



# Examining collaborative buyer–supplier relationships and social sustainability in the “new normal” era: the moderating effects of justice and big data analytical intelligence

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## Abstract

The COVID-19 pandemic has resulted in a slew of new business practices that have put the society and environment under strain. This has drawn the attention of supply chain researchers working to address the COVID-19 pandemic’s looming social sustainability issues. Prior literature has indicated that collaborative relationships improve organizational performance. Over the past years, problems related to justice are reported (e.g., between Walmart Canada and the Lego group), which might negatively affect the buyer–supplier relationship. In the new normal, the effect of justice on collaborative buyer–supplier relationships on social sustainability in the COVID-19 context is obviously essential but under-explored. The current study examines buyer–supplier collaborative relationships’ influence on social sustainability under the moderating effect of justice and big data analytical intelligence. In this paper, we employ the stakeholder resource-based view, loose coupling theory, and resource dependency

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theory as the theoretical lens to establish the research hypotheses. Using primary survey data collected from supply chain practitioners in South Africa, hypothesis testing is done using a covariance-based structural equation modelling technique. To enhance research rigor, we have checked the dyadic perspectives of both buyers and suppliers. Our empirical results reveal that collaborative buyer–supplier relationships positively influence supplier social sustainability in the new normal era. However, it is relatively stronger from the suppliers’ perspective when compared with the buyers’ perspective. Secondly, the moderating effect of perceptions of organizational justice and big data analytical intelligence on the relationship between collaborative buyer–supplier relationships and supplier social sustainability is also statistically significant. However, it is relatively stronger from the buyers’ perspective when compared with the suppliers’ perspective. These are major findings of this study. Theoretical and managerial implications are further discussed.

**Keywords** Collaborative buyer–supplier relationships · Organizational justice · Big data analytical intelligence · Social sustainability · COVID-19 pandemic · New-normal era

## 1 Introduction

The global outbreak of the COVID-19 pandemic has massively impacted the backbone of every business operation in this world (Aiello et al., 2020; Dubey et al., 2021; Xu et al., 2022). The financial crash happened in March 2020 for stock markets, and the subsequent recovery is uneven. The uneven recovery of stock markets is due to variations in infection rates among nations, vaccination rates, and levels of financial spending (Galal, 2021). However, firms that operate in traditional industries have suffered the most and they are the ones that are still showing a poor recovery rate (Choi, 2020; Galal, 2021).

The sudden attack of COVID-19 resulted in supply chain disruptions everywhere (Bag et al., 2021a, 2021b; Li et al., 2022). Every business is still trembling under the “ripple effects” created by COVID-19, as the number of infections and human deaths is still rising at the end of 2021. Almost every day, new crises and challenges related to COVID-19 are emerging and sprouting (Choi & Shi, 2022a, 2022b; Devarajan et al., 2021; Pan et al., 2022). In the literature, Galal (2021) has conducted research covering the impact of COVID-19 on the economy and society in South Africa and pointed out that the pandemic would adversely impact the South African economy as well. The same problem is also seen in developed economies like the United States (U.S.). The COVID-19 pandemic has created a crisis related to health and the economy in the U.S. More than 195,000 deaths were reported in the U.S. and produced supply and demand shocks simultaneously (Lauren et al., 2021). The scary part is that the economic damage to the U.S. caused by COVID-19 is truly tremendous. Walmsley et al. (2021) project that the net U.S. gross domestic product losses would be between “US\$3.2 trillion to US\$4.8 trillion” over 2 years.

No one is sure when this pandemic will end and people will return to their normal life (Sarkis, 2020). In this highly volatile environment, all organizations are like ships caught in a storm in the middle of the ocean. In this situation, adjusting existing theories or developing new theories are critical to achieving sustainable businesses (Li et al., 2020; Sarkis, 2020). The Mckinsey Report (2021) reveals that the delta variant of coronavirus has moved the goalposts, which is truly alarming. This report also shows some interesting findings, such as organizations paying much more attention to developing social, emotional, and advanced cognitive skills in reaction to COVID-19. The level of uncertainty has become extremely high

