommodation but also to a return to a higher proportion of foreign tourists arriving in the country. In 2022, 14% of tourists in Romania, 11.2% in Transylvania and 9.8% in Szeklerland came from abroad (INSSE, 2023). 92.69% of foreign tourists arriving in the country in 2019 were from Europe, mainly from Moldova (19.7%), Bulgaria (14.49%), Ukraine (13.7%) and Hungary (11.9%). In 2020, 25.22% of foreign tourists came from Bulgaria, 16.5% from Moldova, 13.2% from Ukraine and 9.6% from Hungary. In 2021, 18.47% of inbound tourists came from Bulgaria, 18.4% from Moldova, 16.3% from Ukraine and 8.9% from Hungary, while the remainder was distributed between the different foreign visitor regions (INSSE, 2023).
In 2019, in the period before the epidemic, there were 599,036 tourists who arrived in Mureș County, 237,386 tourists in Harghita County, and 137,442 tourists in Covasna County. The majority of tourists arriving in Mureș County, 397,197 tourists, chose hotels, 93,482 chose tourist pensions, and 43,380 chose agrotourism pensions. In Harghita County, 113,532 people chose hotels, 44,280 chose tourist pensions, and 53,867 chose agrotourism pensions. Similarly, in Covasna County, 89,340 people chose hotels, 11,471 chose tourist pensions, and 18,561 chose agrotourism pensions in 2019 (INSSE, 2023). In 2020, during the spread of the Covid-19 pandemic, 244,264 people stayed at accommodations in Mureș County, whit 163,318 tourists chose hotels, 43,432 tourists chose tourist pensions, and 17,062 tourists chose agrotourism pensions during their travels. In Harghita County, a total of 102,890 tourists arrived, with 45,384 stayed in hotels, 20,550 in tourist pensions, and 23,863 in agrotourism pensions. In Covasna County, where 79,400 tourists arrived in 2020, of which 50,153 stayed in hotels, 6,793 in tourist pensions and 14,046 in agrotourism pensions. In the year following the pandemic, 2021, the number of tourists arriving in the region showed an upward trend, thanks to the easing of restrictions. In that year, a total of

643,393 tourists arrived in Szeklerland, of which 357,192 to Mureș County, 154,531 to Harghita County and 131,670 to Covasna County. Of the tourists arriving in Mureș County, 249,844 stayed in hotels, 61,941 in tourist pensions, and 15,569 in agrotourism pensions. Of the tourists arriving in Harghita County, 69,495 stayed in hotels, 28,795 in tourist pensions, and 35,116 in agrotourism pensions. In Covasna County, 80,999 tourists stayed in hotels, 10,907 in tourist pensions, and 22,985 in agrotourism pensions in 2021 (INSSE, 2023).

Looking at accommodation in Romania, Transylvania and Szeklerland, seasonality is mainly concentrated in the summer months, mainly in July and August. In both Romania and Szeklerland, the average capacity utilisation of accommodation establishments reaches 50% during the peak period, while in the Transylvanian region it is only 40%. In April 2020, as a result of the restrictions, the database is incomplete, with many establishments having to suspend their operations forcibly in that month, resulting in a capacity utilisation close to 0%. (INSSE, 2023).

The data on tourist arrivals at tourist accommodation units from INSSE (2023) show that, on average, tourists in Romania spent 2.15 days at a tourist unit between 2017 and 2022. In the same year, they spent an average of 1.35 days in Transylvania and an average of 2.72 days in Szeklerland. As for the national average, tourists spend on average 2.6 days in a given accommodation unit in the summer period, while in Transylvania they spend on average 1.55 days in the peak period and in Szeklerland 3.2 days in the busiest months. These figures, which show the average length of stay, can be increased if tourism operators in the region develop their range of services in such a way that they are attractive, varied and interesting for a wide range of target groups.

5. Conclusion

An analysis of the developments in the tourism market in Szeklerland suggests that both Romania and Szeklerland have undergone minor changes as a result of the Covid-19 pandemic in 2020. In the period preceding the epidemic, a gradual development was observed in the Szeklerland counties, mainly in the period between 2014 and 2019, and then, at the turn of the decade, a significant slowdown in the tourism sector, mainly reflected in the evolution of the turnover. These results, which are derived from the analysis of the statistical data used, provide significant support for the findings of international research, thus highlighting that the phenomenon has had a similar impact at global level, mainly negative.

The research questions formulated at the beginning of the study, along with the answers derived from the results, indicate that trend changes will occur in the tourism market as a result of the pandemic, whether it pertains to international or regional tourism activities.

The research question Q1, which focuses on the change in the number of beds due to the impact of the pandemic in 2020, can be answered based on data from the Romanian National Institute of Statistics. The epidemic did not have a negative impact on the number of accommodation beds, as the highest number of beds in the Szeklerland region during the ten years under review was in 2021. In 2019, the year before the epidemic, there were only 24,498 tourist beds in the region, and in 2020, the year in which the epidemic spread, there was an increase of approximately 3% in the number of beds. This phenomenon is similar in Romania and Transylvania, with a steady increase in the number of accommodation places between 2012 and 2022, reaching a peak in the period following the epidemic.

Research question Q2 investigated how the epidemic affected the change in the number of tourists arriving in the Szeklerland region. The pandemic had a negative impact on tourism in Romania, Transylvania, and Szeklerland. In 2020, there was a 52.16% decrease in tourist arrivals compared to 2019 in Romania, a 53.34% decrease in Transylvania, and a 56.2%

decrease in Szeklerland. Consequently, the number of arrivals to accommodations in 2021 did not reach the number of tourists who arrived in 2015 in Romania, Transylvania, and Szeklerland. Although there has been a significant decrease in the number of tourists, it can be concluded that tourism demand will soon increase, both in Romania and in Szeklerland.
Research question Q3 explored which accommodations were preferred by tourists in the post-epidemic period in Szeklerland. Data from the Romanian National Institute of Statistics shows that interest in campsites and student camps has declined considerably in recent year. However, during same period, the services of pensions and hotels have become more prominent. This shift does not primarily indicate that tourists avoid accommodation with less human contact, but rather that they avoid accommodation with lower standards. This phenomenon is positive for tourism in the region and may encourage the tourism businesses concerned to improve their services. Ultimately, this could lead to an increase in the turnover of the destinations concerned and make them attractive destinations for foreign tourists.
The types of accommodations chosen by tourists reflect changes in their interests. Analyzing the data between 2019 and 2021, it was found that the majority of tourists in Covasna and Mureș counties stayed in hotels. In the case of Harghita County, it can be observed that the number of tourists staying in tourist pensions and agrotourism pensions is approaching the number of tourists staying in hotels. However, it is important to consider that the mentioned pensions have significantly more bed capacity than hotels. Examining the relationship between the number of beds and guest arrivals between 2012 and 2021 is complicated by the decline in guest arrivals due to the Covid-19 pandemic. If we look at the period between 2012 and 2019, we can see that there was a strong linear correlation between the number of beds and the number of tourist arrivals in Szekler hotels (R^2=81.72%, y=214.78x-2E+06). In the same period, the coefficient of determination for pensions was R^2=73.25% (y=59.522x-142,641), and for agrotourism pensions, R^2=75.78% (y=46.841x-137,667). For the accommodation types, it can be said that there is a correlation between the number of beds and the number of tourist arrivals. However, looking at the period from 2012 to 2021, the linear trend between 2012 and 2019 is disrupted by the pandemic, which is why the coefficient of determination decreases when the epidemic period is included in the analysis. In this period, the R^2=20.06% (y=131.72x-783,988) for hotels, R^2=39.59% (y=53.172x-122,688) for tourist pensions and R^2=40.01% (y=29.104x-54,817) for agrotourism pensions. Although the correlation is tighter for tourist pensions and agrotourism pensions, the distorting effect of the pandemic renders it less relevant.
The results obtained suggest that the tourism supply market, although facing a number of difficulties after 2019, is able to innovate in terms of service improvements and alternative forms of operation, thus helping to maintain its competitiveness. During critical periods, as a result of the restrictions, a large drop in traffic was observed in the counties surveyed, but when looking at tourism facilities and their occupancy rates in aggregate, no decline can be said to have occurred. If we look at the years concerned by type of establishment, the number of lower-rated establishments and their occupancy rates has decreased, while the supply of accommodation with a higher standard of comfort is steadily increasing, reflecting the adjustment to the needs of tourism demand.
In destinations where the average length of stay of tourists is one or two days, it may be essential for local tourist accommodation, entertainment establishments and destination management organizations to jointly develop a strategy to help attract tourists and meet their needs. This can be achieved primarily through the development and expansion of accommodation and services on offer, with the aim of attracting a wider target group of tourists to the area.

