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# Validating the Effects of Disruptive Technologies using Operational Breakeven Theory, Relative Solvency Ratio and Altman's Z-score on Selected Firms in Nigeria and India

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Abstract

Disruptive technologies (DT) have featured prominently in almost every human activity since the advent of computerization. The likely effects of DT on economic processes and human professions have and continue to generate fears and debates which spurred this investigation. To break away from the traditional approach the operational breakeven theory and the discriminant analysis techniques of Altman's Z-score, and Enyi's Relative Solvency Ratio were used to examine the relationship between firms' market-induced-survival-ratio (MISR) and the disruptive technology gains index (DTGI) of seventy-three firms drawn from Nigeria and India. Descriptive and inferential statistics were used to analyze the data generated. The results showed that a sizeable number of firms has profited from the introduction of disruptive technologies with MISR and DTGI returning a 10% significant relationship while others are still struggling to measure up to the requirements of disruptive technologies in their chosen economic fields. The implication of this is that businesses must brace up and embrace digital transformation if they must stay afloat in this era of disruptive technologies. This study recommends a revolutionary approach to digital transformation in view of the fast pace of global integration while managers and business owners should adopt more pragmatic approach in appraising the operations and finances of a firm for effective results and timely responses to potential business challenges.

*Keywords*: Disruptive Technologies, Operational Breakeven, Altman's Z-score, Enyi's RSR, Going Concern, Market Induced Survival Ratio, Disruptive Technology Gains Index

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## Introduction

Ever since the first industrial revolution in England between 1760 and 1840, the world has never remained the same again. The first industrial revolution opened the process of transition from manual production methods to machines, chemical and iron production processes, the use of steam and hydropower, the development of machine tools, and the rise of the mechanized factory system (Council of Europe, 1980). This undoubtedly led to an unprecedented rise in the rate of population growth and the consequent increase in demands for consumer goods of which textiles were dominant and became the first industry to use modern production methods (Landes, 1969). It was also of importance to note that many of the technological and architectural innovations were of British origin (Horn, Rosenband, & Smith, 2010) (Wrigley, 2018),

Schwab (2016)[3] pointed out that the second industrial revolution built on the foundation of the first revolution to introduce electric power which improved mass production tremendously, while the third revolution used electronics and information technology to automate production (Schwab, 2016). This invariably gave rise to the use of machines in the form of robots[4] to control the functioning of other machines in the production process. Schwab (2016) further opined that the world has entered the fourth industrial revolution – the digital

[3] Klaus Schwab is the Founder and Executive Chairman of the World Economic Forum
[4] The use of robots and automated machines was the first step in the journey towards the creation of artificial intelligence.

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revolution which is characterized by a fusion of technologies that is blurring the lines between physical, digital, and biological spheres (Schwab, 2016).

Schwab (2016) adduced three reasons why today's transformations represent not merely a prolongation of the third industrial revolution which include: velocity or the unprecedented speed of the current breakthroughs, the scope of its exponential rather than linear evolution, and the impact of the system which has disruptive effect in every industry across the globe. "And the breadth depth of these changes heralds the transformation of entire systems of production, management, and governance" (Schwab, 2016). The transformation and revision of systems of production, marketing, management, and governance owing to new innovations in technology became known as disruptions and the innovations behind them are tagged ***disruptive technologies***. Tim Smith defined disruptive technology as "an innovation that significantly alters the way that consumers, industries, or businesses operate. A disruptive technology sweeps away the systems or habits it replaces because it has attributes that are recognizably superior" (Smith, 2020).

## Literature Review

That the digital transformation is here with humanity is no longer in contention, but what is still unclear about it is the magnitude and time frame. To start with, we need to identify the present contents of the digital transformation which have come to be identified as disruptive technologies because of the disruptive effects they exert on the subsisting methods of business organizational operation processes at the point of their entry. Schwab (2016) identified some disruptive technologies to include cloud computing, artificial intelligence, blockchain technology, and 5G connectivity enabling faster internet connectivity with all the overwhelming

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attendant possibilities in the form of smart cities, digital assistants, smart hospitals, self-driving cars, and a plethora of other innovative possibilities.

Cloud computing can be viewed from the perspective of the ability of systems to customize options in line with business and IT requirements. It builds upon current IT trends like data center consolidation and server virtualization. "Cloud computing moves Web-based applications to the Internet inexorably tying user connectivity and productivity to networking equipment" (Oltsik, 2010). Benefits include – endless network access, simple incremental growth, economy in the use of resources, improved system reliability, and rapid elasticity (Farpoint Group, 2011). Artificial intelligence (AI) systems are powerful computer-based equipment like robots that can provide extremely accurate outputs that can replace and, in some cases, supersede human efforts (ICAEW ITFaculty, 2018). Artificial intelligence devices include autopilot in airplanes, self-driving cars, smart lawyer, and many other business digital assistants. As posited by ICAEW ITFaculty (2021) blockchain technology is an accounting creation. Their view reads:

> Blockchain is a foundational change in how financial records are created, kept, and updated. Rather than having one single owner, blockchain records are distributed among all their users. The genius of the blockchain approach is in using a complex system of consensus and verification to ensure that, even with no central owner and with time lags between all the users, nevertheless a single, agreed-upon version of the truth propagates to all users as part of a permanent record. This creates a kind of 'universal entry bookkeeping,' where a single entry is shared identically and permanently with every participant (ICAEW ITFaculty, 2018).