after the pandemic and the whole world has entered into new rules of shutdowns and hybrid (online–offline) working systems. This has increased the need to learn new skills, adapt to this changing environment, and change the old mind-set and business systems. Organizations must develop a learning environment through collaboration with other stakeholders, such as business partners, communities, government agencies, and universities (Lee et al., 2021). COVID-19 has ushered many challenges and workers/employees may adopt many short-term strategies to overcome the hurdles. However, some of those strategies may not be ethical and cause harm for society and/or organizations in the long run (Bag et al., 2021b). During this pandemic, many companies operating in developing countries have not treated supply chain partners fairly, particularly smaller suppliers, and have exploited them to an extreme level, resulting in losses and the closure of supplier businesses (Bag et al., 2021a). There were issues at Windy group, (a supplier of Hennes and Mauritz) in Bangladesh. This company dismissed 3000 garment workers in mid-2020, eventually leading to human rights involvement and finally causing damages to the corporate image. There was another incident where Opax Group’s Sinha Garments workers protested for not receiving three months’ wages. In Myanmar, 38 garment factories closed down, leading to job losses of about 10,000 employees (Business and Human Rights Resource Center, 2020).

There were also reported incidents where suppliers and contractors filed cases against garment companies due to the stoppage of payments and poor treatment with contractor laborers. It is interesting to see that these justice-related problems increased significantly after COVID-19. This kind of scenario was beyond anybody’s imagination before the pandemic. Before the COVID-19 pandemic, uncertainties were smaller compared to this new-normal era, and firms did not face many issues with order bookings, aggregate production planning, material requirement planning, supplier selection, loading, and routing which has become really challenging due to increased implied demand uncertainties in this new-normal age (Bag et al., 2021a, 2021b). This pandemic raised the question of economic sustainability and hence the initiatives for cost-cutting were on the top of the list for many small and medium-sized firms. Cost-cutting involved stoppage of capital investments, employee layoff, lack of transparency in communication with suppliers, giving orders to non-regular suppliers for quick deliveries or based on low-pricing, stopping all the annual price increases, violating contract terms, holding all contractor payments, and only release the urgent payments was some of the common practices seen among small and medium-sized firms (Bag et al., 2021c). These new practices that emerged in the new-normal age would damage the collaborative relationships with supply chain partners and may negatively affect resource sharing (Bag et al., 2021c).

In the literature, have previously shown the positive influence of supplier engagement and supplier selection on relationship performance. Social issues relevant to suppliers, such as labor rights, safety and health, societal responsibility, diversity, and product responsibility, are directly related to social sustainability and social performance (Mani et al., 2018). In a developing country like India, organizations linked with multi-tier supply chains are overwhelmed with many social problems due to the employment of large manpower (Mathiyazhagan et al., 2021). The COVID-19 pandemic has posed a big threat to social sustainability (Hörisch, 2021); however, there is a dearth of studies explaining how social sustainability can be improved through buyer–supplier collaboration in this new normal age. Hence, there is a need for research in this area to critically examine the relationship between buyer–supplier collaborative relationships and social sustainability in this new-normal age. Therefore, our first research question (RQ) is given as follows:

**RQ1** *What is the role of buyer–supplier collaborative relationships in shaping social sustainability in this new-normal era?*

Purchasing management professionals (buyers) are critical in managing the entire purchasing and supply management process (Choi & Shi, 2022b). The buyers represent the organization while interacting with external suppliers and sub-suppliers (Landeros & Plank, 1996). According to Landeros and Plank (1996), justice is one of the seven values besides “autonomy, beneficence, confidentiality, harm avoidance, professional responsibility, and truth”. Their study also indicates that justice and truth are used extensively, although more situationally. The definition of justice involves “*An equal distribution of benefits and burdens and fair allocation of scarce resources*” (Landeros & Plank, 1996).

According to Liu et al. (2012), justice with suppliers is essential to supply chain sustainability. The need for endorsing four types of justice (namely: “distributive, procedural, interpersonal, and informational”) in managing supply chain relationships is even more critical in post-pandemic times due to business environment uncertainties (Liu et al., 2012); however, the need for endorsing justice has increased multifold in this new normal era. According to Matopoulos et al. (2019), particularly in times of crisis, suppliers who are treated nicely by their customers will devote extra resources to the relationship. Therefore, a strong buyer–supplier relationship in times of crisis requires collaborative working rather than the contractual distribution of benefits.