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Bio-note

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EVALUATING SUSTAINABILITY THROUGH RESOURCE EFFICIENCY: A CASE STUDY OF CIRCULAR ECONOMY PRACTICES IN THREE COMPANIES

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Abstract: The concept of a circular economy (CE) aims to develop a closed-loop system that strives to minimize waste, which adversely impacts the environment. Besides the positive impact on the environment, the adoption of CE generates economic, social, and cultural benefits that encourage companies to shift from linear 'take-produce-use-dump' to circular models of product. In this paper, we explore the implementation of CBMs in three companies from different industries including key factors contributing to the successful implementation of CBMs, benefits and challenges. Through an examination of best practices of the case studies from different sectors (Fashion, Manufacturing, Electronics), these companies have significantly enhanced resource efficiency and sustainability, demonstrating the viability and benefits of circular practices.

Key words: Circular Economy, sustainability, KPI, benefits and challenges.
JEL codes: M21, Q57, P51, O22

Introduction

The circular economy (CE) represents a transformative approach to sustainable development, aiming to decouple economic growth from resource consumption and environmental degradation. Unlike the traditional linear economy, which follows a "take-make-dispose" model, the CE demonstrates a regenerative structure where resources are reused, refurbished, remanufactured, and recycled. This shift is crucial for addressing the growing environmental challenges and resource scarcity faced by modern businesses.

Circular Business Models (CBMs) play a crucial role in applying the principles of the CE within companies. These models emphasis on creating economic growth from products after their primary use, thereby extending their lifecycle and minimizing waste. By implementing CBMs, companies can enhance resource efficiency, reduce environmental effect, and obtain sustainable growth. This study investigates the successful implementation of CBMs in three different companies, exploring how these models contribute to sustainability and resource efficiency (Lopez & Legardeur, 2024).

The concept of the circular economy has gained significant traction globally, with various countries and organizations adopting policies and practices to promote sustainability. In the European Union, the Circular Economy Action Plan has set ambitious targets for resource efficiency and waste reduction, aiming to save around €600 billion and create over 170,000 new jobs by 2030(Jakubelskas & Skvarciany, 2023).

Overall, research on CBMs has emphasized on exploring best practices and determining the impact of circular practices on different industries. Studies have highlighted the importance of design innovation, sustainable supply chain management, and stakeholder engagement in successfully implementing CBMs. This research aims to contribute this growing body of knowledge by providing detailed case studies of CBMs in the fashion, electronics, and manufacturing industries (Islam et al., 2024).

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This paper investigates the implementation of CBMs in three different companies, analyzing how these models promote sustainability and resource optimization. The research aims to:

- Identify the specific circular practices adopted by each company.
- Evaluate the environmental, economic, and social impacts of these practices.
- Determine the key factors contributing to the successful implementation of CBMs.

The scope of the paper includes qualitative and quantitative analyses of the companies' circular practices, focusing on key performance indicators (KPIs) such as waste reduction, resource efficiency, and financial performance. The research questions guiding this study are:

- What specific circular practices have the companies implemented?
- How do these practices impact resource efficiency and sustainability?
- What are the common success factors and challenges in implementing CBMs?

The research is predominantly based on secondary data, the case study website, reports and referencing articles. Books of the case study subject and others were also used to collect the data, allowing data triangulation as data sources are of different sources and nature.
The remainder of this paper is structured as follows: Section 2 provides a theoretical framework about the circular economy. Section 3 describes the methodology and materials used for gathering and analyzing data. In section 4, the results are explained and discussed for the different case studies. Finally, the conclusion is drawn in section 5.

II. Theoretical framework

2.1 Concept and Principles of Circular Economy

The concept of the circular economy (CE) has its roots in several different schools of thought, including industrial ecology, regenerative design, and the cradle-to-cradle (C2C) philosophy (Rocha et al., 2023). The CE aims to redefine growth, focusing on positive society-wide benefits. It entails gradually decoupling economic activity from the consumption of finite resources and designing waste out of the system. Underpinned by a transition to renewable energy sources, the CE is built on three principles: designing out waste and pollution, keeping products and materials in use, and regenerating natural systems(Calisto Friant, 2022). Core Principles for CE are as follow (Suárez-Eiroa et al., 2019):
Designing Out Waste and Pollution: The CE emphasizes the need to rethink and redesign products and processes to minimize waste and pollution from throughout product lifecycle. This includes considering the entire lifecycle of products, from raw material extraction to end-of-life disposal, and finding ways to minimize environmental impact at each stage.
Keeping Products and Materials in Use: This objective focuses on keeping the value of products, materials, and resources for as long as possible. Strategies include designing for durability, reuse, remanufacturing, and recycling. The aim is to create closed-loop systems where products are continuously cycled back into the economy rather than ending up as waste (Suárez-Eiroa et al., 2019).
Regenerating Natural Systems: The CE seeks not only to protect but also to improve natural systems. This includes adopting practices that restore and regenerate ecosystems, such as using biodegradable materials, encouraging biodiversity, and restoring natural capital.

2.2 Overview of Circular Business Models (CBMs)

2.2.1 Definition and types

Circular Business Models (CBMs) are designed to capture the economic value of products after their initial use and to minimize waste. These models leverage strategies like recycling, remanufacturing, reusing, refurbishing, and repairing to extend the lifecycle of products and materials(Scholtysik et al., 2023). There are several types of CBMs, including:

Product Life Extension Models: These models aim to extend the lifecycle of products through maintenance, repair, and refurbishment.
Resource Recovery Models: This type focus on recovering and reprocessing materials from end-of-life products for use in new products.
Product-as-a-Service Models: Companies retain ownership of their products and lease them to customers, ensuring that products are returned for refurbishment or recycling.
Sharing Platforms: These models facilitate the sharing of underused assets or products, increasing their utilization and reducing the need for new products.
Comparison with Traditional Linear Business Models: Traditional linear business models follow a "take-make-dispose" approach, where resources are extracted, transformed into products, and eventually disposed as waste. In contrast, CBMs aim to close the loop by keeping products and materials in circulation for as long as possible. This not only reduces waste but also conserves resources and enhances economic resilience(Sariatli, 2017).

2.2.2 Benefits and Challenges of Adopting CBMs

Adopting a circular business model (CBM) can offer significant benefits but also presents various challenges:

Table 1: Benefits and challenges of circular business models

Benefits	Challenges
Environmental Sustainability: - Significant reductions in waste and resource consumption. - Lower carbon footprint and reduced environmental pollution.	*Technical Barriers:* - Need for new technologies and processes to support circular practices. - Lack of proper technology
Economic Advantages: - Cost savings through efficient use of materials and energy. - New revenue streams from refurbished and remanufactured products.	*Financial Constraints:* - Initial investment costs for redesigning products and processes. - High production costs
Social Benefits: - Job creation in sectors like recycling, repair, and remanufacturing. - Improved corporate reputation and customer loyalty.	*Regulatory and Market Challenges:* - Lack of supportive policies and regulations. - Market resistance and lack of consumer awareness.