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**Why firms must embrace digital transformation**

In the words of Gurumurthy, Nanda, and Schasky (2021) “the shift from digital as an enabler of strategy to digital as the lynchpin of competitive strategy comes at a time when the mere possession of advanced digital technology is becoming table stakes” (Gugumurthy, Nanda, & Schasky, 2021). They introduced the term “digital maturity” and suggested that digitally mature organizations will exhibit greater innovation capacity than less digitized ones. They alluded to the discovery of hitherto unknown digital capabilities during the pandemic, to affirm multiple research reports which predicted a near-term surge in enterprise digital transformation spending. Particularly, they revealed that Gartner’s 2020 CEO Survey found that more than 80% of organizations planned to boost their investments in digital transformation, than in other aspects of their business. They further expressed their belief that investment in enterprise digital transformation will grow at an annual compounded rate of 15.5% between 2020 and 2023, with total investment over that period reaching US$6.8 trillion (Gugumurthy, Nanda, & Schasky, 2021).

The issue of business crisis will be minimized as investments in digital transformation can lay the foundation for long-term resilience to future crisis in business organizations. Schools, hospitals, businesses, and governments must tune up on technological innovations to keep up with the rapid pace of digital transformation to keep their operations afloat. In addition, the 5G connectivity will radically transform the way we work and live with faster internet leading to more efficiency in all industries. Digital transformation will provide more jobs and learning opportunities while creating a more diverse and logically agile global workforce, economic opportunities, and job security. Particularly, 5G connectivity will usher in new innovative technologies like autonomous vehicles, autonomous shops, energy-efficient cities, and smart agricultural systems (Hegarty, 2021).

**Challenges of digital transformation**

Digital transformation arrived with lots of unpleasant surprises and challenges among which include business losses and redundant skills. According to the findings of Gurumurthy et al. (2021), about 67% of commercial respondents to their survey believed that organizations that do not digitize in the next five years will be “doomed”. (Gugumurthy, Nanda, & Schasky, 2021). They also cited a 2019 Deloitte study which revealed that 81% of digitalized companies cited innovation as a strength, as against only 10% of non-digitalized firms.

Redundancy of skills will bring with it the additional costs and time required to upskill or reskill. This is so since the global COVID-19 pandemic has forced many to adopt new work methods of working and running businesses from homes (Hegarty, 2021). Cyber-attacks will present a more daunting challenge as the digital transformation gains ground. As of October 28, 2021, a total of seventy-two breaches, 3.683 billion record leaks, and 1,912 cyber-attack events were recorded in the ten months of 2021 alone (Hackmageddon, 2021). This is not expected to abate in the coming seasons; nevertheless, the actions of hackers cannot deter the global resolve for digital transformation as cyber security expertise is known to increase on daily basis in direct response to preventing future attacks.

**Need for sophistication in data analysis and control information**

Given the overwhelming degree of sophistication in technology and entrepreneurship innovation engendered and continuously envisaged in the new dispensation of digital transformation, it became imperative to reassess the existing operations and financial control data analysis tools. When the need to efficiently measure the effects of digital transformation is

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juxtaposed on the endless possibilities of the fourth industrial revolution, such questions as – what tools do we include in our firms' dynamic data analysis dashboards? What becomes of the existing firms' management parameters such as the concept of going concern, liquidity, and overall firm survival? – all become too apparent.

Going concern is an age-long governance framework in corporate finance. It is a belief based on the outcome of the financials of an organization that the firm will continue to exist beyond the current accounting period (Musvoto & Gouws, 2011). However, there have been divergent opinions on what constitutes the basis for going concern in an organization and how to measure it (Haron, Hartadi, Ansari, & Ismail, 2009), Many attempts have been made at estimating the going concern index, but the different methods employed depict the divergent purposes for which the measurement is intended. In this study, we have applied the method prescribed by Entrepreneur (2013) based on striking a balance between total assets and total liabilities minus equity (Entrepreneur, 2013). This valuation method is also in line with the breakup value prescribed by the Business Development Bank of Canada (BDC, n.d.).