A positive perception of organizational justice signifies that the gains of suppliers are consistent with their efforts, which gives them peace of mind working with the buying organization. Secondly, whenever suppliers find that they are not “discriminated against” by the buyers or they are feeling being respected by the buying organization, they will share timely important information with them. This naturally creates a positive perception of organizational justice and further improves the bonding with the buyers (Liu et al., 2012). A positive perception of organizational justice on the suppliers’ mind thus significantly impacts the supplier’s sustainability practices (Mani et al., 2020). We therefore argue that perceptions of organizational justice can influence buyer–supplier collaboration’s impact on social sustainability. When there is positive perception of organizational justice on the mind of suppliers related to buyers, their morale will be high and they would engage in social sustainability practices; otherwise, their confidence will be low and they would not involve in social sustainability practices. This is a critical element in the buyer–supplier relationship and affects supplier social sustainability outcomes. Our second research question is hence proposed as follows.

**RQ2** *How does perception of organizational justice moderate the relationship between buyer–supplier collaboration and social sustainability in the new-normal era?*

In today’s digital economy (Choi et al., 2022; Luo & Choi, 2022), big data analytical intelligence (BDAI) is critical in improving company performance (Choi et al., 2018). BDAI assimilation refers to how well a company integrates BDAI into its daily activities. In this new normal era, BDAI integration allows a company to gain important insights into its consumers’ unique and special demands and form partnerships to create personalized products or services to fulfill those needs. BDAI should be integrated into the business process to optimize a company’s competitive advantage. Implementing BDAI is complicated, but it yields important information that improves organisations’ capabilities (Zhang et al., 2020). In supply chain management (SCM), BDAI helps create more value by optimizing the resources. Information processing is critical in business management, especially in SCM. Literature reveals that BDAI helps moderate the impact of big data on organisational performance

(Chen et al., 2015). SCM driven by big data improves decision-making and transparency among channel partners (Del Giudice et al., 2020). BDAI helps the firms achieve success by enhancing supplier developmental activities. Social sustainability can be enhanced using BDAI; since BDAI will assist with very important market-related information that is related to business sustainability and buyers and suppliers will be forced to enhance social sustainability (Gu et al., 2021). BDAI is therefore critical for improving an organization's business processes and increasing profitability. It enables management to make the most efficient use of their resources. BDAI works like an intelligent system that acts as a glue to enhance the bonding between the buyer and the supplier (Raguseo et al., 2020). BDAI based management of collaborative relationships will keep every SC partner aligned with the company's interests, resulting in a win-win situation for both buyer and supplier (Ahmed et al., 2020). Nonetheless, the moderating role of BDAI on the buyer-supplier collaborative relationships and social sustainability in the new-normal era is under-researched and hence,

**RQ3** *How does big data analytical intelligence assimilation moderate the relationship between buyer-supplier collaboration and social sustainability in the new-normal era?*

The COVID-19 pandemic has a distressing impact on the SC network globally (Xu et al., 2022). Many research works have been conducted over the past year. The focus has been chiefly about the effects of the COVID-19 pandemic on supply chains, resilience strategies, and technologies in improving supply chain performance (Ivanov, 2021) as well as supply chain sustainability (Chowdhury et al., 2021). However, social sustainability in the context of COVID-19 is still under-explored in the current literature. Hence, this study needs to be pursued to fill this research gap.

The rest of this paper is organized as follows. Following the stakeholder resource-based view, resource dependency theory, and loose coupling theory, we develop the theoretical model, and then build the research hypotheses in Sect. 2. We present the research methodology in Sect. 3. We report the details of data analysis and results in Sect. 4. We discuss both managerial and academic implications in Sect. 5. We conclude this study in Sect. 6. To enhance the presentation, all tables are placed in an "Appendix".

## 2 Theoretical model and hypotheses development

In this section, we review the literature on buyer-supplier relationships, the Stakeholder resource-based view, Loose coupling theory, and Resource dependency theory to support the model building.

### 2.1 Buyer-supplier relationships

The buyer-supplier relationship emphasizes on the partner's collaboration in business networks (Claro and Claro 2010). A collaborative buyer-supplier relationship is essential for a firm to succeed. It improves the partners' combined actions and assists them in achieving their common objectives (Zacharia et al., 2011). An appropriate mechanism is required to protect buyer-supplier coordination. Information sharing, particularly downstream information, is essential for increasing collaboration among partners and improving business performance (Claro et al., 2010). The unpredictability of the environment pushed partners to work together more effectively to share resources. The seven fundamental components of an effective and collaborative partnership between partners are resource sharing, collaborative

