Journal of Management and Research (JMR)
Volume 9 Issue 2, Fall 2022
ISSN(P): 2218-2705, ISSN(E): 2519-7924
Homepage: https://ojs.umt.edu.pk/index.php/jmr

Article QR

Title:	**Diagnostic Assessment of Post-COVID-19 Operations for Business Model Reconfiguration Decision**
Author (s):	Matolwandile Mzuvukile Mtotywa[1,2], Victor Loyiso Vusumzi Mtotywa[3]
Affiliation (s):	[1]Business and Social Research Institute, Centurion, South Africa [2]Mtotywa Publishers, Fort Beaufort, South Africa [3]Anglo American Platinum, Rosebank, South Africa
DOI:	https://doi.org/10.32350/jmr.92.03
History:	Received: May 26, 2022, Revised: August 10, 2022, Accepted: August 24, 2022, Published: December 31, 2022
Citation:	Mtotywa, M. M., & Mtotywa, V. L. V. (2022). Diagnostic assessment of Post-COVID-19 operations for business model reconfiguration decision. *Journal of Management and Research*, *9*(2), 66–94. https://doi.org/10.32350/jmr.92.03
Copyright:	© The Authors
Licensing:	This article is open access and is distributed under the terms of Creative Commons Attribution 4.0 International License
Conflict of Interest:	Author(s) declared no conflict of interest

A publication of
Dr. Hasan Murad School of Management
University of Management and Technology, Lahore, Pakistan

Diagnostic Assessment of Post-COVID-19 Operations for Business Model Reconfiguration Decision

Matolwandile Mzuvukile Mtotywa[1,2*] and Victor Loyiso Vusumzi Mtotywa[3]

[1]Business and Social Research Institute, Centurion, South Africa
[2]Tshwane School for Business and Society, Pretoria, South Africa
[3]Anglo American Platinum, Rosebank, South Africa

Abstract

The current study develops a diagnostics assessment model of post-COVID-19 operations for business model reconfiguration decision referred to as the Pakade model. For this purpose, it identified seven diagnostic factors namely business operations disruptions, loss of human resources, changing cost structure due to safety requirements, work structure and culture change, disruption of supply chain and logistics, changing customer requirement and behaviour, and consequences of interventions on sustainability. The assessment was conducted using a 29-item scale scored on a 7-point scale representing the level of impact on the respective firm's business model. The proposed model assesses the composite score and relative importance index for each business factor, highlights the approach for investigating the validity and reliability of this multidimensional model, and makes short- and long-term impact evaluation with multiple linear regression and difference-in-difference (DiD) method, respectively. Diagnostics assessment determines the form and extent of business model reconfiguration. It can either be an adjustment driven by the introduction or enhancement of world class work practices, a business re-engineering, or a complete change of the business model. This model can be applied to both the primary and secondary economic sectors to determine the changes required in the business model of a firm.

Keywords: COVID-19, impact assessment, operational performance, Pakade model, technology usage

JEL Classification: M11, O14, N60

Introduction

The coronavirus (COVID-19) pandemic has compelled countries, societies, businesses, and individuals to reconsider their living and working

* Corresponding Author: andile@bsri.co.za

environments (Bartik et al., 2020; Nicola et al., 2020). It has asserted a significant impact on global industries including mining and manufacturing as well as their related supply chains (Kumar et al., 2020). Sun et al. (2021) argued that the COVID-19 pandemic has substantially impacted adversely the operating methods, profitability, remote work, stakeholder satisfaction, safety, and overall firm performance in a number of developed and developing nations (Bartik et al., 2020; Sun et al., 2021). These negative impacts have been exacerbated by inadequate availability of workforce, resulting from labour loss due to sickness, quarantine, or death (Dhakal et al., 2021). Regardless of business size and country, this disruption has resulted in firms around the world reporting lower-than-normal turnover, temporary closure or trading interruptions, as well as a projected reduction in their workforce (Nwosu & Oyenubi, 2021). Anakpo and Mishi (2021) highlighted that the pandemic has also impacted industries in South Africa as well as firms on the rest of the African continent.

Apart from the immediate health issues for workers and their families, the pandemic and the consequent economic disruptions have had a significant influence on the world of work in three important dimensions, namely job availability (both unemployment and underemployment), job quality (pay and access to social security), and effects on specific populations that are more susceptible to bad labour market outcomes (International Labour Organization (ILO), 2020). This situation demands that businesses should continuously and systematically review the impact of COVID-19 on their operations as well as on the rest of their value chain, within an operating environment that is in flux. This is critical as most of the response models are only solution-based, either at the macro-level with interventions or at firm level, with little regard for a diagnostic analysis that can assist the firms to ensure that the provided solution is either adequate or requires adjustment.

At the firm level, most work is performed on shift business models to focus on digital transformation (Seetharaman, 2020; Kronblad & Pregmark, 2021). The gap addressed in this study is the inadequate focus on the diagnostics state for an optimum and sustainable solution in operations, together with the development of a conceptual model that describes the state of a firm due to the impact of COVID-19. It focuses on different areas which can then be prioritised towards finding the ideal solution and, thereby, determine the implication of the macro-level interventions. As such, the

purpose of the current study was to develop a post COVID-19 operations' diagnostics assessment for business model reconfiguration decision - Pakade Model - for goods-producing firms, such as in mining and manufacturing industries.

This paper is organised as follows. An initial literature review focuses on the theory underpinning business disruption and the impact of disruption on business models. The development of the model follows the literature review which, in turn, is followed by demonstrating the usefulness of the model in relationship analysis. The paper closes by providing the conclusion, limitations of the study, and suggested recommendations for future studies.

Literature review

Theory Underpinning Business Disruption

Brea-Solís and Casadesus-Masanell (2015) posited that in the behavioural theory, a firm is conceived as a set of loosely related organisational pieces which need to be built in a way that achieve "fit." Casadesus-Masanell and Zhu (2013) argued that a business model has a high internal fit when its components work well with each other and a high external fit when the components, when combined, can assist in addressing the needs of the product-market, as also expressed in the firm's strategy. Based on this line of reasoning, Desyllas et al. (2022) argued that even while the internal characteristics of the business models of successful organisations may be built to last for an extended period of time, changes in the external environment may compel such firms to make adjustments to their business models. This is because the market is constantly evolving, forced by changes created by COVID-19-associated environmental turbulence. This increases the unpredictability, uncertainty, and volatility in the firm's external environment (Wong, 2014; Rego et al., 2021). Ansoff (2007) postulated that each change in the environment occurs naturally, gradually increasing the available knowledge from the initial stage where all that is discernible is a general condition of turbulence in the operating environment.

The impact of COVID-19 pandemic on businesses is evident globally, with imposed lockdowns and other operational consequences having a detrimental effect on economies, seriously harming firm sustainability. The disruption of business operations can be assessed keeping in view the

impact of limited supervision in the workplace due to work from home or remote work, the time it takes to solve a problem, team availability, and limited ability of the 'Gemba' working place, among others. Moreover, an increase or decrease in product requirements is experienced due to market turbulence, such as change in consumer behaviour (Mehta et al., 2020), difficulty in exporting or importing goods (Barbero et al., 2021), and the influence on employee availability for work and operations pattern due to curfew or other COVID-19 restrictions.

