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

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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

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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_

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

**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*

<table>
<thead>
<tr>
<th>Score</th>
<th>Impact criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Major long-term impact</td>
</tr>
<tr>
<td>6</td>
<td>Major short-term impact</td>
</tr>
<tr>
<td>5</td>
<td>Significant short-term impact</td>
</tr>
<tr>
<td>4</td>
<td>Moderate short-term impact</td>
</tr>
<tr>
<td>3</td>
<td>Short-term impact</td>
</tr>
<tr>
<td>2</td>
<td>Minimal impact</td>
</tr>
<tr>
<td>1</td>
<td>No impact</td>
</tr>
</tbody>
</table>

**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:

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

where $ID_1, QI_2, \ldots, QI_n$ 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),

$$RII = \frac{\sum W}{(A+N)}$$  \hspace{1cm} (2)
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:

\[
AVE = \frac{\sum \lambda^2}{n}
\]  

where \( \lambda \) 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:

\[
CR = \frac{(\sum \lambda)^2}{(\sum \lambda)^2 + (\sum \varepsilon)}
\]

where \( \varepsilon = 1 - \lambda \). 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).

\[
HTMT_{ij} = \frac{W}{\sqrt{R \times Q}}
\]

where
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\[ W = \text{Average heterotrait-heteromethod correlations which is the average of all pairwise correlations between the items of the first and second constructs.} \]

\[ R = \text{Average monotrait-heteromethod correlations which are the means of all pairwise correlations between the items of the first construct.} \]

\[ Q = \text{Average monotrait-heteromethod correlations which are pairwise correlations between the items of the second construct.} \]

**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:

\[ BPR = \alpha + \beta_1 \text{BOD} + \beta_2 \text{HRL} + \beta_3 \text{MNP} + \beta_4 \text{WSF} + \beta_5 \text{SCL} + \beta_6 \text{CRB} + \beta_7 \text{CXI} + \epsilon \]  \hspace{1cm} (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 \( \beta_1, \beta_2, \ldots, \beta_7 \) are statistically significant and whether they are positive or negative. Moreover, \( \alpha \) signifies the constant, while \( \epsilon \) 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

\[ \text{VAR}(\hat{\beta}) = (X'X)^{-1}X'EX(X'X)^{-1} \]  \hspace{1cm} (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:

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

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:

\[
DiD_{BPR} = \alpha + \beta_1 TP_i + \beta_2 GR_i + \beta_3 TP_i * GR_i + \varepsilon_i \tag{9}
\]

where \(DiD_{BPR}\) is the measurement before and after changes (treatment), \(\alpha\) 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 lock downs 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.

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