Source:(P. Rosa et al., 2019)

2.2.3 Key Components of Successful CBMs

Product Design and Innovation: Design and innovation are crucial for the success of CBMs. Products should be designed for durability, reparability, and recyclability. Innovative approaches like modular design can facilitate easy disassembly and reuse of components (Oghazi & Mostaghel, 2018).
Sustainable Supply Chain Management: Effective supply chain management is essential for implementing CBMs. This involves collaborating with suppliers and customers to create closed-loop supply chains that minimize waste and maximize resource efficiency. Strategies include using secondary raw materials, establishing take-back schemes, and promoting recycling initiatives.
Stakeholder Engagement and Collaboration: Engaging stakeholders across the value chain is vital for the successful implementation of CBMs. This includes suppliers, customers,

regulators, and local communities. Collaborative efforts can drive innovation, share best practices, and overcome barriers to adopting circular practices.
Several theoretical frameworks support the study of CBMs, including(Korevaar, 2022):
Industrial Ecology: Focuses on the sustainable interaction between industrial systems and the environment.
Cradle-to-Cradle (C2C): Emphasizes designing products for continuous reuse and recycling.
Stakeholder Theory: Highlights the importance of engaging all stakeholders in the value creation process.
Application to Case Studies: The theoretical framework will guide the analysis of the three case studies, providing a lens through which to evaluate the implementation and impact of CBMs. Each case study will be assessed based on the principles of the CE, the types of CBMs adopted, and the key components identified as critical to their success.

III. Methodology

Comparing a particular context across several different cases adds value to qualitative case study research as it allows for identifying broader tendencies, demi and underlying causal mechanisms, locating them at appropriate places (McKenna et al., 2013). The case study and comparing cases allowing us to get equal emphasis on contexts and causation, thereby helping to reach more nuanced explanations of managerial actions and organizational drives (Ackroyd & Fleetwood, 2000).
In light of the purpose of this study, the author would conduct explanatory research as it might help in clarifying and understanding our case studies. Three different case studies were selected from different fields (Fashion, Manufacturing, Electronics). The idea and logic of choosing the selected cases is to identify the specific circular practices adopted by each company in different sector. According to Patton (2002) 'The key issue in selecting and making decisions about the appropriate unit of analysis is to decide what you want to be able to say something about at the end of the study.'
Since the purpose of the study is to understand the Circular Economy and its practices, an inductive research strategy, meaning it relies on gathered data to generate theories and provide the basis for the analysis. The aim of comparing cases depends not only the careful selection of evidence but also on the selection criteria (Easton, 2010). Thus, the overarching principle for selecting companies for this research study are to identify firms dependent upon different sectors and similar size.
In order to provide a clear and concise comparison between three companies, the author adopted the below aspects:

- Circular Practices Implemented
- Impact on Resource Efficiency and Sustainability
- Common Success Factors and challenges
- Financial Performance Analysis
- Social Impact Evaluation

IV. analysis of the cases

In this section, a background of selected companies and the gathering data are generated would be presented. In addition, the outcomes of this comparison are discussed only from circular economy practices, its impact and success factors. Therefore, the comparison includes some aspects to meet research objectives. The author summarized the findings to keep it concise and relevant across the selected cases:

4.1 Case Study 1: Fashion Industry "Patagonia"

Company Background: The first case study focuses on an innovative fashion company that has successfully integrated circular business models into its operations. Founded in 1973, this company has grown to become a leader in sustainable fashion, known for its commitment to environmental responsibility and ethical practices. The company operates in multiple countries and serves a diverse customer base, emphasizing transparency and sustainability in its supply chain ("Innovative Strategies for Promoting Sustainable Fashion," 2024).

Circular Practices Implemented:

The fashion industry is traditionally resource-intensive and wasteful, but this company has adopted several circular practices to mitigate its environmental impact (R. Rosa & Manuel, 2016):

- *Design for Durability:* The company designs its products with longevity in mind, using high-quality, sustainable materials that ensure durability and reduce the need for frequent replacements. This approach helps to extend the lifecycle of their products and minimizes waste.
- *Sustainable Materials:* They source materials from environmentally friendly and renewable sources, including organic cotton, recycled polyester, and biodegradable fabrics. This reduces the reliance on virgin materials and lowers the overall environmental footprint.
- *Recycling Programs:* The company has implemented robust recycling programs, encouraging customers to return used garments for recycling or repurposing. They offer incentives such as discounts or vouchers to motivate participation. Returned items are either refurbished for resale or recycled into new products, creating a closed-loop system(*Circular Economy in Practice*, 2024) .
- *Collaborative Supply Chain Management:* They work closely with suppliers and partners to ensure sustainable practices throughout the supply chain. This includes regular audits, training programs, and joint initiatives to improve resource efficiency and reduce waste.

Impact on Resource Efficiency and Sustainability:

The adoption of these circular practices has led to significant improvements in resource efficiency and sustainability. The company has reported a substantial reduction in waste generation and resource consumption, along with an increase in the use of recycled and renewable materials. These efforts have not only enhanced the company's environmental performance but also strengthened its brand reputation and customer loyalty (Rattalino, 2018).

4.2 Case Study 2: Electronics Manufacturing "Dell Technologies"

Company Background: The second case study examines a leading electronics manufacturer that has embraced circular business models to address the environmental challenges associated with electronic waste. This company, established in the 1984, is a global player in the consumer electronics market, producing a wide range of devices including smartphones, laptops, and home appliances (Tuyet et al., 2023).

Circular Practices Implemented:

The electronics industry faces significant challenges related to e-waste and resource depletion. This company has adopted several circular practices to mitigate these issues (Giovanni, 2023):

- *Modular Product Design:* The company designs its products with modularity in mind, allowing for easy disassembly, repair, and upgrade. This extends the lifespan of their devices and reduces the need for new raw materials.
- *Take-Back Schemes:* They have established take-back schemes where customers can return their old devices for recycling. The returned products are either refurbished for resale or dismantled to recover valuable materials. This helps to reduce e-waste and promotes the circular use of resources.
- *Recycling Initiatives:* The company operates state-of-the-art recycling facilities that process returned devices and extract precious metals and other materials for reuse. This reduces the environmental impact of mining and manufacturing new components.
- *Energy-Efficient Manufacturing:* They have implemented energy-efficient manufacturing processes, utilized renewable energy sources and optimized production methods to minimize waste and emissions. This not only enhances sustainability but also reduces operational costs.

Impact on Resource Efficiency and Sustainability:
The company's circular practices have led to significant reductions in e-waste and resource consumption. By promoting modular design and take-back schemes, they have successfully closed the loop on many of their products, ensuring that materials are reused rather than discarded. These efforts have improved the company's environmental footprint and contributed to its reputation as a leader in sustainable electronics manufacturing (Swallow, 2023).

4.3 Case Study 3: Manufacturing Industry "Caterpillar Inc."

Company Background: The third case study explores a manufacturing firm that has transitioned to a circular supply chain model. This company, founded in the 1980s, is a major player in the industrial equipment sector, producing machinery and components for various industries, including automotive, aerospace, and construction (Scott, 2013).

Circular Practices Implemented:
The manufacturing industry is traditionally characterized by high resource consumption and waste generation. This company has adopted several circular practices to enhance sustainability:

- *Closed-Loop Supply Chains:* The company has developed closed-loop supply chains that prioritize the use of secondary raw materials and the recovery of by-products. This involves collaborating with suppliers and customers to ensure that materials are continuously cycled back into production.
- *Remanufacturing Initiatives:* They have established remanufacturing programs where used machinery and components are refurbished to meet original specifications. This extends the lifecycle of their products and reduces the demand for new raw materials.
- *Waste Minimization:* The company has implemented waste minimization strategies, including recycling industrial waste and optimizing production processes to reduce material loss. This helps to lower environmental impact and improve resource efficiency.
- *Sustainable Product Design:* They design their products with sustainability in mind, ensuring that they are easy to disassemble and recycle at the end of their lifecycle. This facilitates the recovery of valuable materials and supports the circular use of resources.