The impact of business disruption requires a response by the firms depending on the form or extent of the impact. It can involve the adjustment of the current model driven by the introduction or enhancement of well-proven and world-class work practices or methodologies, such as the theory of constraints, lean manufacturing practices, and six sigma, which together can be termed as TLS. These practices improve productivity, efficiency, and the overall firm performance (Moyano-Fuentes & Sacristán-Díaz, 2012; Alipour et al., 2013; Panizzolo, 2016; Hill et al., 2018). If the impact is large, business re-engineering is recommended to drive creativity and innovation (Evans, 2017), while a huge, sustained, and negative impact requires a change in the business model (Cavalcante, 2014; Ramdani et al., 2019). Allegretti et al. (2021) posited that there are situations that may require altering the business model of the firm for it to survive in today's dynamic marketplace. This requires identifying new market opportunities in a timely manner, evaluating them, and finding a method to incorporate the most profitable opportunities into their operations. Without this, the firms risk losing market relevance and, as such, both the modification of the business model and the restructuring of the organisation are required for market success.

Impact of Disruptions on Business Models

Osterwalder and Pigneur (2010) explained that a business model describes the rationale of how an organisation creates, delivers, and captures value. The COVID-19 pandemic has generated very high uncertainty and has created a turbulent business operating environment, particularly where authorities implemented costly and mandatory non-pharmaceutical interventions, periodic lockdowns which include restrictions on movement (curfew), and other measures that seek to protect human life. Disruption in business typically calls for the adoption of a new business model or, at the very least, the modification of the one already in place in a firm (Christensen

et al., 2016). Breier et al. (2021) argued that the COVID-19 situation is being viewed as a potential obstacle that can be overcome through the use of innovative business modelling strategies. There is evidence that firms which experimented with different business models and those that switched their business models profited from the opportunities that emerged as a result of the crisis (Seetharaman, 2020). The current COVID-19 and post-COVID-19 period presents an opportunity for a sustainable economic transition and the need to strengthen supply and production systems by developing a flexible and resilient manufacturing system capable of maintaining economic and social sustainability of the production processes (Sarkis et al., 2020).

Pakade Diagnostics' Assessment Model for Business Reconfiguration Decision

Determinants and Indicators

The study developed seven factors (determinants) namely business operations disruption (BOD), loss of human resources (HRL), changing cost structure due to safety requirements (MNP), work structure and culture change (CSS), disruptions of supply chain and logistics (SCL), changing customer requirement and behaviour (CRB), and consequences of interventions on sustainability (CXI).

Business Operations Disruption

There are several outcomes resulting from the impact of COVID-19 on employees, which are the most important resource for any business. The policies of stay-at-home (full lockdown) and frontier closure undertaken by the most affected regions, notably the EU, the United States, and China, resulted in low productivity and disruptions to critical value chains. Moreover, trade disruptions resulted in a decreased demand for African products, having the largest effect on nations with a significant role in global value chains (United Nations, 2020). In 2021, an improved business outlook incorporating a projection for economic growth was noted for most countries. This instilled hope in businesses for the future. However, future economic growth can be short-lived or limited unless a business can conduct a proper assessment of the impact of COVID-19 and the implications of the measures that policymakers and management put in place in response to its outbreak and other disruptions caused by it.

Loss of Human Resources

Lippens et al. (2021) and Tušl et al. (2021) reviewed the many impacts on businesses resulting from infection and deaths associated with the COVID-19 pandemic. These included demotivation of employees because of health and emotional issues, disruption of business capacity/human resources resulting from the loss of experienced employees and consequent recruitment of inexperienced staff, and maintaining vulnerable groups off site. This situation is exacerbated when staff members worry about losing their jobs, expect to lose promotion opportunities, experience unbalanced working conditions, or are incapacitated by an out-of-kilter work-life balance or infection, particularly with long COVID-19 (ILO, 2020).

This indicates that employees may not be prepared to work longer hours, be less conscientious, or they may demand better working conditions than they did in the past. The net result is the disruption in the well-being and performance of employees which has a domino effect on the overall performance and sustainability of a firm. Moreover, social isolation has a detrimental effect on the private lives of employees, especially those who live alone. Overall, disadvantaged groups have a greater fear of the negative consequence of COVID-19 infection. This can be measured by the loss of team members (death), increase in emotional trauma, fears of job security (ILO, 2020; Bavel et al., 2020), increased work-life imbalance, and increased absenteeism due to sickness (Grigore, 2020; Faramarzi, 2021). To this end, it is critical to understand whether this impact has shifted the levels of productivity and employee commitment – from affective commitment to normative commitment – as to whether they stay in the firm out of obligation or whether they stay in the firm due to the cost of change (Meyer & Allen, 1997).

Changing Cost Structure due to Safety Requirements

The advent of the COVID-19 pandemic saw fundamental changes regarding safety within firms. Non-pharmaceutical measures have been used to effectively fight COVID-19 (Perra, 2021). These are regarded as the first line of defence in mitigating the effects of the COVID-19 pandemic, especially given the evidence of their success in prior pandemics (Hatchett et al., 2007). These measures include physical separation, isolation, hygiene promotion comprising hand washing and sanitizing, respiratory etiquette, avoiding touching one's face, and the wearing of mask. These measures

may flatten the peak of infection in populations (Seale et al., 2020). In the workplace, however, these initiatives rely on firms providing the necessary personal protective equipment and ensuring compliance by the workforce. While some of these measures have been discontinued post-COVID-19, some have been retained at a higher cost of safety as compared to pre-COVID-19. This remains necessary as the firms have a responsibility to safeguard the health and safety of their employees. Furthermore, workers should be able to obtain information to assist in adapting their behaviour and should have the confidence that if they are exposed to a co-worker exhibiting symptoms, they can take immediate and appropriate action. Overall, businesses have a vested interest in maintaining a healthy, productive, and committed workforce. The frequency, range, and extent of safety interventions create a huge cost implication for businesses and put pressure on costs, especially for firms with low-cost margins.

The costly and mandatory non-pharmaceutical safety interventions are also confirmed by the proposed regulations in South Africa that form a part of the National Health Act, which is a long-term replacement of the country's state of disaster regulations. In these proposals, social distancing, masks, and other non-pharmaceutical measures are still embedded as part of COVID-19 management in the event of another epidemic in South Africa. The impact can be measured via the cost of PPE required as per COVID-19 protocol, demands for regular decontaminating of the workplace, and an increase in administrative bottlenecks. Cacciapaglia et al. (2021) argued that non-pharmaceutical interventions can delay or reduce the impact of future COVID-19 waves or other epidemics, if such actions are taken during the strolling period between epidemic peaks, rather than after a significant increase in new infections. The Renormalisation Group (eRG) framework, guided by the global symmetries of the system under time rescaling, shows that interfering during the diffusion strolling period can delay or prevent a fresh wave.