communication, goal congruence, joint knowledge production, incentive alignment, decision synchronization, and information sharing (Cao & Zhang, 2011). A dynamic buyer–supplier relationship enables the ability to analyze the existing problem through numerous lenses (Shamsollahi et al., 2021). A dynamic and strong relationship leads to higher performance for both the buyer and the supplier. The strength of the relationship heavily influences the firm’s performance. The periodic fluctuations of an organization’s effectiveness can be seen in the pattern of stronger and weaker relationships between buyer and seller. Partners should work hard to create their relationship; the strength of their partnership is based on their previous performance and mutual understanding (Autry & Golicic, 2010). Alghababsheh and Gallar (2020) establish the social capital limit in buyer–supplier relationships. Besides commercial considerations, the social aspect should also be considered in long-term buyer–supplier relationships. The social aspect fosters trust among business partners. Buyers and suppliers must share their knowledge to build inter-organizational trust. It benefits both parties during the contingency period (Rungsithong & Meyer, 2020). Both the buyer and the seller needed all of the resources and knowledge available to deal with uncertainty (Prajogo et al., 2020). Sharing essential information would build trust among the partners. Inter-organizational relationships between buyer and seller motivate them to communicate and share critical information (Mirkovski et al., 2016). Information exchange is critical between the buyer and the supplier to maintain a positive performance. Sharing information improves transparency and the quality of relationships between buyers and suppliers (Kros et al., 2019). The identification of buyer and supplier is defined by mutual information sharing. The distinction between business partners and others is based on trust. Therefore, trust is the most crucial factor that motivates people to share information (Corsten et al., 2011). The power imbalance between buyer and seller impacts the firm’s performance (Prosman et al., 2016). The recent impact of COVID-19 has made the maintenance of buyer–supplier relationships increasingly complex and challenging to create a long-term favourable business environment (Aiello et al., 2020). Understanding the buyer–supplier relationship is essential to achieving long-term objectives (Adhikary et al., 2020). Improving the firm’s success necessitates resolving the buyer–supplier complex relationship challenges (Chowdhury et al., 2021).

## 2.2 Stakeholder resource-based view

Freeman et al. (2021) demonstrated that RBV in its current form is insufficient and that it can be expanded by including the fundamental elements from the stakeholder theory, namely: “incorporating normativity”, “recalibrating the concept of sustainability”, “viewing people as more than just resources”, and “allowing for more cooperative behaviours”.

Freeman et al. (2021) also pointed out that it is impossible to build a sustained competitive edge without long-term stakeholder connections. Therefore, SRBV aims to make all businesses sustainable, which can be accomplished through cultivating long-term stakeholder connections. Also, SRBV incorporates values, norms, and ethics, which are the bedrock of our society. Building a durable cooperative advantage—developing cooperative aspects in a firm’s economic ties—is one of the managerial goals.

Building on the SRBV, we argue that buyer–supplier collaboration allows partners to develop rare, non-imitable, and valuable resource sets that can help in achieving sustainability. In the work of Carter and Jennings (2004), we find that tangible and intangible resources like workforce skills and learning through collaborative relationships during buyer–supplier engagement enhances sustainability. Stakeholders are the different parties involved with the organizations; hence, any development/profit or losses impact them. Stakeholders are engaged

in social change, they have the power to influence and solve social problems associated with the supply chain, which ultimately enhances sustainable outcomes (Maignan et al., 2002). Firms need to be cautious about social issues and resolve them very quickly to meet stakeholders' expectations as it may impact social performance (Waddock et al., 2002). The stakeholder resource-based view (SRBV) is a theory based on RBV, utility theory, and stakeholder theory (Sodhi, 2015). The SRBV understands that "distinct sets of stakeholders with their own resources, routines, and dynamic capabilities aim to maximize their utilities under ambiguity and across their own time horizons, whether for the firm, specific operations within a company or across organizations" (Sodhi, 2015).

In the current study, the "resources" could be knowledge and skills, capital, and inventory, whereas "routines" could be stakeholder management, i.e., "avoiding suppliers' holdouts and employee strikes", managing proper relations with stakeholders; and achieving justice (fairness) in the process. "Dynamic capabilities" could be the capability to use big data analytical intelligence to look for increasing shareholder value. Lastly, "utility considerations" could include shareholder value. We use the SRBV theoretical lens to support our hypotheses. This theory supports our first and second hypotheses.