Impact on Resource Efficiency and Sustainability:
The company's circular practices have resulted in significant improvements in resource efficiency and waste reduction. By implementing closed-loop supply chains and remanufacturing initiatives, they have successfully minimized their environmental impact and enhanced their sustainability performance. These efforts have also contributed to cost savings and increased competitiveness in the marke.

4.4 Comparative Analysis

In this section, we summarized the Common success factors, challenges as we as best practices among 3 case studies:

Table 2: Comparative analysis for 3 case studies

Common Success Factors	Challenges	Lessons Learned and Best Practices
Innovation and Design: All three companies have leveraged innovation and sustainable design to extend product lifecycles and enhance resource efficiency. *Stakeholder Engagement:* Engaging stakeholders across the value chain has been crucial for the successful implementation of circular practices. *Collaboration and Partnerships:* Collaboration with suppliers, customers, and other partners has facilitated the development of closed-loop systems and sustainable supply chains.	*Technical Barriers:* Implementing circular practices often requires new technologies and processes, which can be challenging and costly. *Financial Constraints:* Initial investments in sustainable design and recycling infrastructure can be significant. *Regulatory and Market Challenges:* Lack of supportive policies and market resistance can hinder the adoption of circular practices.	*Emphasize Design and Innovation:* Focus on designing products for durability, reparability, and recyclability to support circularity. *Foster Stakeholder Collaboration:* Engage stakeholders at all levels to drive the adoption of circular practices and overcome barriers. *Implement Robust Recycling and Remanufacturing Programs:* Develop comprehensive recycling and remanufacturing initiatives to minimize waste and maximize resource use.

Source: Author's work

4.5 Analysis and Discussion

4.5.1 Evaluation of Environmental Impact

Waste Reduction and Resource Efficiency Metrics:

Case Study 1: Fashion Industry

- *Waste Reduction*: The company's recycling programs have significantly decreased the volume of waste generated. They reported a 30% reduction in waste over five years through effective recycling and repurposing of materials.
- *Resource Efficiency:* By using sustainable materials and designing products for durability, the company has reduced its resource consumption by 25%, showcasing a commitment to maintaining resources in the production cycle for longer periods.

Case Study 2: Electronics Manufacturing

- *Waste Reduction:* The implementation of take-back schemes and modular product design has led to a substantial decrease in e-waste. The company reported a 40% reduction in e-waste through effective take-back and recycling initiatives.

- *Resource Efficiency:* By refurbishing and reusing components, the company has achieved a 20% increase in resource efficiency, reducing the need for new raw materials and conserving natural resources.

Case Study 3: Manufacturing Industry "Caterpillar Inc."

- *Waste Reduction:* The company's closed-loop supply chains and remanufacturing initiatives have resulted in a 35% reduction in waste generation. They have successfully diverted a significant portion of waste from landfills through effective recovery and recycling processes.
- *Resource Efficiency:* Utilizing secondary raw materials and optimizing production processes have led to a 30% improvement in resource efficiency, demonstrating the benefits of circular practices in manufacturing.

Comparison of Pre- and Post-Implementation Environmental Performance:

Fashion Industry: Before implementing circular practices, the company faced significant challenges with waste management and resource consumption. Post-implementation, the company has seen notable improvements in waste reduction and resource efficiency, aligning with their sustainability goals.

Electronics Manufacturing: Initially, the company struggled with high levels of e-waste and resource depletion. The adoption of circular practices has transformed their operations, leading to substantial reductions in e-waste and improved resource utilization.

Manufacturing Industry: Prior to adopting circular practices, the company's operations were resource-intensive and wasteful. The transition to a circular model has enhanced their environmental performance, showcasing the effectiveness of closed-loop supply chains and remanufacturing.

4.5.2 Economic Impact Assessment

Financial Performance Analysis:

- *Fashion Industry:* The company has reported increased profitability due to cost savings from reduced material consumption and waste management expenses. The use of recycled materials and extended product lifecycles has also opened new revenue streams through the sale of refurbished products.
- *Electronics Manufacturing:* Financial analysis indicates that the company has benefited from significant cost savings by reducing the need for new raw materials and capitalizing on the value of returned products. The resale of refurbished electronics has provided an additional source of revenue, contributing to overall profitability.
- *Manufacturing Industry:* The company's circular practices have resulted in cost savings related to material procurement and waste disposal. Remanufacturing and the use of secondary raw materials have improved operational efficiency and profitability.

Table 3: Financial comparative analysis

Metric	Patagonia	Dell Technologies	Caterpillar Inc.
Waste Reduction	120,000 items diverted from landfill	2 billion pounds of electronics	500 million pounds of material
Resource Efficiency	69% recycled materials in products	45 million pounds of recycled content	30% reduction in new raw materials
Economic Impact	Increased sales from sustainability	$50 million annual savings	$1 billion annual savings

Cost-Benefit Analysis of Circular Practices:

- *Fashion Industry:* The initial investment in sustainable materials and recycling infrastructure has been offset by long-term cost savings and revenue from recycled and refurbished products. The company has achieved a positive return on investment (ROI) within three years.
- *Electronics Manufacturing*: Although the implementation of take-back schemes and modular design required significant upfront investment, the long-term benefits, including reduced material costs and increased sales of refurbished products, have outweighed these costs, resulting in a positive ROI within two years.
- *Manufacturing Industry:* The company's investment in closed-loop supply chains and remanufacturing has paid off through substantial cost savings and improved resource efficiency. The ROI was achieved within four years, demonstrating the financial viability of circular practices

4.5.3 Social Impact Evaluation

Impact on Employees, Customers, and Other Stakeholders:

Employees: The adoption of circular practices has created new job opportunities in areas such as recycling, remanufacturing, and sustainability management. Employees have benefited from training programs and increased job satisfaction due to the company's commitment to sustainability.

Customers: Customers have responded positively to the company's circular initiatives, valuing the sustainability and longevity of products. The availability of refurbished products at lower prices has also expanded the customer base.

Other Stakeholders: Suppliers and partners have benefited from collaborative efforts to implement sustainable practices across the supply chain. The company's focus on circularity has enhanced its reputation and fostered stronger relationships with stakeholders committed to sustainability.

Analysis of Stakeholder Engagement and Collaboration:

- Fashion Industry: The company's engagement with suppliers, customers, and recycling partners has been critical to the success of its circular practices. Collaborative initiatives have facilitated knowledge sharing and innovation, driving continuous improvement in sustainability.
- Electronics Manufacturing: Effective stakeholder engagement has enabled the company to implement take-back schemes and modular design successfully. Collaboration with recycling partners and customers has been essential in closing the loop on e-waste.
- Manufacturing Industry: The company's closed-loop supply chains have relied on strong partnerships with suppliers and customers. Stakeholder collaboration has been vital in optimizing resource use and minimizing waste.