The focus of the article remains the business turbulence generated by the COVID-19 pandemic. However, the health strategies introduced here are pertinent to business responses to future pandemics or local epidemics that may occur relatively soon due to factors such as climate change (Ranger et al., 2021) and/or a recent down-turn in vaccination that has contributed to a measles outbreak currently experienced in Zimbabwe (Eisenstein, 2022).

Work Structure and Culture Change

Work structures and formats have created challenges for the firms. During the peak of COVID-19, work from home or social distance in production lines was the norm. Social distancing was highlighted as a successful COVID-19 infection prevention strategy and mandated by the governments, worldwide (Al-Hasan et al., 2020). However, simply telling staff to maintain social distance is insufficient as human beings are social beings by nature. Hence, they occasionally find themselves violating the recommended distance from other people without realizing it. Thus, the protocol to promote safe behaviour can sometimes be breached due to multiple reasons, such as attending to fellow employees who become unwell, reaction to news or engagement within teams that have worked together for very long, or interaction between fellow employees who have developed strong relationships and bonds over a period of time (Zhao et al., 2021). The impact of social distancing can be assessed by the decrease in team interaction, process changes to ensure social distancing, work areas or spaces unsuitable for social distancing, lack of team function to promote team building, and human interaction such as hugs and shaking hands that promote strong bonds. Fear is a common emotional response during a pandemic (Bavel et al., 2020) and threat evaluation has a beneficial effect on adherence to social distancing. Meta-analysis suggests that appealing to fear can be beneficial in cases where people feel capable of coping with the threat but react defensively when they feel unable to act. This is a problem when considering expectations in the workplace with organizational theory that requires the building of culture through employee involvement and participatory methods. However, there has been improvement in the post-COVID-19 situation in this regard. The lingering questions are whether it has inflicted lasting damage to the work relationship and what is its impact on the overall culture in the firms.

Disruptions of Supply Chain and Logistics

Major supply chain and logistics disruptions occur when there is a major event, such as a natural disaster and COVID-19 pandemic. It creates a ripple effect within operations and disrupts lean supply chain management. Blackhurst et al. (2005) and more recently Katsaliaki et al. (2022) posited that continuous flow processing with low inventory volumes, levelled and just-in-time production, and accurate scheduling of transport for cross-docking operations are all hallmarks of lean supply chain management

(SCM) practices which have gained widespread popularity in recent years due to their effectiveness and efficiency. There are also experienced disruptions within the reverse logistics flows caused by several factors, such as unavailability or limitations in warehouse spaces (Katsaliaki et al., 2022). The impact of disruptions can be intra-, inter-, and extra-firms (Nel et al., 2018) which can create difficulties in operations that compromise a firm's performance.

Changing Customer Requirement or Behaviour

COVID-19 has yielded unprecedented changes in customer requirements or consumer behaviour. These range from impulsive purchases, product and brand substitution, shifts in channel preferences, and lifestyle changes (Das et al., 2022). This behaviour has been attributed to a number of factors, including the pandemic's effects on consumers' socioeconomic status (Das et al., 2022). As a result of economic uncertainty, consumers are also undergoing a transition in their behaviour, although it is uncertain how much of this transformation will endure in the future (Mehta et al., 2020). Critical events include the COVID-19 pandemic (Sun et al., 2021) and, in some developing countries such as South Africa, worsening 'triple challenges' of unemployment, poverty, and inequality (The World Bank, 2018; Statistics South Africa, 2022). At this stage, the South African unemployment rate is 34.9%, with youth unemployment at more than 60% (Statistics South Africa, 2022). What is exacerbating the situation is that the inflation rate has bridged the threshold of 6% (range 3 – 6%) set by the South Africa Reserve Bank (SARB) and is now at 7.4% (South African Reserve Bank, 2022), indicating that there is an increase in the cost of living (Anafo et al., 2014). Furthermore, European countries have recently experienced increasing inflation rates, resulting in a higher cost of living (Abdel-Baqui, 2022). Most European countries now have double-digit inflation, some of the worst in more than 30 years. The resulting complexity impacts firms and it will continue to do so in the foreseeable future (Gössling et al., 2020).

External Intervention in Business Sustainability

In order to boost economic recovery and business continuity, countries have implemented a variety of measures ranging from financial stimulus packages to loan repayment delays (Khambule, 2021), fiscal and financial regulations, providing support for special funds, lowering tax and rental

costs and services supplied electronically (Chen et al., 2020), and fee waivers and technology assistance (Telukdarie et al., 2020). In South Africa, despite a ZAR 500 billion fiscal package to protect jobs and stabilize the economy, estimates show that the economy has shrunk, increasing an already alarming unemployment rate (Lukani, 2020; Statistics South Africa, 2021). Despite this, there were also interventions where the government and creditors such as banks offered loans or deferred payments. This needs attention since there might be situations where this short-term reprieve, as noble as it might be, can also have long-term consequences, especially in situations where sales drop due to an economic down-turn leading to increased unemployment and a rising cost of living. Table 1 shows a post-COVID-19 diagnostics assessment for business model reconfiguration decision and lists seven factors using a 29-item scale.

Table 1

Pakade Model for Diagnostic Assessment for Business Model Reconfiguration Decision

Determinants	Indicators
Business operations disruptions (BOD)	▪ Longer time to solve operational problems ▪ Increased administrative bottlenecks – disruption of operations ▪ Changes in regulatory compliance or requirements for operating licences ▪ Increased production and stoppages to accommodate safety protocols
Loss of human resources (HRL)	▪ Loss of team members (due to death) ▪ Increased emotional trauma on employees ▪ Fears of job security ▪ Increased work-life imbalance ▪ High levels of absenteeism
Changing cost structure due to safety requirements (CSS)	▪ Increased costs from PPE requirements ▪ Increased labour relations costs culminating from vaccination policies ▪ Increased costs of psychosocial support ▪ Lack of optimised operational space for safety requirements

Determinants	Indicators
Work structure and culture change (WSC)	▪ Changes in supervision format ▪ Decrease in team interaction and diminishing natural bonding such as handshaking or hugging from members ▪ Process changes ensure social distancing or other safety requirements ▪ Changes in rewards and recognition structure ▪ Changes in motivation and commitment of employees
Disruptions of supply chain and logistics (SCL)	▪ Difficulties in importing or exporting goods ▪ Delays in turn-around-time or delivery of orders ▪ Increased costs of logistics ▪ Increase in inventory levels or costly contingencies to buffer uncertainty
Changing customer requirement and behaviour (CRB)	▪ Low levels of sales due to high cost of living and / or high unemployment ▪ Customer demand not aligned to optimum production configuration. ▪ Increased requirements for cost effective alternative or substitutes ▪ Changes in requirements in terms of trade or terms of purchase
Consequences of interventions for sustainability (CXI).	▪ Challenges with repayment of deferred loans or other obligations from creditors ▪ Cumulative interest or high cost of borrowing which negatively impact profits ▪ Salary cuts impact job security or firm sustainability

Model Score Criteria

Likert scale analysis is heavily dependent on the assignment of the ordinal or interval scale variables based on the research instrument. Research instrument is, in turn, based on the study objectives, which are the operational form of the phenomena under investigation. A Likert scale is a 5-point or 7-point ordinal scale used to measure the extent to which people agree or disagree with a topic. In this conceptual model, either a 5-point or 7-point Likert scale can be used; however, the 7-point scale performs slightly better as respondents using a 5-point scale are more likely to interpolate, that is, attempt a response between two distinct values presented to them, compared to those using a 7-point scale. This result reinforces that

7-point Likert scale items provide a more accurate representation of a respondent's real opinion. So, they are more acceptable for electronic self-administered questionnaires. An example of the proposed scoring criteria is given in Table 2.