Owing to the various criticisms against the unified approach to going concern measurement and the obvious limitations emanating from the use of only a firm's intrinsic attributes, this study attempted to strengthen the index by considering the market value of the firm's shares/stocks. The new resulting measurement described fully under the methodology section became known as the ***market-induced survival ratio*** (MISR). MISR, being a combination of a firm's intrinsic and market-based attributes can be regarded as a more reliable going concern measurement – the main reason for choosing it as our outcome variable in this study. Another ratio introduced for this study is the disruptive technology gains index (DTGI). It is a measure of the effects of disruptive technologies on the activities and financial performance

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of a firm. The value is obtained by isolating the noted differences in firms' activities represented by the pre/post DT implementation turnovers and the financial performance attributable to changes in the operational pattern of firms resulting from the introduction of disruptive technologies.

The traditional financial control data analysis tools have been seen to become ineffective and moribund as organizations become larger in size and areas of geographical operations (Enyi, 2018). Current ratios, stock-turnover rates, and a host of other traditional financial ratios have been found to be grossly deficient in guiding managers on the fiscal health status of a firm as firms' operations are now dependent on data-driven decisions. This was first observed by Altman (1968) which led to the introduction of a discriminant analysis model using the Z-score measurement which combined the parameters of internal financial control data with the external market-based rating of a firm (Altman, 1968). The Altman's Z-score gradually overcame the obstacle of myriads of peer review criticisms to become a reference point in alternative control data mechanisms. Specifically, the advent of digital transformation and the stiff competitions that accompany it have made it mandatory for organizations to increasingly enhance traditional control information dashboards with dynamic storytelling tools powered by artificial intelligence (AI) and machine learning (ML) (Gartner Finance, 2021).

A credible attempt to overcome the main criticisms[5] of the Altman's Z-score was made by Enyi (2008) which introduced a firm-based discriminant analysis tool known as the relative solvency ratio (RSR) (Enyi, 2008). This model was developed based on the theory of a firm's operational breakeven which states that a firm reaches its ***operational breakeven point*** where

[5] Criticisms bordering on the inexplicable use of certain coefficients as multipliers and the introduction of market-based ratio which bears no relationship with the internal functioning of a firm,

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cumulative contribution margin on recovered production outputs equal the total cumulative production, marketing, and administrative costs and losses of the learning period (Enyi, 2005). The theory assumes a learning period for every entrepreneurial process. A study on selected textile firms in India by Pai and Dam (2017) affirmed that the RSR works effectively and performs well in identifying default and predicting prior period distress. The study went further to suggest that the current ratio has a limitation of giving a spurious overall view of a firm's liquidity as the research result indicated that the current ratio showed a contradictory picture of solvency whereas both CRISIL[6] and Enyi's RSR pointed to default/distress (Pai & Dam, 2017). An Indian Ph.D. research findings posited that both the Altman's Z-score and the Enyi's RSR have their area of comparative advantage in application, for instance, while RSR produced a high predictive accuracy of 100% for distressed firms and 85% to 100% for safe firms, Z=score achieved 88% accuracy for distressed firms and 80% to 94% accuracy for safe firms (Pai, 2019). Two other studies in Uzbekistan tend to suggest that using the Altman's Z-score and Enyi's RSR for the measurement and prediction of insolvency and fiscal health of banks and manufacturing enterprises achieves better operational and liquidity control (Abdullaeva, 2017), (Khasanova, 2018), (Meliboeva, 2021).

Outside financial control, the digital transformation has made every other aspect of entrepreneurial control to depend on instantaneous analysis of intrinsic and extrinsic business data. This is the reason businesses do not only need to digitalize but to do so with the appropriate strategy. In the words of Gurumurthy et al. (2021) "Companies will need to be digital to play—but they will need the right strategy to win" (Gugumurthy, Nanda, & Schasky, 2021). The supply

[6] CRISIL is an Indian firm rating and global analysis company. It is a subsidiary of the US S&P Global engaging in research, risk analysis, and policy advisory services.

chain being an important link in any business enterprise must be strengthened to enable the firm to achieve seamless uninterrupted operations. "Therefore, businesses should invest in technologies that allow them to connect with suppliers and make use of real-time data that can enable the whole supply chain to operate more efficiently based on better-informed decisions" (Davies & Appt, 2020).

**Research objectives**

The purpose of this research paper is to highlight the benefits and disruptive effects of digital transformation on global business enterprises which form the major boulder of the global economy. It was also designed to highlight mankind's vulnerability to the effects of disruptive technologies and to fashion out the best approach towards managing them for the benefit and continued advancement of humanity.

**Research hypotheses**

This study was guided by the need to address and find contextual validations to the underlisted research hypotheses:

$H_0 1$ – That the going concern index (GCI) as defined in this study is not a significant measure of a firm's longevity.

$H_0 2$ – That the current ratio cannot significantly support firms' solvency management and data-driven decision process in a disruptive technologies' environment.

$H_0 3$ – That the Altman's Z-score cannot significantly support firms' solvency management and data-driven decision process in a disruptive technologies' environment.