4.6 Key Performance Indicators (KPIs)

4.6.1 Definition

The KPI is a quantified measure that allows you to measure an action or evaluate its results. These indicators allow you to monitor the evolution of team performance. They are followed by teams directly impacted at the operational level up to decision-makers to obtain a concatenated view of the activity and adjust the strategy if necessary. KPIs therefore make it possible to monitor the alignment between the company's strategy and operational activities. Identification and Explanation of Relevant KPIs:

Table 4: Different KPI areas

KPI	Explanation
Resource Efficiency	Measures the ratio of output produced to the resources consumed. A higher resource efficiency indicates better utilization of materials and energy.
Waste Reduction	Assesses the decrease in waste generated as a result of circular practices. A significant reduction in waste reflects the effectiveness of recycling and repurposing initiatives.
Financial Performance	Evaluates the economic benefits derived from circular practices, including cost savings, revenue from refurbished products, and overall profitability.
Customer Satisfaction	Measures customer responses to circular products and practices, including perceived value, product longevity, and willingness to participate in recycling programs.
Employee Engagement	Assesses employee involvement and satisfaction with the company's circular initiatives, reflecting the internal impact of sustainability practices.

Source:(Aithal & Aithal, 2023)

4.6.2 Evaluation of the Effectiveness of KPIs in Measuring CBM Success

Resource Efficiency and Waste Reduction: These KPIs are critical in quantifying the environmental benefits of circular practices. They provide tangible metrics to assess improvements in sustainability and resource use.

Financial Performance: This KPI helps in evaluating the economic viability of CBMs. It demonstrates the financial benefits of adopting circular practices, making a compelling case for their implementation.

Customer Satisfaction and Employee Engagement: These KPIs provide insights into the social impact of circular practices. High levels of customer satisfaction and employee engagement indicate broad support for sustainability initiatives and their positive impact on stakeholder relationships.

V. Conclusions

5.1 Summary of findings

This study investigated the implementation of Circular Business Models (CBMs) in three diverse companies within the fashion, electronics, and manufacturing industries. By adopting CBMs, these companies have significantly enhanced resource efficiency and sustainability, demonstrating the viability and benefits of circular practices. Key findings from the case studies include:

- *Environmental Impact:* The fashion company reduced waste by 30% and improved resource efficiency by 25% through recycling programs and sustainable materials.

The electronics manufacturer decreased e-waste by 40% and increased resource efficiency by 20% through modular design and take-back schemes.

The manufacturing firm cut waste by 35% and boosted resource efficiency by 30% through closed-loop supply chains and remanufacturing initiatives.

- *Economic Impact:* All three companies achieved significant cost savings and new revenue streams through the sale of refurbished products and efficient use of

materials. These benefits offset the initial investments required for implementing circular practices.

- *Social Impact:* Enhanced job opportunities and employee satisfaction were observed across all case studies, along with positive customer responses to sustainable products. Effective stakeholder engagement and collaboration were critical to the success of these initiatives.

5.2 Implications for Business Practice

The successful implementation of CBMs in the case studies offers valuable insights for other businesses considering a transition to circular practices. Key implications for business practice include:

Design and Innovation: Companies should prioritize sustainable design and innovation to extend product lifecycles and facilitate recycling and remanufacturing.

Stakeholder Engagement: Engaging stakeholders across the value chain is essential for overcoming barriers and driving the adoption of circular practices. Collaborative efforts can lead to shared knowledge and innovative solutions.

Investment in Infrastructure: Initial investments in recycling, remanufacturing, and sustainable supply chain management can yield significant long-term benefits, including cost savings and new revenue opportunities.

5.3 Future Research Directions

To further advance the understanding and implementation of circular business models, future research could focus on:

Industry-Specific Studies: Investigating the unique challenges and opportunities of CBMs in different industries can provide tailored insights and best practices.

Longitudinal Studies: Conducting long-term studies to evaluate the sustained impact of circular practices on resource efficiency, financial performance, and stakeholder engagement.

Policy and Regulatory Analysis: Examining the role of government policies and regulations in promoting or hindering the adoption of circular economy practices.

Technological Innovations: Exploring emerging technologies that can support and enhance circular business models, such as advanced recycling techniques, blockchain for supply chain transparency, and IoT for product tracking and lifecycle management.

5.4 Final Remarks

The transition to a circular economy is crucial for achieving sustainable development and addressing the environmental challenges posed by traditional linear economic models. The case studies in this paper demonstrate that adopting circular business models can lead to significant environmental, economic, and social benefits. By focusing on innovation, stakeholder engagement, and sustainable practices, businesses can not only enhance their competitiveness but also contribute to a more sustainable and resilient economy. It is imperative for companies, policymakers, and stakeholders to collaborate and support the transition to circular practices, paving the way for a sustainable future.

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Bionote:

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CORPORATE GOVERNANCE AND REAL EARNINGS MANAGEMENT IN NIGERIAN LISTED FINANCIAL FIRMS

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Abstract: *The focus of the study is the examination of the relationship that exists between corporate governance and real earnings management in Nigerian listed financial firms, with attention on three corporate governance variables (board tenure, board expertise and CEO ownership).* The study adopts a longitudinal research design. *Descriptive statistics, correlation analysis and panel regression analysis technique, with emphasis on the random effect model, were used for data analysis. A purposive sample of thirty seven (37) firms, out of the Forty nine (49) financial firms listed on the Nigerian Exchange Group, at year end 31st December, 2022 was studied for a period of seven years, 2016 to 2022. Findings from data analysis revealed that board expertise and CEO ownership have insignificant but positive relationships with real earnings management. In addition, board tenure was found to be significantly but negatively related to real earnings management. The correlation analysis revealed that there is a negative correlation between the variables board expertise, CEO ownership and real earnings management. Also, board tenure has a positive correlation with REM. The study recommends that directors of companies should be encouraged to spend longer time on the board as this will serve as incentive to avoid unfavourable earnings management.*

Keywords: Corporate Governance, Earnings Management, Real Earnings Management, Board Tenure, Board Expertise, Chief Executive Officer Ownership.

JEL classification: M4, M41

1. Introduction

Globalisation, advances in technology and increased competition have necessitated corporate organisations to become more competitive, generate profit, create long term value for their shareholders, have funds for investments and also meet operating costs in order to continue in to the future. Organisations are therefore sometimes pushed to take extreme measures such as real earnings management (REM) involving manipulation of operating cash flow, production costs and discretionary expenses, in their need to achieve these basic objectives (Suffian et al., 2023).

The use of REM activities like financial statement manipulation are major ways in which corporate management can manipulate the performance of their organisations (*Gong,*

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http://doi.org/10.47535/1991ojbe201.

Young and Zhou, 2023) Corporate management takes very great interest in their corporation's financial statement showing a profit. Profit, being one of the major criteria which shareholders use in making investment decisions in firms and also a criteria through which shareholders evaluate the performance of the corporation (Mellado and Sauna, 2020). This creates an incentive for managers to carryout REM.

Effective Corporate Governance (CG) in companies can reduce this incentive to a very bare minimum. Corporate governance, being the process, by which corporate organisations are controlled and directed, thus has a major role to play in minimising REM. Hence, though, managers can use REM to achieve a desired earnings level, with certain corporate governance measures this activity can be reduced.

Studies such as Musa, Latif and Majid (2023) and Abubakar, Ishak and Chandren (2017) have studied the relationship between CG and REM among Nigerian listed firms. This study contributes to the existing body of knowledge by using the model of Attia, Ismail and Mehafdi (2022), which examines REM more robustly than the models used to study REM among Nigerian financial listed firms.

2.1. Theoretical Framework

Agency theory evaluates the dynamics of the relationship between corporate owners and the management of a company. The owners of the company are the principal who invest their funds and take risk for economic benefits while the management is the agents who manage the company (Panda, 2017). In this relationship problems arise, which are caused by the separation of owners from managers.

Corporate management is given the power to manage the corporation for the owner/shareholders. Agency problems occur because managers have more corporate information than the owners. So there is the need for managers to provide corporate information to the owners (Widiasmara, 2021). Agency theory emphasises the need to implement various CG mechanisms, in order to control the actions of the management who are agents (Panda, 2017).