Table 2
Score Criteria of the Model

Score	Impact criteria
7	Major long-term impact
6	Major short-term impact
5	Significant short-term impact
4	Moderate short-term impact
3	Short-term impact
2	Minimal impact
1	No impact

Composite Score and Relative Importance Index

Composite score measures the level of impact of the determinant. $CoMS_j$ is the composite score of each determinant - BOD, HRL, MNP, WSF, SCL, CLG, CRB, CXI and is analysed using the following equation 1:

$$CoMS_j = \frac{\sum_{i=1}^{n} ID_{nj}}{x} \quad (1)$$

where ID_1, QI_2,…. QI_n are indicators, with x being the number of indicators. A score of 30% or less indicates less impact, while 30% ≥ 70% indicates medium impact, and >70% indicates high impact.

The form or extent of the business model reconfiguration is determined by the impact on the firm. This can either be an adjustment driven by introduction or an enhancement of TLS work practices (30% or less), business re-engineering (30% ≥ 70%), or a complete change (>70%) of the business model.

The relative importance index (RII) can then be used to determine the relative importance of each determinant in order to classify and prioritize the one with the highest impact on business performance (equation 2),

$$RII = \frac{\sum W}{(A*N)} \quad (2)$$

where

W = weight for each factor of the 5-point Likert scale

A = highest weight

N = total number of respondents

Multidimensional Model Validity and Reliability

For multidimensional models, it is critical to conduct the exploratory factor analysis (EFA) and confirmatory factor analysis (CFA). KMO and Bartlett's test for sphericity confirmed the suitability of factor analysis, so that KMO values above 0.8 are regarded as good while KMO values below 0.5 are not as good. The value generated by Bartlett's test should statistically be significant at $p < .001$. CFA, using structural equation modelling either covariance (SEM-CB) or partial least square (PLS-SEM), determines the convergence validity, composite reliability, and discriminant validity. Convergent validity is evaluated using average variance extracted (AVE), which is the measure of the amount of variation collected by a construct in relation to the amount of variance attributable to measurement error. It is measured using the following equation 3:

$$AVE = \frac{\sum \lambda^2}{n} \tag{3}$$

where λ represents factor loadings, while n represents the indicator in the factor. The results show that an AVE higher than 0.5 confirms convergence.

Composite reliability (CR) is assessed using the following equation 4:

$$CR = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + (\sum \varepsilon)} \tag{4}$$

where ε = 1- λ. CR results confirm the reliability of the factors (Hair et al., 2010).

The heterotrait-monotrait criterion (HTMT) determines the discriminant validity based on equation 5 provided by Henseler et al. (2015), so that HTMT values for all variables should be either less than 0.85 (Kline, 2011) or 0.90 (Hair et al., 2018).

$$HTMT_{ij} = \frac{W}{\sqrt{R \ x \ Q}} \tag{5}$$

where

W = Average heterotrait-heteromethod correlations which is the average of all pairwise correlations between the items of the first and second constructs.

R = Average monotrait-heteromethod correlations which are the means of all pairwise correlations between the items of the first construct.

Q = Average monotrait-heteromethod correlations which are pairwise correlations between the items of the second construct.

Impact on Business Performance at a Point in Time

The outbreak of COVID-19 has had significant economic implications globally and no country appears to be immune from its implications, as are their businesses (Nicola et al., 2020).. The following model is used to test the extent of the COVID-19 impact on business performance using multiple linear regression:

$$BPR = \alpha + \beta_1 \mathrm{BOD} + \beta_2 \mathrm{HRL} + \beta_3 \mathrm{MNP} + \beta_4 \mathrm{WSF} + \beta_5 \mathrm{SCL} + \beta_6 \mathrm{CRB} + \beta_7 \mathrm{CXI} + \varepsilon \quad (6)$$

where BPR (business performance) is the dependent variable, while the explanatory variables are BOD, HRL, MNP, WSF, SCL, CLG, CRB, and CXI.

The main objective is to determine if there is an effect of these explanatory variables (factors) on business performance by understanding whether the values of β_1 , β_2 ,… β_7 are statistically significant and whether they are positive or negative. Moreover, α signifies the constant, while ε signifies the error term. When homoscedasticity is violated, the variances of OLS estimators (and standard errors) must be estimated using White-Huber standard errors or heteroscedasticity robust standard errors using $\hat{E}$

$$\mathrm{VAR}(\hat{\beta}) = (X'X)^{-1}X'EX(X'X)^{-1} \quad (7)$$

Business performance can be assessed by non-financial and financial measures (Chen et al., 2009; Ahmad & Zabri, 2016). Non-financial performance such as firm culture, productivity, change in labour relations, customer loyalty, attracting new customers, perceived image, and reputation can be measured. Financial performance can include the cost of business, turnover, and profitability.

Impact on Business Performance over a Period of Time

The difference-in-difference (DiD) method is a useful econometric approach that may be used to estimate the intervention's actual effect on an operation (Schwerdt & Woessmann, 2020). Simply put, DiD is a longitudinal estimation which is regarded as a "controlled before-and-after measurement." (Villa, 2016; Fredriksson & Oliveira, 2019). Using two groups and two periods the equation for DiD is as follows:

$$DID = (\bar{a}_s = treatment, t = after - \bar{a}_s = treatment, t = before) - (\bar{a}_s = control, t = after - \bar{a}_s = control, t = before + \varepsilon_i \quad (8)$$