$H_0 4$ – That the Enyi's relative solvency ratio (RSR) cannot significantly support firms' solvency management and data-driven decision process in a disruptive technologies' environment.

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$H_0 5$ – That the disruptive technologies gains index (DTGI) cannot significantly capture the effects of digital transformation in a firm.

$H_0 6$ – That the operational breakeven point (OBEP) is not a significant measure of a firm's operational competence.

$H_0 7$ – That the mark-up strategy of the firms studied cannot significantly sustain their going concern and long-term survival.

## Methodology

This study was conducted on a selected group of seventy-three companies listed on public exchanges in India and Nigeria. The group made up of 49 Indian and 23 Nigerian firms comprised of companies in every sphere of economic activity ranging from banking, ICT, oil-and-gas to aviation. The study was based on a discriminant analysis of the five years financial statements of the selected firms up to 2019 using the going concern index (GCI), current ratio (C. Ratio), Altman's Z-score, Enyi's Relative Solvency Ratio (RSR), the disruptive technology gains index (DTGI), the operational breakeven point (OBEP), and the firm's achieved mark-up rate (m). The resulting values were regressed against the market-induced survival ratio (MISR) for each company using a GLM multiple regression model to test for fitness and variances.

To measure the value of the MISR and other listed discriminant analysis variables, the study adopted the use of the following formulas:

Going Concern Index (GCI) = $\frac{Total\ Assets}{Total\ Debts}$

Current Ratio (C. Ratio) = $\frac{Current\ Assets}{Current\ Liabilities}$

Altman's Z-score = 1.2 WC/TA + 1.4 RE/TA + 3.3 EBIT/TA + 0.6 MV /BV +1.0 Sales/TA (Altman, 1968).

Where,

Z score = financial condition of the company (strong, moderate, and weak)

WC/TA = working capital/total asset

RE/TA = retained earnings/total asset

EBIT/TA = earnings before interest and tax /total asset

MV/BV = market value of share/book value of debt

Sales/TA = sales/total asset

Altman (1968) interprets Z-score, as strong when it is > 2.99, or moderate when it is between 1.811-2.98, and weak when it is below 1,811.

Enyi's RSR = $\frac{104p(a-l)}{t(t-p)}$

Where,

RSR = Relative Solvency Ratio

p = Profit before tax

t = Turnover (total earnings)

a = Current assets

l = Current liabilities

The cutoff value for RSR measurement is 1.0. Meaning that any firm with RSR less than 1.0 is technically insolvent, while those with values above 1.0 are in good fiscal health (Enyi, 2018).

The disruptive technologies gains index (DTGI) is a measure introduced within this study to gauge the effect of disruptive technologies on the operations and financial performance of a firm. It is measured by isolating increase/decrease in a firm's activities, turnover, and/or financial performance attributable to changes in the operational pattern because of the introduction of any identified disruptive technology such as cloud computing, blockchain engagement, digital or

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internet marketing, 3D printing, and many more. The method of measurement is to find the difference between the pre-introduction capital turnover ratio (CTR) and the post-introduction CTR and divide the result with the pre-introduction CTR, then take the result to a percentage. This measure in its truest sense indicates how the activity has changed since the introduction of the disruptive technology.

But, since turnover does not always indicate profitability, it is also necessary to gauge how efficiently the use of the disruptive has impacted the firm's financial performance. This is done by finding the difference between the pre-introduction return on capital employed (ROCE) and the post-introduction ROCE. The result is derived the same way as previously stated. To find the firm’s effective DTGI, we find the geometric mean of the CTR, and ROCE based values as follows:

$$\text{DTGI} = \sqrt{\frac{(C1-C0)(R1-R0)}{C0.R0}} \text{ x } 100$$

Where,

DTGI = disruptive technologies gains index

$C_0$ = pre-introduction CTR

$C_1$ = post-introduction CTR

$R_0$ = pre-introduction ROCE

$R_1$ = post-introduction ROCE

The mark-up rate (m) for each firm as defined in Enyi (2008) is the difference between the total income (turnover plus other income) and the total cost of operations divided by that total cost of operations in an accounting period. It is the same as the profit before tax divided by the difference between the cost of operations and profit before tax. That is:

$$\text{m} = \frac{p}{t-p} \quad \text{(Enyi, 2018)}$$

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where,

m = mark-up rate

with ***p***, and ***t*** as previously defined

The operational breakeven point (OBEP) is the point of operational homeostasis or equilibrium in an organization that guarantees the most efficient use of the organizational resources. It is a point where the technical, managerial, and marketing functions of the firm have grown to efficiently and effectively manage the resources of the organization to attain the objectives of the firm without wastages (Enyi, 2008).