In relation to EM, there is the need to ensure the accuracy and reliability of financial reports. Instituting good CG mechanisms can ensure reliability and accuracy of these reports. This can also help to align the interest of management to shareholders which is the dominant theme of agency theory. This can help prevent agency problems of non-alignment of interest between the owners and the managers, which can prevent the occurrence of EM practices where management may try to manipulate the earnings of the corporation for their benefit personal benefit. Good CG in companies can therefore, help to mitigate EM.

2.2. Concept of Earnings Management

According to Sianturi et al. (2020), Earnings Management (EM) is the act of implementing deliberate, improper accounting methods and the abuse of accounting standards. Earnings management is also defined by Suffian and Sanusi (2015) to be the deliberate act of attaining a level of desired earnings within the limits of the standards of generally accepted accounting principles. EM is thus seen as actions carried out by an individual to change the accounting numbers in order to present a corporation as having a good performance (Suffian et al., 2023).

Earnings management is a very frequent cause of corporate failure. However it is seen as having both merits and demerits for corporations (Suffian et al., 2023). Good EM activity is to be developed and protected while EM with negative corporate impact such as loss of investors and public confidence has to be eliminated. While EM has merits and demerits, it is generally seen as a problem causing activity by regulators of companies (Egiyi, 2022). This is because EM is seen to reduce the reliability of a company's financial report and this

is deemed to have a significant negative impact on the quality of a corporation's earnings (Egiyi, 2022).
Due to earnings being a major aspect of corporate financial reports, it is usually used by corporate stakeholders especially owners and investors to evaluate the performance of a company's management in carrying out its corporate stewardship (Crawford et al., 2018). Suffian et al., (2023) opines that corporate earnings is the measure used by corporate stakeholders to evaluate corporate management's performance, determine management's compensation, assess corporate prospects, allocate resources and make decisions on corporate valuation. This major role of earnings thus gives most management the incentive to carry out EM.

2.2.1. Real Earning Management (REM)

These are EM practices that involve the use of operating, investing and financing decisions that do not align with the optimising of corporate strategy. REM is less easily detectable and has greater impact as it is considered more costly to firms in the long run (Kothari, Mizik and Roychowdhury, 2016). REM involves making changes to normal business operations. REM reduces firm value because manipulation by decisions taken on current real activity is a practice that deviates from normal operation of the period can have negative effect on cash flows in future periods (Mellado and Sauna, 2020).
REM is a practice that deviates from normal operations of the company motivated by desire of managers to mislead stakeholders. Due to the long-lasting effect of REM and the fact that its practice is widely employed by managers of firms and developed countries to improve reported earnings, REM deserves attention from researchers (Mellado and Sauna, 2020).
REM is carried out through three basic approaches which are manipulation of operating cash flow, production costs and discretionary expenses. These are economic activities that deviate from normal operational policies (Gong, Young and Zhou, 2023). Gao and Gao (2016) also buttress this point by stating that REM is achieved by manipulating an enterprise real activities e.g. sales, production & discretionary measures by abnormal operating activities, net cash flow, abnormal product cost & abnormal discretionary expenses.

2.3. Concept of Corporate Governance

Corporate governance (CG) is defined as of rules that guides the relationship that exist between shareholders, management, creditors, government, employees and holders of other material and external interest relating to rights and obligations (Susanto and Pradipta, 2016). Miran (2022) also defined corporate governance to be the means through which a corporation's stakeholders exert control over corporate executives and management in terms of protecting their interests.
CG uses mechanisms which can be external or internal to the corporation. External ones include a strict regulatory environment while internal CG include the board of directors and how the various levels of executive provide checks and balances in the corporation and its decision making (Cheng, Lee and Shelvin, 2016). CG mechanisms are therefore the ways through which a corporation's management effectively and efficiently governs their corporations.
In Nigeria CG practices are regulated through the Nigerian Corporate Governance Code 2018, along with the Nigerian Securities Exchange Commission's guidelines and regulations for the Nigerian Securities Market and the Companies and Allied Matters Act 2020. The board of directors is the major corner stone of CG. The board is charged with the responsibility of supervising the operations of the company, monitoring and avoiding risk, failure and loss which can cause loss for shareholders and preventing opportunistic behaviour from staff and making key decisions (Miran, 2022).

2.4. Corporate Governance and Real Earnings Management

The board of directors is the key component of CG that is seen as providing effective control over EM (El Diri, Lambrinoudakis and Alhadab, 2020). The CEO is also a major determinant of financial reporting quality (Cheng, Lee and Shelvin, 2015). Senior executives' of corporations such as CEOs hold meetings regularly for important decision making on the corporation activities and these decisions are made to ensure the corporations achieves its corporate goals.

Directors of corporations are therefore, authorised to oversee and control a corporations operations. The director's ensure that corporations maintain corporate credibility, are open in their corporate disclosures and include integrity when reporting. Thus, senior corporate executives are a major and potent factor that has great impact on a firm's corporate report and also the extent of EM practices in a corporation.

Corporate directors also have the responsibility of ensuring reliability and relevancy of the information which firms provide to users of corporate information. Thus, financial reporting quality can be impacted on by the extent of corporate director's participation in EM.

2.4.1. Board Tenure and Earnings Management

Board tenure is defined as the average number of years a company's directors have served on its board (Hambrick and D'Aveni, 1992). Members of the board of directors with long term employment, usually have very vast extensive knowledge and experience of the company. Livnat et al. (2020) notes that members of a company's board of directors who have short termed employment, have insufficient understanding of their corporate responsibilities and this makes their behaviour limited, Also, directors with longer tenure on corporate board have a strong reputation, which has been built over time, thus they are more likely to protect their hard earned reputation, by not engaging in practices such as EM. Bouaziz, Salhi and Jarboui (2020), however, viewed that the longer a company board tenure the higher the practice of EM because, these very experienced directors take advantage of their experience and familiarity with the corporation's governance framework, to carry out EM undetected.

Khan et al. (2022) studied the effect of board of directors on earrings manipulation. The results revealed that there is no relationship between board independence and expert direction with real activity manipulation. Board independence and expertise are also negatively related to discretionary accruals while there is positive relationship of female directors with discretionary accruals, which is same for real activity manipulation. Dokas (2022) studied the effect of board characteristics on REM in different sized European firms. Oversized boards were deemed a restricting determinant to REM, board tenure was also negatively correlated with REM. In smaller firms, board size had a positive association with REM.CEO duality was negatively related to REM. Usman, Nwachukwu and Ezeani (2022) examined the impact of board of directors' characteristics on EM among non-financial UK companies and found a non linear association between board characteristics and discretionary accrual. Empirical results also revealed that board mechanisms reduce the existence of EM among UK firms with higher discretionary accrual then firms with low and medium discretionary accrual levels. Board gender diversity, board tenure were negatively related to EM, board independence was positively but insignificantly associated with EM. CEO duality was significantly and positively associated with EM and number of board meeting is significantly and negatively associated with EM. Board tenure was also significant at the lower percentile of quantile, while it was insignificant at the top percentile.

Ahmed et al. (2022) examined the impact of CEO characteristics on EM. Results showed that CEO tenure and presence of an independent audit committee have a positive and significant impact on EM. CEO duality also has a positive and significant impact on EM. CEO tenure without audit committee independence result showed an inverse relationship, same for CEO duality. CEO age is negatively linked to EM. Flowing from the discussion, we expect that board tenure should have a significant relationship with REM.

2.4.2. Board expertise and Earnings Management

Board expertise or board financially literate directors are persons who are members of a recognised professional accounting body or have a higher degree in finance (Khan et al., 2023). Board members' having financial literacy is important because, board members with accounting and finance knowledge are equipped with the framework of financial reporting and have broader and deeper understanding of financial reporting (Githaiga, Kabete and Bonareri, 2022).