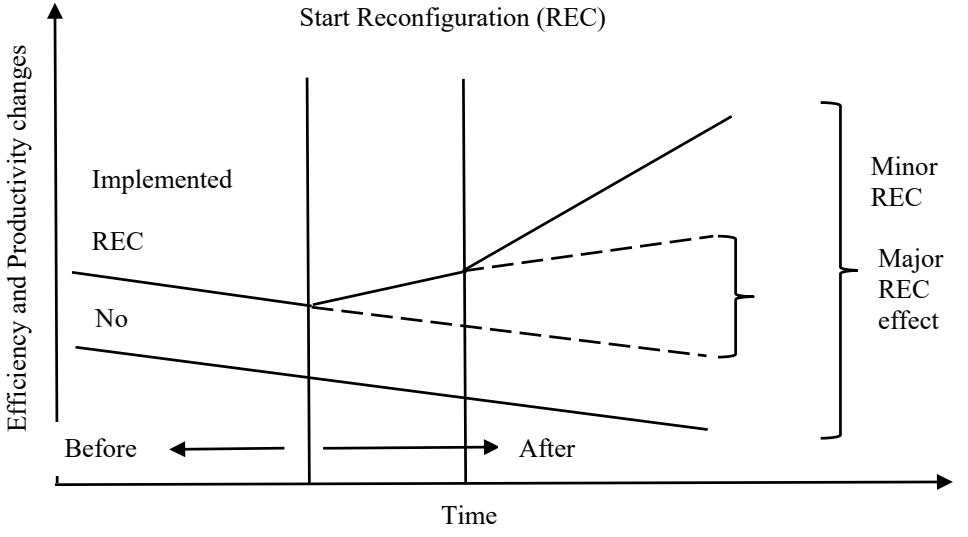
where $\bar{a}_s$ represents the averaged value of the outcome variable for the group *s* and *t* is time. DiD is usually implemented as an interaction term in a regression model using time and the treatment groups' dummy variables through the following equation:

$$DiD_{BPR} = \alpha + \beta_1 TP_i + \beta_2 GR_i + \beta_3 TP_i * GR_i + \varepsilon_i \quad (9)$$

where DiD_{BPR} is the measurement before and after changes (treatment), α is the constant, TP_i is the dummy variable for pre-and post-treatment (0 or 1), GR_i is the dummy variable which measures the control and treated groups respectively (0 or 1), and $TP_i * GR_i$ is the interaction term

Figure 1

DiD-based Business Model Reconfiguration (REC) Process



This can be used to determine whether operational reconfiguration is successful or not over a period of time. This effect can be measured on a monthly or quarterly basis. Figure 1 visualises the DiD-based reconfiguration decision with the projected outcomes. A firm without implemented reconfiguration, despite the impact, is expected to experience a gradual or stepwise deterioration in its performance, thus threatening its survival. Continuous improvement is expected to be more of a stepwise post-reconfiguration of the business model.

Application to Primary and Secondary Economic Sectors

There are three main sectors of the economy- primary, secondary and tertiary (Alshehhi & Olah, 2017). These sectors constitute a continuum that provides commodities and services. The primary sector comprises mining, agriculture, forestry, and fisheries and uses natural resources to produce goods and services. The secondary sector includes manufacturing, construction, and engineering. It transforms raw materials and natural resources into finished commodities using a more efficient manufacturing method (Kenessey, 1987; Alshehhi & Olah, 2017). To this end, these sectors are compatible and have similar characteristics including employing a large workforce that generally works in teams, remains process orientated with generally complex systems, and experiences substantial conversion costs and high capital investment (Windmark & Andersson, 2018). The workforce or employees remain the most valuable resource of a business and *workforces are generally large* with several dynamics associated with their commitment and productivity, such as firm culture. Such firms have a *process-oriented layout complexity* due to multiple orientations from different volumes or a diverse range of feedstocks and product items. These can involve cellular manufacturing, lean, pull or push with rigid and flexible production systems to maximize equipment use and optimise operator experience and outputs. Among business disadvantages are complex ordering and dispatching systems, increased distances, and complex material routing, all of which result in extended lead times and the possibility of missing delivery performance. Another downside of prolonged lead times is the financial outlay for raw materials and semi-finished products. Furthermore, there is also *substantial conversion costs and high capital investment*. The costs are extensive, from material costs to process equipment costs, personnel costs, material handling and conversion costs, tied-up costs for material and inventory, quality costs and other

hidden costs, such as rework, scrap, overtime, and others. Some of the costs related to the cost of quality are highlighted in the preventative appraisal and failure (PAF) paradigm (Evans, 2017). These costs negatively affect profitability, return on investment, and business competitiveness.

For several decades, manufacturing, mining, and construction businesses have worked together in pursuit of cost savings and chief among them is the low profit margin. Motivated by the desire for manufacturing profitability, there is substantial discussion over how to re-establish manufacturing competitiveness (de Treville et al., 2017). Some of this work was disrupted by the COVID-19 pandemic which has changed work practices leading to an increase in the costs of doing business (Nicola et al., 2020).

Conclusion

There is a continuous debate, that is difficult to conclude with certainty, as to whether the COVID-19 pandemic has ended or whether some peaks are still expected in the future that will disrupt societies and businesses. Irrespective of the answer, what is evident today is that the COVID-19 pandemic has had a devastating impact that is expected to be felt by firms for years to come. This will be felt, in particular, by those firms with weak fundamentals and reduced resilience to shocks (Fatoki, 2018). Businesses face daunting challenges as they mitigate the existing and future effects of the COVID-19 pandemic. The form or extent of business model reconfiguration is based on the impact in the firm. This can either be an adjustment driven by introduction or enhancement of TLS work practices, a business re-engineering or complete change of business model.

Theoretical Implications

The current study developed a conceptual model based on behavioural theory (Brea-Solís & Casadesus-Masanell, 2015). This model is influenced by environmental turbulence and specifically addresses the turbulence caused by the COVID-19 pandemic (Chatterjee & Chaudhuri, 2021). It contributes to the expansion of behavioural theory and highlights that it is influenced by various factors, such as environmental turbulence. Certain business obstacles, such as the COVID-19 pandemic, are uncontrolled and firms may lose control over these obstacles. However, some environmental instability may be leveraged into business opportunities, such as increased firm responsiveness, learning, innovation, and competitive advantage.

However, such responsiveness is only possible when a firm has a good understanding of the impacts of environmental turbulence on loosely related organisational pieces. Only then, it can achieve "fit." This can be achieved through an optimum reconfiguration. The COVID-19-initiated business revolution has changed the ways firms and employees work and will continue to do so, necessitating their continuous reinvention as to how firms operate and initiate novel activities that result in profound changes in the workplace.

Managerial and practical implications

While crises are not unfamiliar to any firm, the COVID-19 pandemic provided an unprecedented challenge, even for the most organized, responsive, adaptive, and crisis-prepared firms. With employees' lives at stake and lockdowns imposed — often overnight — firms were faced with a slew of difficult decisions. Worldwide, firms and particularly those hardest hit by the pandemic, confronted dangers to their vitality, survival, and sustainability. The resulting positive or negative complexity has a continuous impact on businesses and is expected to continue into the future (Gössling et al., 2020).

With the challenges presented by the COVID-19 pandemic, businesses have had to adapt to fundamental shifts in consumer behaviour, supply networks, and routes to market, in addition to changes to their internal operations. This concept paper can be used by the management to assist in their decision-making. At the very least, the COVID-19 outbreak serves as a stark reminder that pandemics, like other uncommon but devastating events, have occurred in the past and will continue to occur again in the future (Donthu & Gustafsson, 2020). While many firms fought for survival by rethinking and re-strategizing their operations and even business directions, few have succeeded. Despite this, efforts are still going on where industry managers continue to scramble to find efficient ways to maximize production patterns and meet customer demand during the COVID-19 pandemic and beyond (Kumar et al., 2020). Businesses must manage the financial and operational obstacles associated with the pandemic, while effectively addressing the demands of their staff, customers, and suppliers. In addressing such internal and external challenges, managers must develop plans that have the potential to evolve within a dynamic business context. Importantly, these business disruptions can make some of the existing business models obsolete. Despite this, little is understood about how firms

should determine a need on the one hand and a trigger on the other, including the quantum of reconfiguration to respond to business disruption. Consequently, the concept of the workplace will never be what was anticipated prior to COVID-19. Indeed, reinvention of work, technology, and safety are key to its development (Ancillo et al., 2021).