OBEP = $\frac{1+m}{2m}$ (which is further refined below)

OBEP = $\frac{t}{2p}$

Where,

OBEP = Operational breakeven point

with ***m***, ***p***, and ***t*** as previously defined

The GLM regression model developed for this study is as follows:

$$MISR = \beta_0 + \beta_1 GCI + \beta_2 Crat + \beta_3 Zsco + \beta_4 RSR + \beta_5 DTGI + \beta_6 OBEP + \beta_7 m + \varepsilon$$

## Findings and Discussions

### Descriptive statistics results

Table 1 contains the summary descriptive statistics for all the variables used in the study. The figures revealed that the companies studied achieved a high average market induced survival rate (MISR), a reasonable going concern, and disruptive technologies gain indices as follows: The mean MISR of 261.08 indicates that all the firms studied are publicly listed companies and that majority of them are enjoying a good market rating. While the most active of the firms enjoy

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a survival rate of 3,670.08, the least active achieved only a marginal survival rate of 0.52 indicating a dormant or moribund enterprise. The going concern index (GCI) revealed that all the firms studied have good chances of surviving beyond the current accounting period with a mean GCI of 1.61 and the least of 1.05. On the other hand, the current ratio (C. Ratio) indicates that while some of the firms are technically insolvent or have liquidity issues, the average firm was unable to reach the standard general current ratio requirement of 2:1 for current assets to current liabilities, respectively. The disruptive technology gains index (DTGI) shows that most of the firms which have embraced the use of one form of disruptive technology, or another achieved a mean gain index of 6.86 while those still struggling with the introduction made as little as 0.02 overall impact. Significantly, one of the ***digitally maturing*** firms studied in India achieved the highest impact of 36.39 DTGI.

The mean operational breakeven point (OBEP) of 18.61 cycles means that most of the firms studied still grapple with problems of inefficient management of people, machines, and market integration; however, the minimum OBEP of 0.6 indicates that one or more of the companies studied attained operational equilibrium at the lowest possible level. The mark-up rate figures showed that most of the companies studied achieved a mean rate of operational costs recovery of 25% while one or more of the firms made operational losses by returning a 0% mark-up rate. The standard deviation figures for GCI = 0.697, C. Ratio = 1.284, and m = 0.665, pointed to the close dispersion of the values around their means.

When the discriminant analyses values of the Altman's Z-score and Enyi's RSR were converted to the interpretative values of **strong**, **moderate**, and **weak** fiscal health values, both models return a *mean* status of **moderate fiscal health** (Z-score = 1.88; RSR = 0.51); whilst the dispersions around the mean are close with *standard deviations* = 0.908 and 0.465 for Z-score

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and RSR respectively indicating the closeness and normality of the data distribution. To understand these results better, we provide the interpretative values of the two models hereunder:

Altman's Z-score: $Z \geq 2.99$ = **Strong**; $Z < 2.99 \geq 1.811$ = **Moderate**; $Z < 1.811$ = **Weak**

Enyi's RSR: $RSR \geq 1$ = **Strong**; $RSR \geq 0.25 < 1$ = **Moderate**; $RSR < 0.25$ = **Weak** or Distressed firm**.**

**Inferential statistics results**

The GLM test results in tables 2 and 3 produced a robust model which addressed the seven research hypotheses, revealed much about the relationship between firms' market-induced survival ratio (MISR) and the seven other research variables employed in this study. The model generated by data analysis is as follows:

$$MISR = 234.04 - 35.06\text{gci} + 36.31\text{crat} - 6.6\text{zsco} - 2.17\text{rsr} + 11.07\text{dtgi} - 2.49\text{obep} + 206.28\text{m} + \varepsilon$$

First, the test of ANOVA in table 1 revealed no similarity between the means of variables used in the study with $F\,(7, 65) = 0.76$, $p = .6198$, and $Adj.\ R^2 = -0.0235$. Secondly, the Ramsey RESET test showed clearly that there are no significant deviations from the predictive powers of included variables on the MISR outcome variable. This assures that all variables used are important and useful in the determination of the market-induced survival ratio (MISR) of the firms studied [$F\,(3, 62) = 0.83$, $p = 0.4844$]. However, the Breusch-Pagan test for heteroskedasticity on the data spread-out was significant [ $\chi^2\,(1) = 16.14$, $p = 0.0001$] but this does not significantly alter the linearity and predictive quality of the model generated.