### **2.3 Resource dependency theory**

The resource dependence view has been used in previous studies to examine the buyer—supplier engagement and relationship aspects (Chu & Wang, 2012). This theory can explain how firms can lower their dependency on other firms and increase the dependence of other firms on them (Ulrich & Barney, 1984). Buyer–supplier engagement can help improve inter-organizational sustainability performance (Schnittfeld & Busch, 2016). Big data analytical intelligence can be considered a critical resource that increases the dependency of partners on each other to enhance sustainability. This provides the support to form our third hypothesis as we will show later on.

### **2.4 Loose coupling theory**

The loose coupling theory investigates the partners' relationship in a supply chain. It can explain the inconsistencies and tensions between the buyer and the supplier. If there is a lack of coupling between buyer and supplier, it may be difficult for them to fulfill their goals (Demartini & Otley, 2020). The coupling behavior of both parties is positively related to the buyer–supplier relationship based on mutual justice. Loose coupling theory is essential for understanding inter-organizational behavior relationships. In supply chain management, it's critical to understand loose coupling in buyer–supplier relationships. Loose coupling is a procedure in which both partners are independent but have common goals (Liu et al., 2012). The loose coupling theory focuses on the patterns of business partners' relationships. It contributes to creating a network diagram that depicts inter-organizational relationships (Beekun & Glick, 2001). Loose coupling leads to a proactive attitude, which facilitates re-evaluating and resolving issues that arise in the buyer–supplier relationship. It contributes to the long-term sustainability of businesses (Grosvold et al., 2014). Loose coupling theory is useful in addressing inter-organizational dissonance. The relationship mechanism may be vulnerable if the buyer and supplier conflicts are not handled properly. The loose coupling theory assists in resolving disputes and aligning the buyer and supplier's common goals (Liu et al., 2020). This theory supports our first hypothesis.

## 2.5 Hypotheses development

### 2.5.1 Collaborative buyer–supplier relationships and social sustainability in the new normal era

Collaborating with suppliers is a broader notion that influences supplier behavior and improves supply chain performance (Singh & Power, 2009). Supplier involvement improves the focal firms' collaboration and cooperation. Setting shared goals and performance standards rely heavily on supplier collaboration (Wu et al., 2014).

Demand patterns have changed dramatically in this new normal age, necessitating changes in forecasting, inventory modeling, and transportation network (Sarkis, 2020). Innovative product companies must increase supply chain responsiveness, which requires a close working relationship with suppliers. However, companies must be cautious when picking suppliers, as many have turned to unethical business practices in the aftermath of the COVID-19 outbreak to keep more profits. As a result, social sustainability is one of the most important criteria to examine when selecting suppliers (Bag et al., 2021b). In addition to economic viability, corporations must consider crucial factors such as labor equity, healthcare, safety, and charity when making supply chain decisions (Hutchins & Sutherland, 2008; Sarkis, 2020).

The integration with suppliers can be improved with a practical and suitable information exchange network (Tidy et al., 2016). Demand fluctuations significantly impact supply chain performance (Parast & Subramanian, 2021). Therefore, the crisis and unpredictable environment emphasize the need for engaging suppliers in developmental projects (Sawyer & Harrison, 2019). Unless the suppliers are aligned with the buyers' interests, it will not be possible to achieve the sustainability goals. Moreover, if the suppliers do not conform to the social sustainability standards, buyers will lose important customers sensitive to social and environmental sustainability. Therefore, buyers should invest in developing collaborative relationships as it is critical for a firm's survival in this new-normal era (Mani et al., 2018; Xu et al., 2021). Hence, we propose Hypothesis H1.

**Hypothesis H1** Collaborative buyer–supplier relationships positively impact supplier social sustainability in the new normal era.

### 2.5.2 Moderating effect of justice

Justice is the main pillar of social exchanges and relationships (Liu et al., 2012). Examining justice is essential to address inter-organizational issues related to strategic alliances and channel partners. Justice is critical, particularly when two partners need to develop collaboration to use each other's resources and avoid scarcity. Therefore, failing to maintain justice may collapse the partnership between the supply chain players (Liu et al., 2012). Few studies examined the effect of justice on firm performance, for instance, Griffith et al. (2006), Narasimhan et al. (2009). However, previous studies have missed investigating this element from a dyadic perspective. It is essential to study both the buyer's and suppliers' perceptions of justice and its effect on the performance of both buyers and suppliers (Liu et al., 2012). Using loose coupling theory, the study of Liu et al. (2012) has highlighted that mutual justice perceptions promote their mutual coupling behavior, resulting in better relationships. Liu et al. (2012) also highlighted the various types of justice (i.e., "distributive, procedural, interpersonal, and informational"). Using the theoretical support of loose coupling theory, Liu et al. (2012) visualized supply chains as a loosely coupled system, where the firms are free