Musa, Latif and Majid (2023) examined the relationship between CEO attributes, board independence and REM. CEO financial expertise, compensation and CEO nationality were found to have a negative and significant relationship with REM, CEO gender had a positive relationship with REM and board independence had a negative relationship with REM. Khan et al. (2022) studied the effect of board of directors on earrings manipulation. No relationship was found between board independence and expert direction with real activity manipulation. As compared with the pre period of CCG-2017 in post period CCG-2017, board independence and expertise were negatively related to discretionary accruals while a positive relationship was found between female directors and discretionary accruals, which is same for real activity manipulation. Adewale, Kolawale and Emmanuel (2021) showed that board composition had a significant and positive effect on EM. Board independence also had a negative significant relationship with EM. Financial expertise of the board members had a positive significant relationship with EM. Board gender has no significant relationship with EM.

Githaiga, kabete and Bonareri (2022) examined the relationship between board characteristics and EM by studying whether firm size moderates the relationship between them. Board independence, board gender diversity, board financial expertise had a negative significant relationship with EM. Flowing from the discussion, we expect that board expertise should have a significant relationship with REM. Abubakar, Ishak and Chandren (2017) examined the relationship between board attributes and REM of Nigerian listed financial companies. Results show that board meeting and board expertise have a significant positive impact on REM. Female directors have a significant negative influence on real earrings management also.

2.4.3. CEO Ownership and Earnings Management

Share ownership of CEOs is the amount or number of shares which is owned by a company's CEO. Zhang, Zhou and Chuntao (2016) reveal that CEO ownership in a coy is connected to making some very vital decision in the company such as remuneration in the company. However, Qawasmeh and Mohammed (2020) are of the opinion that CEO ownership is a very major factor that enables a CEO to manipulate the earning of their corporation.

Farouk and Ahmed (2023) therefore, studied the impact of executive compensation and share ownership with bank size as moderator, on EM. Findings reveal that CEO pay increases the bank level of earnings management. EM has positive association with CEO pay. Executives owning corporate shares and bank size had a correlation that was positive with EM, but weak association. The variables were significant. O' Callaghan et al. (2018) studied large UK firms. The regression results revealed that there is no statistically significant relationship between managerial ownership and EM. Qawasmeh and Mohammed (2020) investigated the association between CEO characteristics and EM. EM practices were seen to be higher in CEO's early years than in their later years. CEO ownership was also important in increasing EM. Age and expertise of CEO did not have any role in increasing or decreasing EM. Thus, fixed effect regression revealed that CEO ownership is positive and significantly associated with EM. Firm age is positive and significantly linked with EM, firm size is also negatively associated with EM. Flowing from the discussion, we expect that board expertise should have a significant relationship with REM.

3. Methodology

3.1. Research Design and model

This study uses a longitudinal design. This enables the study to examine empirically the relationship between corporate governance and REM among financial firms that are listed on the NGX and also how changes in corporate governance attributes affect REM over a period of seven (7) years (2016-2022).

A population of forty-nine (49) financial companies listed on the NGX as at 31st December 2022 is used. A purposive sample of thirty-seven (37) financial companies was selected. Data was derived from the published financial reports of the sampled companies.

This study is anchored on the agency theory for its theoretical framework and used an adapted version of the model of *Dokas (2022)*. The adapted model is;

$REM_{i,t}$ =β_0+ $\beta_1(Tenure_{i,t})$+ $\beta_2(Expertise_{i,t})$ +$\beta_3(COwnership_{i,t})$ + β_4(FPerf) + β_5(FSize) +$\varepsilon_{i,t}$

Where; REM= Real Earnings Management; Tenure- Board Tenure; Expertise- Board Expertise; COwnership- CEO Ownership; FPerf= Firm Performance (Control variable 1); FSize= Firm Size (Control variable 2); ε = Error term; I = Cross Section (1...11); T = Time Frame (1...7)

3.2. Operationalisation of Variables

Board Tenure =Average number of years each board members has been on the board (Dokas, 2022). Board Expertise = Number of directors with financial qualification (Bala and kumai, 2015). CEO Ownership =Percentage of shares owned by CEO at start of year (Qawasmeh and Mohammed, 2020). Firm Performance = Return on Asset (ROA) (Fariha, Hossain and Ghosh, 2021). Firm Size = Log value of total Assets (Yadav, Pahi and Gangakhedkar, 2021).

Real Earnings Management = REM1 +REM2 +REM3 + REM 4 +REM5 + REM6 (Attia, Ismail and Mehafdi, 2022). Based on the agency theory, we expect all the variables to have a negative relationship with earnings management (β_1, β_2…β_3< 0)

3.3. Method of Data Analysis

Descriptive statistics including; mean, maximum and minimum, are for data analysis. Correlation analysis is also used to analyse the relationship of the variables. Panel regression analysis used for model estimation.

4. Data Analysis and Presentation

4.1. Descriptive Statistics

This section provides a descriptive analysis of the relationship between the variables. It's deals with the mean, median, maximum, minimum, standard deviation and other descriptive measures.

Table 1: Descriptive Statistics

	REM	TENURE	EXPERTISE	COWNERSHIP	FPERF	FSIZE
Mean	0.499	3.145	0.269	0.109	0.536	16.771
Median	0.363	3.105	0.222	0.004	0.032	17.176
Maximum	15.797	7.375	3.8	6.55	116	21.595
Minimum	-1.395	0.1	0	0	-1.430	10.956
Std. Dev.	1.141	1.559	0.302	0.765	7.224	2.390
Skewness	9.899	0.183	6.351	7.885	15.862	-0.339
Kurtosis	128.706	2.293	73.086	64.354	253.981	2.395
Jarque-Bera	174759.1	6.845	54750.53	43307.26	690641.5	8.893
Probability	0	0.033	0	0	0	0.0117
Sum	129.324	814.596	69.541	28.323	138.762	4343.608
SumSq. Dev.	335.803	627.274	23.603	151.164	13463.16	1474.244
Observations	259	259	259	259	259	259

Source: Researchers' Compilation (2024)

The mean and median value of the Real Earnings Management (REM) of listed financial entities in Nigeria has a value of 0.499 and 0.363 respectively indicating that the average REM of 49.9% persists within the listed firms under review. The kurtosis value of 128.706 which measures the how peaked or tailed of a distribution tends to be leptokurtic or long tailed, that is, it has extreme values or outliers because this value is less than the bench mark of 3. The positive JarqueBera value of 174759.1 expresses a goodness of fit of the REM distribution. The mean and mean value of the Board Tenure that measures corporate governance of 3.145 and 3.105 respectively shows that the average tenure of a board member within the financial sector in Nigeria is 3 years.

The Kurtosis value of 2.293 and a low JarqueBera value of 6.845 for board tenure show's a short-tailed distribution or a platykurtic distribution with few extreme values'. The board expertise mean and median value of 0.269 and 0.222 respectively indicates that averagely, 26.9% of listed financial entities board members are equipped with the requisite financial knowledge. The kurtosis coefficient of 73.086 and the JarqueBera values of 54750.53 indicate a long-tailed distribution which tends to be Leptokurtic because the Kurtosis is greater than 3. The chief executive officer ownership with an average and median value of 0.109 and 0.004 which shows the fact that averagely, chief executive officers own 10.9% of the ownership structure of listed financial entities in Nigeria. The Kurtosis value of 64.354, with JarqueBera value of 43307.26, indicates a leptokurtic long tailed test with outliers or extreme values.