Limitations and Directions for Future Research

This concept paper is limited to the knowledge of the impact of the determinants associated with the COVID-19 pandemic within the manufacturing sector and how such knowledge can be used to understand the effects on business performance of such environmental challenges. A concept paper is a tool for not only taking stock but also for breaking new territory by businesses. Empirical research accumulates over time but its scope for generalization is quite limited. In comparison, concept papers can aim to enhance the understanding of a topic or phenomenon by leaps and bounds, rather than via incremental stages (Jaakkola, 2020). The current study delineates the conceptual realm of the COVID-19 impact determinants that integrate theories and practices, illuminating the realities associated with businesses (Hirschheim, 2008). This conceptual model assimilates and draws on empirical research but it is still at a foundational stage which can then be empirically evaluated. Any future study could benefit from developing and testing hypotheses of the significant factors of the conceptual model of this research. This can be achieved not only within the manufacturing and mining industries but also across other primary and secondary sectors.

References

Alipour, H. R., Reza, H., Khorshidi, G. R., Naghdi, A., Honarmand, H., & Shabani, Z. (2013). The theory of constraints: A comparative assessment. *Arabian Journal of Business and Management Review*, *1*(5), 10–21. https://doi.org/10.36953/ECJ.2015.SE1664

Allegretti, S., Seidenstricker, Sm, Fischer, H., & Arslan, F. (2021). Executing a business model change: identifying key characteristics to succeed in volatile markets. *Leadership, Education, Personality: An Interdisciplinary Journal*, *3*, 21–33. https://doi.org/10.1365/s42681-021-00020-x

Ahmad, K., & Zabri, S. M. (2016). The Application of non-financial performance measurement in Malaysian manufacturing firms. *Procedia Economics and Finance*, *35*, 476–484. https://doi.org/10.1016/S2212-5671(16)00059-9

Al-Hasan, A., Khuntia, J., & Yim, D. (2020). Threat, coping, and social distance adherence during COVID-19: Cross-continental comparison using an online cross-sectional survey. *Journal of Medical Internet Research*, *22*, 1–11. https://doi.org/10.2196/23019

Allen, M. (2017). *The sage encyclopaedia of communication research methods*. Sage Publications. https://doi.org/10.4135/9781483381411

Alshehhi, Y. Z., & Oláh, J. (2017). Sectorial analysis: Growth accounting of secondary industries. *Network Intelligence Studies*, *5*(9), 39-45.

Anafo, S. A., & Naatu, V. A. K. F. (2014). The impact of inflation on the standard of living: A case study of Navrongo in the upper east region of Ghana. *Methodology*, *6*(29), 106–115.

Anakpo, G., & Mishi, S. (2021). Business response to COVID-19 impact: Effectiveness analysis in South Africa. *The Southern African Journal of Entrepreneurship and Small Business Management*, *13*(1), ea397. https://doi.org/10.4102/sajesbm.v13i1.397

de Lucas Ancillo, A., del Val Núñez, M. T., & Gavrila, S. G. (2021). Workplace change within the COVID-19 context: A grounded theory approach. *Economic Research-Ekonomska Istraživanja*, *34*(1), 2297–2316. https://doi.org/10.1080/1331677X.2020.1862689

Ansoff, H. I. (2007). Model of environmental turbulence. In *Strategic management*. Palgrave Macmillan. https://doi.org/10.1057/97802305906016

Barbero, J., de Lucio, J. J., & Rodríguez-Crespo, E. (2021). Effects of COVID-19 on trade flows: Measuring their impact through government policy responses. *PloS one*, *16*(10), e0258356. https://doi.org/10.1371/journal.pone.0258356

Bartik, A. W., Bertrand, M., Cullen, Z. B., Glaeser, E. L., Luca, M., & Stanton, C. T. (2020). *How are small businesses adjusting to COVID-19? Early evidence from a survey* (National Bureau of Economic

Research, Working Paper No. w26989). https://www.nber.org/papers/w26989

Bavel, J. J. V., Baicker, K., Boggio, P. S., Capraro, V., Cichocka, A., Cikara, M., Crockett, M. J., Crum, A. J., Douglas, K. M., Druckman, J. N., Drury, J., Dube, O., Ellemers, N., Finkel, E. J., Fowler, J. H., Gelfand, M., Han, S., Haslam, S. A., Jetten, J., . . . Willer, R. (2020). Using social and behavioural science to support COVID-19 pandemic response. *Nature Human Behaviour*, *4*(5), 460–471. https://doi.org/10.1038/s41562-020-0884-z

Blackhurst, J., Craighead, C. W., Elkins, D., & Handfield, R. B. (2005). An empirically derived agenda of critical research issues for managing supply-chain disruptions. *International Journal of Production Research*, *43*(19), 4067–4081. https://doi.org/10.1080/00207540500151549

Brea-Solís, H., Casadesus-Masanell, R., & Grifell-Tatjé, E. (2015). Business Model Evaluation: Quantifying W almart's Sources of Advantage. *Strategic Entrepreneurship Journal*, *9*(1), 12–33. https://doi.org/10.1002/sej.1190

Breier, M., Kallmuenzer, A., Clauss, T., Gast, J., Kraus, S., & Tiberius, V. (2021). The role of business model innovation in the hospitality industry during the COVID-19 crisis. *International Journal of Hospitality Management*, *92*, e102723. https://doi.org/10.1016/j.ijhm.2020.102723

Cacciapaglia, G., Cot, C., & Sannino, F. (2021). Multiwave pandemic dynamics explained: How to tame the next wave of infectious diseases. *Scientific Reports*, *11*(1), 1–8. https://doi.org/10.1038/s41598-021-85875-2

Cavalcante, S. A. (2014). Preparing for business model change: the "pre-stage" finding. *Journal of Management & Governance*, *18*(2), 449–469. http://dx.doi.org/10.1007/s10997-012-9232-7

Casadesus-Masanell, R., & Zhu, F. (2013). Business model innovation and competitive imitation: The case of sponsor-based business models. *Strategic Management Journal*, *34*(4), 464–482 .https://doi.org/10.1002/smj.2022

Chatterjee, S., & Chaudhuri, R. (2022). Supply chain sustainability during turbulent environment: Examining the role of firm capabilities and government regulation. *Operations Management Research*, *15*(3), 1081–1095. https://doi.org/10.1007/s12063-021-00203-1

Chen, J. S., Tsou, H. T., & Huang, A. Y. H. (2009). Service delivery innovation: Antecedents and impact on firm performance. *Journal of Service Research*, *12*(1), 36–55. http://dx.doi.org/10.1177/1094670509338619