and still work in an interdependent manner to share resources. Both the buyer and supplier maintain their roles while involved in collaborating activities. Although looseness cannot be avoided because both the buyer and supplier have the freedom to change the level of resources, the coupling is essential due to interdependence on resources and goals common to both parties. During this COVID-19 pandemic, new normal age, every company is under a lot of stress as they are facing considerable fluctuations in customer demands. At the same time, they are also suffering from a supply crisis (Bag et al., 2021a).

In these circumstances, the interdependence on resources has increased significantly and the joint goals may have also slightly changed. Organizational justice with each other (buyer–supplier) at this point is very important as literature has pointed out its impact on organization performance (Griffith et al., 2006). Recent work by Majumdar et al. (2020) has indicated that COVID-19 has created distress in the supply chain network. Millions of workers are jobless and trying to survive in this uncertain environment. Many clothing manufacturers in South Asia adopted practices that are socially non-compliant, like sub-contracting of production and use of contract labor, which resulted in the code of conduct of social non-compliance. Therefore, supplier selection and supplier collaboration need to be done in such a way as to facilitate the social security of laborers (Majumdar et al., 2020). This has led to the increased attention of firms toward justice and further strengthened collaborative relationships to avert supply risks and jointly innovate new products/services without jeopardizing social sustainability (Petrucci et al., 2021). Building on the above discussion of literature, we argue that a high perception of organizational justice will strengthen the impact of collaborative relationships on social sustainability and vice versa. Hence, we have Hypothesis H2.

**Hypothesis H2** Perception of organizational justice will moderate the relationship between collaborative buyer–supplier relationships and social sustainability in the new normal era.

### 2.5.3 Moderating effect of big data analytical intelligence

In today's globalized world, big data has emerged as one of the most valuable assets for a company. Organizations are rapidly adopting digital technology, resulting in massive amounts of data being generated due to various business processes (Dubey et al., 2020).

Data mining (Luo & Choi, 2021) is a multidisciplinary field that seeks to discover novel and sound patterns in large data sets by employing various approaches such as machine learning, statistics, and database systems. It must produce meaningful patterns for data stakeholders and provide some benefit. While descriptive analytics is reactive and focused on understanding the past, predictive and prescriptive analytics are proactive and focused on the future (El Morr & Ali-Hassan, 2019). Big data technologies can be used for segmentation, profiling, promotions, pricing, competition, community dynamic analysis, and other purposes that partnering firms can use to make supply chain decisions with sustainability in mind (Fan et al., 2015). Since BDAI creates solutions to help firms harness and structure the value of data to gain insight, BDAI can greatly aid in strengthening buyer–supplier relationships and assisting them in achieving their mutual goals by sharing their available resources (Anshari et al., 2019; Dubey et al., 2020). Drawing on resource dependence theory, BDAI can be viewed as a resource on which buyers and suppliers can rely to carry out social sustainability initiatives. In order to obtain BDAI resources, buyers and suppliers must conduct transactions in its environment. BDAI can increase the dependency of partners on each other to enhance sustainability. Therefore, BDAI can influence the behaviour of the buyers and supplier firms. The RDT theory is significant because a firm's capacity to collect, change, and use raw

materials faster than competitors can be critical to its victory (Cai & Yang, 2008; Hillman et al., 2009).