The GCI value which bears an inverse relationship with the MISR was not significant ($GCI = -35.0583$, $t = -0.0245$, $p = 3.3769$) because it ignores the market value or market expectation of the firm as it merely measures the ability of the firm to pay its debts with all available assets. This is particularly so because, though, the GCI was able to measure the going

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concern of a firm in the short run, it cannot adequately represent the foreseeable position of the firm in a medium or long-term period. The same is true of the current ratio which was also not significant (*crat* = 36.3135, *t* = 0.059, *p* = 1.4049) because of its limited application in identifying short-term solvency problems. The Altman's Z-score was surprisingly not significant as it bears inverse relationship with the MISR (*Z-sc* = -6.593, *t* = -0.3387, *p* = 0.2448). This insignificant inverse relationship is an indication that the Altman's Z-score is an important but weak measure of MISR even when market valuation is one of its cardinal measurement parameters. The import of the non-significance of the results for GCI, current ratio, and the Altman's Z-score is that ***we do not reject*** hypotheses **$H_0$1**, **$H_0$2**, and **$H_0$3**. Meaning that the going concern index (GCI) as defined in this study is not an adequate measure of a firm's longevity just as the current ratio cannot effectively support firms' solvency management and data-driven decision process in a disruptive technologies' environment. Likewise, the Altman's Z-score cannot significantly support firms' solvency management and data-driven decision process in a disruptive technologies' environment.

The Enyi's RSR and the operational breakeven points (OBEP) are significant at 5% but are both inversely related to the MISR (RSR = -2.1707, t = -4.8729, p = 0.017 | *OBEP* = -2.4848, *t* = -5.0725, *p* = 0.0163). The reason for the significant relationship of these two with MISR may not deviate from the fact that they measure the intrinsic and internal strengths of firms which are woven around the integration of human capacity, managerial competence, technology, and market penetration ability which the introduction of disruptive technologies has come to consolidate. The RSR and OBEP negative relationship with MISR was because it has been established that a firm's profitability is inversely related to its operational breakeven point - meaning that the lower the operational breakeven point, the higher the profitability of the firm.

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The operational breakeven point is the building block for generating a firm's relative solvency ratio (Enyi, 2005). Going by the analyzed results for RSR and OBEP, ***we reject*** hypotheses $\mathbf{H_04}$ and $\mathbf{H_06}$ and state that the Enyi's relative solvency ratio (RSR) adequately supports firms' solvency management and data-driven decision process in a disruptive technologies' environment and that the operational breakeven point (OBEP) is an acceptable measure of a firm's operational competence.

The disruptive technology gains index maintains a positive significant relationship with the MISR at the 10% but not at 5%level of significance ($DTGI$ = 11.074, $t$ = 0.865, $p$ = 0.0958). This implies that, though a sizable number of the firms studied have implemented some forms of disruptive technologies undergone some digital transformations in their area of economic operations, many others are yet to come to terms with the development. This is in line with the suggestions of Gurumurthy, et al. (2021) that digitally mature organizations perform better and exhibit a greater capacity for innovation than less mature ones. Based on the significant result, ***we reject*** hypothesis $\mathbf{H_05}$ and affirm that the disruptive technologies gains index (DTGI) can efficiently and effectively capture the effects of digital transformation on a firm's activities and financial performances.

The mark-up rate is the last of the variables considered in the study and like the DTGI it was positively related to MISR, but its predictive value was not significant (m = 206.2799, $t$ = 0.031, $p$ = 2.6769) because it is a ratio derived entirely from internal operations and not based on extrinsic or market value of the firm's stocks. On strength of this result, ***we do not reject*** hypothesis $\mathbf{H_07}$ because it indicates that the mark-up strategy of the firms studied cannot adequately sustain their going concern and long-term survival, particularly as the mean mark-up rate of the firms studied stood at 0.25 with some firms recording close to zero mark-ups. This is

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an indication of high operational breakeven point cycles which could induce extremely low financial performance which is an antithesis to corporate survival.

Tables 4 and 5 highlights separate GLM analysis results for India and Nigeria. Table 4 revealed that Enyi's RSR was significant at the 95% confidence interval or 5% significant level while Operational Breakeven point (OBEP) and DTGI were significant at the 90% confidence interval or 10% significant level. The significance of these three variables is an indication of the presence of the application of disruptive technologies in many Indian companies. The same cannot be said of the Nigerian firms as none of the three variables was significant at both the 95% and 90% confidence levels.

## Conclusion and Recommendations

Disruptive technologies have come to be part of every aspect of modern-day economic activity in the world and their effects have made tremendous impacts on the successes of business enterprises while marring the chances of survival of those others which refuse to flow with the tide of digital transformation. The effects of disruptive technologies are everywhere but must be accurately determined for the full benefits to be tapped. Determination of the effects of disruptive technologies must be conducted with tools that capture the dynamism with which the phenomenon penetrates society. This study has used a combination of business accounting efficiency and effectiveness measuring instruments like capital turnover ratio (CTR) and the return on capital employed (ROCE) to fashion out a disruptive technology gains index (DTGI) through which a firm's technical and financial progressions on the application of modern technologies can be ascertained.

The results of the study revealed that many firms have embraced the conversion to new methods of operations as resulting from implementing full or partial aspects of disruptive

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technologies. The results also showed that the introduction of disruptive technologies (DT) significantly improved the economic fortunes of the firms which embraced their use while facilitating the exit of those others that choose to sit on the fence. The discriminant analysis tools employed in the analysis of the financial statements indicate that only the operational breakeven point and the Enyi's relative solvency ratio were significant and consistent in measuring the solvency status of the firms studied at all stages of DT implementation.