Chen, H., Huang, X., & Li, Z. (2022). A content analysis of Chinese news coverage on COVID-19 and tourism. *Current Issues in Tourism*, *25*(2), 198–205. https://doi.org/10.1080/ 13683500.2020.1763269

Christensen, C. M., McDonald, R., Altman, E. J., & Palmer, J. (2016). *Disruptive innovation: Intellectual history and future paths* (pp. 1-52). Harvard Business School. https://hbr.org/2015/12/what-is-disruptive-innovation

Das, D., Sarkar, A., & Debroy, A. (2022). Impact of COVID-19 on changing consumer behaviour: Lessons from an emerging economy. *International Journal of Consumer Studies*, *46*(3), 692–715. https://doi.org/10.1111/ijcs.12786

de Treville, S., Ketokivi, M., & Singhal, V. (2017). Competitive manufacturing in a high-cost environment: Introduction to the special issue. *Journal of Operations Management*, *49*(1), 1–5. http://dx.doi.org/10.1016/j.jom.2017.02.001

Desyllas, P., Salter, A., & Alexy, O. (2022). The breadth of business model reconfiguration and firm performance. *Strategic Organization*, 20*(2)*, 231–269. https://doi.org/10.1177/1476127020955138

Dhakal, S., Burgess, J., & Connell, J. (2021). COVID-19 crisis, work and employment: policy and research trends. *Labour & Industry*, *31*(4), 353–365. https://doi.org/10.1080/10301763.2021.2005758

Di Domenico, L., Pullano, G., Sabbatini, C. E., Boëlle, P. Y., & Colizza, V. (2020). Impact of lockdown on COVID-19 epidemic in Île-de-France and possible exit strategies. *BMC Medicine*, *18*(1), 1–13. https://doi.org/10.1186/s12916-020-01698-4

Donthu, N., & Gustafsson, A. (2020). Effects of COVID-19 on business and research. *Journal of Business Research*, *117*, 284–289. https://doi.org/10.1093/pubmed/fdaa219

Eisenstein, M. (2022). Vaccination rates are falling, and its not just the COVID-19 vaccine that people are refusing. *Nature*, *612*(7941), S44–S46. https://doi.org/10.1038/d41586-022-04341-9

Evans, J. R. (2017). *Quality and performance excellence: Management, organization and strategy* (8th ed.). Cengage Learning.

Faramarzi, A., Javan-Noughabi, J., Tabatabaee, S. S., Najafpoor, A. A., & Rezapour, A. (2021). The lost productivity cost of absenteeism due to COVID-19 in health care workers in Iran: a case study in the hospitals of Mashhad University of Medical Sciences. *BMC Health Services Research*, *21*(1), 1–7. https://doi.org/10.1186/s12913-021-07200-x

Fatoki, O. (2018). The impact of entrepreneurial resilience on the success of small and medium enterprises in South Africa. *Sustainability*, *10*(7), e2527. https://doi.org/10.3390/su10072527

Fredriksson, A., & Oliveira, G. M. D. (2019). Impact evaluation using Difference-in-Differences. *RAUSP Management Journal*, *54*, 519–532. http://dx.doi.org/10.1108/RAUSP-05-2019-0112

Grigore, O. M. (2020). Factors contributing to work-related absenteeism during the COVID-19 pandemic. *Management Dynamics in the Knowledge Economy*, *8*(4), 401–418. https://doi.org/10.2478/mdke-2020-0026

Gössling, S., Scott, D., & Hall, C. M. (2020). Pandemics, tourism and global change: a rapid assessment of COVID-19. *Journal of Sustainable Tourism*, *29*(1), 1–20. https://doi.org/10.1080/09669582.2020.1758708

Hair, J. F., Black, W. C., Babin B. J., Anderson, R. E. (2018). *Multivariate data analysis* (8th ed.). Cengage Learning

Hatchett, R. J., Mecher, C. E., & Lipsitch, M. (2007). Public health interventions and epidemic intensity during the 1918 influenza pandemic. *Proceedings of the National Academy of Sciences*, *104*, 7582–7587. https://doi.org/10.1073/pnas.0610941104

Henseler, J., Ringle, C.M., & Sarstedt, M. (2015). A new criterion for assessing discriminant validity in variance-based structural equation

modeling. *J. of the Acad. Mark. Sci*., *43*, 115-135. https://doi.org/10.1007/s11747-014-0403-8

Hill, J., Thomas, A. J., Mason-Jones, R. K., & El-Kateb, S. (2018). The implementation of a Lean Six Sigma framework to enhance operational performance in an MRO facility. *Production & Manufacturing Research*, *6*(1), 26–48. https://doi.org/10.1080/21693277.2017.1417179

Hirschheim, R. (2008). Some guidelines for the critical reviewing of conceptual papers. *Journal of the Association for Information Systems*, *9*(8), 432–441. https://doi.org/10.17705/1jais.00167

International Labour Organization. (2020). *ILO Monitor: COVID-19 and the world of work*. http://www.ilo.int/wcmsp5/groups/public/---dgreports/---dcomm/documents/briefingnote/wcms_743146.pdf

Jaakkola, E. (2020). Designing conceptual articles: Four approaches. *AMS Review*, *10*(1–2), 18–26. https://doi.org/10.1007/s13162-020-00161-0

Katsaliaki, K., Galetsi, P., & Kumar, S. (2021). Supply chain disruptions and resilience: A major review and future research agenda. *Annals of Operations Research*, *319*, 965–1002 https://doi.org/10.1007/s10479-020-03912-1

Kenessey, Z. (1987). The primary, secondary, tertiary and quaternary sectors of the economy. *Review of Income and Wealth*, *33*(4), 359–385. https://doi.org/10.1111/j.1475-4991.1987.tb00680.x

Khambule I (2021). COVID-19 and the counter-cyclical role of the state in South Africa. Progress in Development Studies, *21*(4), 380–396. https://doi.org/10.1177/14649934211030457

Kline, R. B. (2011). *Principles and practice of structural equation modelling*. Guilford Press.

Kronblad, C., & Pregmark, J. E. (2021). Responding to the COVID-19 crisis: the rapid turn toward digital business models. *Journal of Science and Technology Policy Management*. Advance Online Publication. https://doi.org/10.1108/JSTPM-10-2020-0155

Kumar, A., Luthra, S., Mangla, S. K., & Kazançoğlu, Y. (2020). COVID-19 impact on sustainable production and operations

management. *Sustainable Operations and Computers*, *1*, 1–7. https://doi.org/10.1016/j.susoc.2020.06.001

Lippens, L., Moens, E., Sterkens, P., Weytjens, J., & Baert, S. (2021). How do employees think the COVID-19 crisis will affect their careers? Plos one*,* 16*(5), Article e0246899. https://doi.org/10.1371%2Fjournal.pone.0246899*

Mehta, S., Saxena, T., & Purohit, N. (2020). The new consumer behaviour paradigm amid COVID-19: permanent or transient? *Journal of Health Management*, *22*(2), 291–301. https://doi.org/10.1177/0972063420940834

Meyer, J. P., & Allen, N. (1997). *Commitment in the workplace: Theory, research and application.* Sage Publications.