4.2. Correlation Matrix

This study explores the relationship between variables through the use of Pearson product moment correlation method. The results are presented in the table below:

Table 2: Correlation Matrix

	REM	TENURE	EXPERTISE	COWNERSHIP	FPERF	FSIZE
REM	1	0.008	-0.066	-0.09	0.055	-0.038
TENURE	0.008	1	0.034	0.04	0.174	0.001
EXPERTISE	-0.066	0.034	1	0.237	0.071	0.071
COWNERSHIP	-0.09	0.04	0.237	1	0.188	0.092
FPERF	0.055	0.174	0.071	0.188	1	-0.055
FSIZE	-0.038	0.001	0.071	0.092	-0.055	1

Source: Researchers' Compilation (2024)

The variables interdependence is displayed in table 4.3 above. The correlation coefficient of a variable with itself is 1.000 which indicate that multicollinearity does not exist among variables that is the problem of an independent variable predicting another independent variable is eliminated. The correlation or association between the exogeneous variables and endogenous variable (REM) are expressed as follows: board expertise and chief executive officer ownership which are independent variables have a negative association with real earning management of listed financial firms in Nigeria with values of -0.066 and -0.09 respectively. The independent variables of board tenure have a positive association with real earnings management with coefficient value of 0.008.

4.3. Multicollinearity Test

This is used to examine how much the variance of an independent variable is influenced by its correlation with other independent variables through an econometric method of variance inflation factor (VIF).

Table 3: Variance Inflator Factor estimates

Variance Inflation Factors			
Date: 02/24/24 Time: 12:29			
Sample: 1 259			
Included observations: 259			
	Coefficient	**Uncentered**	**Centered**
Variable	**Variance**	**VIF**	**VIF**
C	0.287	56.416	NA
TENURE	0.002	5.315	1.045
EXPERTISE	0.057	1.830	1.022
COWNERSHIP	0.009	1.098	1.076
FPERF	9.845	1.009	1.004
FSIZE	0.001	51.709	1.026

Source: Researcher's Computation (2024)

The center variance inflation factor values of 1.045, 1.022, 1.076, 1.004, 1.026 with respect to board tenure, board expertise, chief executive officer ownership, firm performance and firm size in which their values are less than 5 which implies that multicollinearity problem does not exist. This implies that the selected proxies for corporate governance can explain the variation in the dependent variable of real earnings management.

4.4. Diagnostic Test

These include Breusch-Godfrey serial correlation LM test to test autocorrelation in the errors in a regression model. If the P-value is greater than 0.05, then there is no evidence of autocorrelation. The ARCH heteroskedasticity test is used to assess the null hypothesis that a series of residuals exhibit no conditional heteroskedasticity. if the P-value is greater than 0.05; it implies that the model is not heteroskedastic but homoskedastic.

Table 4: Diagnostic Test Estimates

Diagnostic test	P-value	Significance Level	Decision
Breusch-GodfreySerialCorrelation LM Test:	0.909	0.05	No autocorrelation
Heteroskedasticity Test: ARCH	0.833	0.05	Homoskedastic

Source: Researcher's Computation (2024)

The Breusch Pagan LM test with P-value of 0.909 and Heteroskedasticity ARCH test P-value of 0.833 is greater than the 0.05 level of significance indicate that there is no autocorrelation and the model is homoscedastic that is the explanatory variables can explain the dependent variables reliably.

4.5. Hausman test for fixed or random effect model

This enables the study to choose the model that suit the predictive reliability of the exogeneous variables on the endogenous variable based on the criteria that if the P-value estimated exceed the P-value critical value accept the null hypothesis of a random effect; otherwise use the fixed effect model.

Table 5: Hausman correlated random effect test

Correlated Random Effects - Hausman Test			
Equation: Untitled			
Test cross-section random effects			
Test Summary	Chi-Sq. Statistic	Chi-Sq. d.f.	Prob.
Cross-section random	2.726	7	0.742

Source:Researcher's computation 2024

Evidence from Table 5 show's that a random effect model will be constructed, because the P-value of the hausman test of 0.742 is greater than P-critical value of 0.05. The random effect implies that the unique errors are uncorrelated with the regressors therefore random effect helps to distribute randomly the error term across the cross-sectional sample which impact the dependent variable.

4.6. Panel Least Square Regression Result

This is used to predict the behaviour of the endogenous variables which indicate the line of best fit that enhances prediction with significant accuracy. The rejection or acceptance of the null hypothesis is based on the estimates in Table 6.

Table 6: Panel Least Squares Regression Estimates

Dependent Variable: REM			
Method: Panel Least Squares			
Variable	**Coefficient**	**Std. Error**	**Prob.**
C	0.776	1.019	0.447
TENURE	-0.073	0.093	0.031
EXPERTISE	0.024	0.318	0.94
COWNERSHIP	0.041	0.142	0.773
FPERF	-0.002	0.011	0.868
FSIZE	-0.003	0.054	0.951
R-squared	0.279		
Adjusted R-squared	0.024		
Log likelihood	-375.632		
Durbin-Watson stat	2.019		

Source: Researcher's computation 2024

4.7. Test of Hypothesis

The Durbin-Watson statistics of 2.019, which is lower than 2.5, implies that the auto-correlation is within the normal region which aid co-integration and enhance the relationship between the dependent and exogeneous variables. The log likelihood that measures the goods of fit of the model with a value of -375.632 which is high indicate that the panel least square regression is a good model that will enhance the explanatory variable prowess to explain the dependent variable. The corporate governance measure of board tenure (TENURE) shows a negative association and has a significant impact on real earnings management of listed financial entities in Nigeria with a coefficient value of -0.073 and P-value of 0.031. Based on this fact, the alternative hypothesis is accepted. This finding is in line with our expectation of a negative relationship and also studies like Usman, Nwachukwu and Ezeani (2022) and Dokas (2022), who found a negative relationship, but against Ahmed et al. (2022) who found a positive relationship.

Board expertise (EXPERTISE) shows a positive relationship but an insignificant impact on real earning management which is exhibited by its coefficient value of 0.024 and P-value of 0.94. Due to this result the null hypothesis is accepted. This positive relationship implies the prevalence of earnings management as a result of board experts. This finding is in line with Abubakar, Ishak and Chandren (2022) and Adewale, Kolawale and Emmanuel (2021), but against the study of Musa, Latif and Majid (2023), which found a negative relationship. The finding also negates our expectation of a negative relationship.

Chief executive officer ownership (COWNERSHIP) has a positive coefficient value of 0.041006 and a P-value of 0.773 which is greater than 0.05 level of significance; therefore, the null hypothesis is accepted which implies that chief executive officer ownership (COWNERSHIP) does not have a significant impact on real earning management of listed financial firms in Nigeria. Therefore, this finding supports the study of O'Callaghan et al. (2018) who found a positive relationship but negates our expectation of a negative relationship. The control variables of firm performance (FPERF) and firm size (FSIZE) with negative coefficient values of -0.002,-0.003 and significant P-values of 0.868, 0.951 respectively indicate that firm performance and firm size have an insignificance impact on real earnings management.

5. Conclusion and Recommendations

The study examined the relationship between corporate governance and real earnings management, with specific focus on board tenure, board expertise and CEO ownership as

independent variables and real earnings management as dependent variable. Firm performance and firm size where used as control variables. The study contributes to knowledge and general practice by using panel regression analysis with random effect model, to reveal that board expertise and CEO ownership have an insignificant but positive relationship with REM and are against our expectation. However, the independent variable board tenure was significantly but negatively related to REM and supports our expectation.
The correlation analysis also revealed that there is a negative correlation between the variables board expertise, CEO ownership and real earnings management. Board tenure also has a positive correlation with REM. The study recommends that CEOs should not be encouraged to own large shares in corporate organisations, as CEO ownership is insignificant but positively related to real earnings management and can increase the practice. Directors should be encouraged to spend more years on the board as board tenure has a significant and negative relationship with real earnings management.
Also, the number of directors with financial expertise should not exceed half of the total number of directors on the board. This is because board expertise has a positive though insignificant relationship with real earnings management and are therefore, likely to increase it. The study also recommends for further study, the need to use the model of Attia, Ismail and Mehafdi (2022) to investigate other corporate governance variables and real earnings management.

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Bio-note

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