Though the Altman's Z-score agreed with the Enyi's RSR that the average number of the companies studied fell into the ***moderate fiscal health*** category, it nevertheless failed to strike a significant relationship with the firms' market-induced survival rate (MISR). Likewise, the simplified going concern index (GCI), and the current ratio fell short of being significant in their relationship with MISR. This is probably due to their non-market-related origin. In like manner, the firms' mark-up rate (m) was insignificant in its interaction with MISR because most of the firms studied have low mark-up rates and high operational breakeven point cycles with a poor financial performance which stands inimical to the overall objective of long-term corporate survival.

The study recommends a complete re-engineering of firms' activity and financial performance appraisal tools noting that the traditional methods like the current ratio, acid-test ratio, credit policy, and other time-based management ratios are no longer dependable in these days of online shopping, cashless/card payment, QR scanning and bank transfer system which reduces transaction time from days/hours to minutes/seconds. The introduction of a more robust programmable tool like the Enyi's relative solvency ratio, and the Altman's Z-score and their improved variants might be more appropriate in a jet-speed internet transaction age such as being introduced by the emergence of diverse kinds of disruptive technologies. In addition, companies

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still dragging their feet on the issue of implementing disruptive technologies should come to terms with modern-day realities and retool to avoid being consigned to the abyss of history because digital transformation – the fourth industrial revolution is here with us.

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Tables

Table 1

Summary Statistics

| Item | Misr | Gci | C.ratio | Z-scor | Rsr | Dtgi | Obep | m |
|---|---|---|---|---|---|---|---|---|
| *Mean* | 261.08 | 1.61 | 1.5 | 1.88 | 0.51 | 6.86 | 18.61 | .25 |
| *Median* | 213.13 | 1.21 | .71 | 2.0 | 0.0 | 3.05 | 2.44 | .26 |
| *Max* | 3670.08 | 4.35 | 8.41 | 3.0 | 1.0 | 36.39 | 200.5 | 4.86 |
| *Min* | .52 | 1.05 | .1 | 1.0 | 0.0 | .02 | .6 | .0 |
| *Std.Dev* | 569.13 | .697 | 1.284 | 0.908 | 0.465 | 7.211 | 36.558 | .665 |
| *Skewness* | 4.381 | 1.793 | 3.079 | 0.102 | -0.031 | 1.828 | 3.096 | 5.793 |
| *Kurtosis* | 23.379 | 7.156 | 15.27 | 1.432 | 1.113 | 7.051 | 12.573 | 37.262 |
| Obs | 73 | 73 | 73 | 73 | 73 | 73 | 73 | 73 |

*Interpretative values of between 1 and 3 were used to analyze Z-scor and Rsr in place of actual values*

Table 2

Test of ANOVA

| Source | SS | Df | MS |
|---|---|---|---|
| Model | 1791139.89 | 7 | 255877.127 |
| Residual | 21786058.7 | 65 | 335170.133 |
| Total | 23577198.6 | 72 | 327461.091 |

| | | |
|---|---|---|
| Number of obs | = | 73 |
| F (7, 65) | = | 0.76 |
| Prob > F | = | 0.6198 |
| R-squared | = | 0.0760 |
| Adj R-squared | = | -0.0235 |
| Root MSE | = | 578.94 |

Table 3

Multiple regression analysis results (combined)

| Var | Coef. | Std.Error | t | p > \| t \| | |
|---|---|---|---|---|---|
| _Cons | 234.0422 | 6010.7949 | .0389 | 2.1291 | |
| GCI | -35.0583 | 1428.0874 | -0.0245 | 3.3769 | |
| C. Ratio | 36.3135 | 615.3837 | .059 | 1.4049 | |
| Z-Score | -6.593 | 19.4674 | -0.3387 | .2448 | |
| RSR | -2.1707 | 0.4455 | -4.8729 | .017 | (Significant at 5%) |
| DTGI | 11.074 | 12.8025 | .865 | .0958 | (Significant at 10%) |
| OBEP | -2.4848 | 0.4899 | -5.0725 | .0163 | (Significant at 5%) |
| m | 206.2799 | 6660.9027 | .031 | 2.6769 | |

R-squared = 0.076; Adjusted R-squared = -0.0235; Durbin-Watson statistics = 1.62703