Moyano-Fuentes, J., & Sacristán-Díaz, M. (2012). Learning on lean: A review of thinking and research. *International Journal of Operations & Production Management*, *32*(5), 551–582. http://dx.doi.org/10.1108/01443571211226498

Nel, J., De Goede, E., & Niemann, W. (2018). Supply chain disruptions: Insights from South African third-party logistics service providers and clients. *Journal of Transport and Supply Chain Management*, *12*(1), 1–12. http://dx.doi.org/10.4102/jtscm.v12i0.377

Nicola, M., Alsafi, Z., Sohrabi, C., Kerwan, A., Al-Jabir, A., Iosifidis, C., ... & Agha, R. (2020). The socio-economic implications of the coronavirus pandemic (COVID-19): A review. *International Journal of Surgery*, *78*, 185–193. https://doi.org/10.1016%2Fj.ijsu.2020.04.018

Nwosu, C. O., & Oyenubi, A. (2021). Income-related health inequalities associated with the coronavirus pandemic in South Africa: A decomposition analysis. *International Journal for Equity in Health*, *20*(1), 1–12. https://doi.org/10.1186/s12939-020-01361-7

Abdel-Baqui, O. (2022, January 3). *Omicron Surge Stymies Public-Transit Systems*. The Wall Street Journal. https://www.wsj.com/articles/omicron-surge-stymies-public-transit-systems-11641247808

Osterwalder, A., & Pigneur, Y. (2010). *Business model generation: a handbook for visionaries, game changers, and challengers* (Vol. 1). John Wiley & Sons.

Panizzolo, R. (2016). Theory of constraints (TOC) production and manufacturing performance. *International Journal of Industrial Engineering and Management*, *7*(1), 15–23.

Lukani, M. (2020). *The R500 billion stimulus package is one of the largest economic response packages in the developing world*. Parliament of the Republic of South Africa. https://www.parliament.gov.za/news/r500-billion-stimulus-package-one-largest-economic-response-packages-developing-world-tito-mboweni

Perra, N. (2021). Non-pharmaceutical interventions during the COVID-19 pandemic: A review. *Physics Reports*, *913*, 1–52. https://doi.org/10.1016/j.physrep.2021.02.001

Ramdani, B., Binsaif, A., & Boukrami, E. (2019). Business model innovation: a review and research agenda. *New England Journal of Entrepreneurship*, *11*(4), 348–369. https://doi.org/10.1108/NEJE-06-2019-0030

Ranger, N., Mahul, O., & Monasterolo, I. (2021). Managing the financial risks of climate change and pandemics: What we know (and don't know). *One Earth*, *4*(10), 1375–1385. https://doi.org/10.1016/j.oneear.2021.09.017

Rego, L., Brady, M., Leone, R., Roberts, J., Srivastava, C., & Srivastava, R. (2022). Brand response to environmental turbulence: A framework and propositions for resistance, recovery and reinvention. *International Journal of Research in Marketing*, *39*(2), 583–602. https://doi.org/10.1016/j.ijresmar.2021.10.006

Sarkis, J., Cohen, M. J., Dewick, P., & Schröder, P. (2020). A brave new world: Lessons from the COVID-19 pandemic for transitioning to sustainable supply and production. *Resources, Conservation, and Recycling*, *159*, Article e104894. https://doi.org/10.1016%2Fj.resconrec.2020.104894

Seale, H., Dyer, C. E., Abdi, I., Rahman, K. M., Sun, Y., Qureshi, M. O., ... & Islam, M. S. (2020). Improving the impact of non-pharmaceutical interventions during COVID-19: examining the factors that influence engagement and the impact on individuals. *BMC Infectious Diseases*, *20*(1), 1–13. https://doi.org/10.1186/s12879-020-05340-9

Seetharaman, P. (2020). Business models shifts: Impact of Covid-19. *International Journal of Information Management*, *54*, Article e102173. https://doi.org/10.1016%2Fj.ijinfomgt.2020.102173

South African Reserve Bank (2022). *Monetary policy*. https://www.resbank.co.za/en/home/what-we-do/monetary-policy#:~:text=What%20is%20the%20inflation%20target,the%20Governor%20of%20the%20SARB

Stats, S. A. (2019). Statistics South Africa P0211 Quarterly Labour Force Survey Quarter 1: 2019. *Statistics South Africa, Pretoria*.

Sun, T., Zhang, W. W., Dinca, M. S., & Raza, M. (2022). Determining the impact of Covid-19 on the business norms and performance of SMEs in China. *Economic Research-Ekonomska Istraživanja*, *35*(1), 2234-2253. https://doi.org/10.1080/1331677X.2021.1937261

Schwerdt, G., & Woessmann, L. (2020). Empirical methods in the economics of education. *The Economics of Education*, 3-20. https://doi.org/10.1016/B978-0-12-815391-8.00001-X

The World Bank. (2018). *Overcoming poverty and inequality in South Africa: An assessment of drivers, constraints and opportunities*. http://documents.worldbank.org/curated/en/530481521735906534/Overcoming-Poverty-and-Inequality-in-South-Africa-An-Assessment-of-Drivers-Constraints-and-Opportunities.

Telukdarie, A., Munsamy, M., & Mohlala, P. (2020). Analysis of the impact of COVID-19 on the food and beverages manufacturing sector. *Sustainability*, *12*(22), Article e9331. https://doi.org/10.3390/su12229331

Tušl, M., Brauchli, R., Kerksieck, P., & Bauer, G. F. (2021). Impact of the COVID-19 crisis on work and private life, mental well-being and self-rated health in German and Swiss employees: A cross-sectional online

survey. *BMC Public Health*, *21*(1), 1–15. https://doi.org/10.1186/s12889-021-10788-8

United Nations (2020). *Impact of the COVID-19 pandemic on trade and development: transition to a new normal*. United Nations. https://unctad.org/system/files/official-document/osg2020d1_en.pdf

Villa, J. M. (2016). diff: Simplifying the estimation of difference-in-differences treatment effects. *The Stata Journal*, *16*(1), 52–71. https://doi.org/10.1177/1536867X1601600108

Windmark, C., & Andersson, C. (2018). Cost assessment of a production system–A method targeting a product´ s aggregated value stream costs. *Procedia Manufacturing*, *25*, 231-238. https://doi.org/10.1016/j.promfg.2018.06.078

Wong, S. K. S. (2014). Impacts of environmental turbulence on entrepreneurial orientation and new product success. *European Journal of Innovation Management*. European Journal of Innovation Management, *17*(2), 229–249. https://doi.org/10.1108/EJIM-04- 2013-0032

Zhao, T., Xuan, K., Sun, C., & Sun, Y. (2021). The importance of social distancing policy. *Journal of Public Health*, *43*(2), e269–e269. https://doi.org/10.1093/pubmed/fdaa219