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Table 4

Multiple regression analysis results (Indian Firms)

| Var | Coef. | Std.Error | t | p > \| t \| | |
|---|---|---|---|---|---|
| _Cons | -162.8927 | 7871.0018 | -0.0207 | 4.0371 | |
| GCI | 110.1147 | 2963.1515 | .0372 | 2.2483 | |
| C. Ratio | 59.2975 | 301.2053 | .1969 | .4244 | |
| Z-Score | -6.7465 | 12.6066 | -0.5352 | .1561 | |
| RSR | -11.6513 | 1.9684 | -5.919 | .0141 | (Significant at 5%) |
| DTGI | -5.9538 | 6.5789 | -0.905 | .0923 | (Significant at 10%) |
| OBEP | 0.4253 | 0.2783 | 1.5283 | .0547 | (Significant at 10%) |
| M | 1593.3973 | 42124.7013 | .0378 | 2.2088 | |

R-squared = 0.2534; Adjusted R-squared = 0.1259; Durbin-Watson statistics = 2.01241

Table 5

Multiple regression analysis results (Nigerian Firms)

| Var | Coef. | Std.Error | t | p > \| t \| |
|---|---|---|---|---|
| _Cons | 1375.339 | 94167.5671 | .0146 | 5.8678 |
| GCI | -468.5319 | 17441.0214 | -0.0269 | 3.1902 |
| C. Ratio | 105.3967 | 42921.2939 | .0025 | 34.9001 |
| Z-Score | 37.5145 | 190.7637 | .1967 | .4358 |
| RSR | 28.8889 | 256.2231 | .1127 | .7601 |
| DTGI | 53.6356 | 138.5882 | .387 | .2214 |
| OBEP | -77.3401 | 233.2886 | -0.3315 | .2585 |
| m | -736.675 | 139038.8574 | -0.0053 | 16.1749 |

R-squared = 0.3529; Adjusted R-squared = 0.0698; Durbin-Watson statistics = 1.17422

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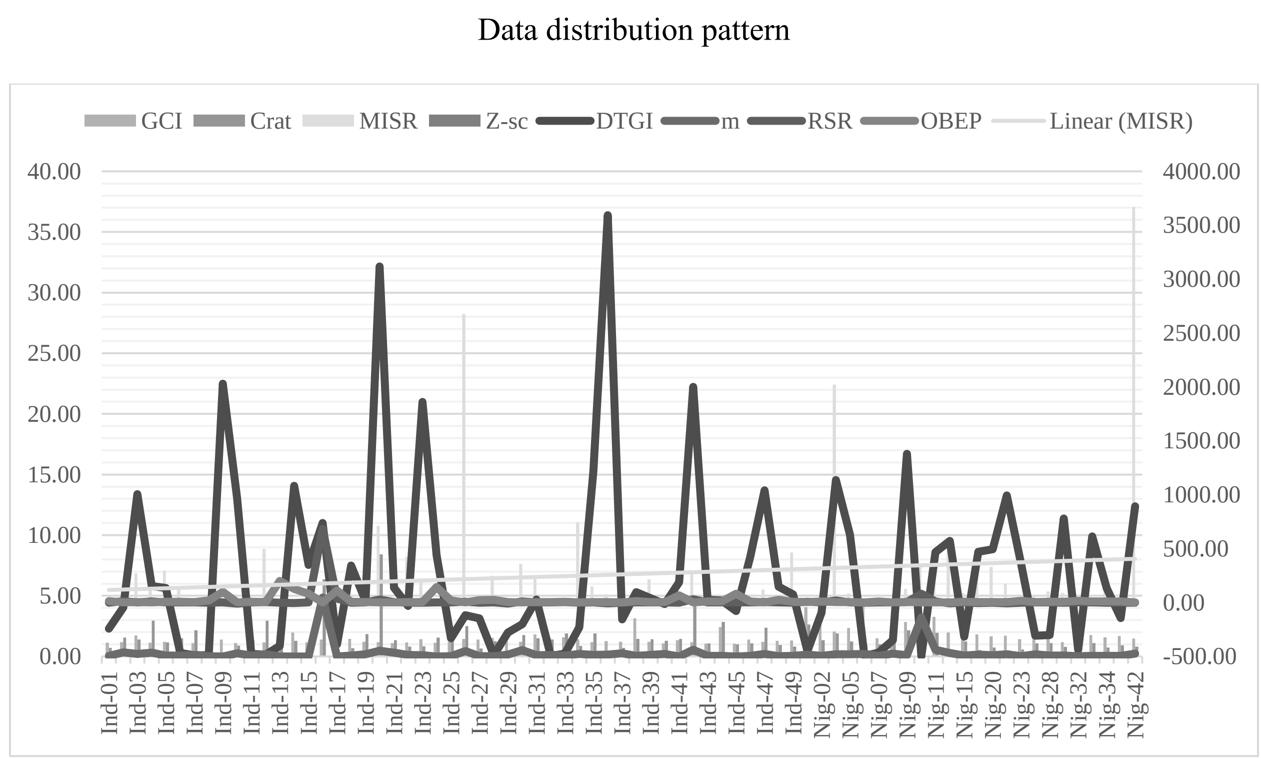


*Figure 1*. Data distribution pattern