The worldwide supply chain has been disrupted by the COVID-19 pandemic (Choi, 2021a, 2021b), wherever the weak links were exposed in terms of weak buyer–supplier relationships. COVID-19 resulted in a large demand–supply mismatch and buyers switching suppliers, and related changes in the market can be captured and analyzed via BDAI systems. It will assist managers in tackling complicated problems and improve their decision-making qualities. In their study, Del Giudice et al. (2020) explained the value of BDAI in contributing to sustainability. The buyer and supplier should have a healthy and collaborative partnership to deal with uncertain circumstances (Dubey et al., 2021). BDAI provides beneficial information for reconfiguring the business process and aligning the buyer–supplier relationships with social sustainability practices. It helps enhance social sustainability standards (Wang et al., 2020). Based on previous literature review (Singh, 2022; Wang et al., 2020), we argue that if the BDAI is widely used throughout the firm, it will assist buyers in clearly understanding market requirements and guiding them to invest time, money, and share resources with the right suppliers while also aligning them with social sustainability standards to improve total SC performance in the new normal era. Firms that do not use big data analytical technologies, on the other hand, fail to strengthen relationships with their partners, which has a negative impact on social sustainability performance. Therefore,

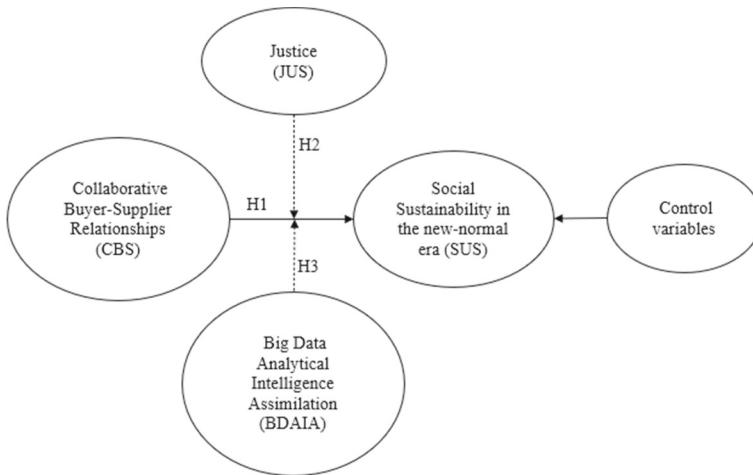
**Hypothesis H3** Big data analytical intelligence assimilation will moderate the relationship between collaborative buyer–supplier relationships and social sustainability in the new normal era.

Past studies have highlighted the importance of understanding the necessity of managing collaborative relationships and the perspectives of supply chain partners (Ambrose et al., 2010; Nyaga et al., 2010; Paulraj et al., 2008). The current study provides implications for practice as it showcases the perceptual gaps between buyers and suppliers. For a buyer, there are implications for managing buyers in this new normal era by leveraging on BDAI and justice. Equally, supplier firms' can gain an understanding of buyers' view of their social sustainability performance. Given the lack of understanding of buyer–supplier relationships on social sustainability perspectives, this study aims to explore similarities and differences in this context. The proposed hypothesized relationships of the conceptual model were examined independently by applying two independent samples (buyers and suppliers). The first data analysis examined the conceptual model from buyers' perspectives. The second study sample looks at the same model from suppliers' perspectives. Therefore, the data analysis was divided into two stages: bivariate analysis (t-test) and antecedents of relationship towards outcome variables (CB-SEM).

Building on the above theoretical arguments, we develop our theoretical model to demonstrate how buyer–supplier collaborative relationships influence supplier social performance in the post-COVID-19 pandemic while perceptions of organizational justice and big data analytical intelligence act as key moderators (refer to Fig. 1).

### 3 Research methodology

For this study, we adopted the positivism approach and designed a piece of cross-sectional based quantitative research (Saunders et al., 2009). The study applied dyadic constructs (i.e., buyer–supplier perspectives) to collect data and capture the relationships and interactions that take place between a dyad. Data used in this study to examine the dyadic models are primarily



**Fig. 1** Theoretical model (P.S.: JUS and BDAIA are moderating factors, indicating the moderating link with a dashed line)

collected at the individual level from dyad members at the dyad level (e.g., buyer–supplier relationships) that permit us to test hypotheses at multiple levels (Kozłowski & LeBreton, 2012; Matta et al., 2015). Further, we followed the methodological considerations suggested by LaPlaca et al. (2018). The selected methods must be appropriately justified and linked with the research objectives/research questions. In this study, we conducted an industrial survey using an instrument to collect data. We had carefully built the model and conducted analyses, from the operationalization of constructs, validity to reliability coefficient checking. We also paid attention to data collection to reduce bias. Common method bias is a fear in survey research, particularly when a single respondent from every firm is used for answering both the antecedent and dependent variable related questions. Hence, we checked common method bias in our study. Thirdly, a non-response bias tested for identifying any sort of heterogeneity in the sample is performed. The details are provided in subsequent sub-sections.

### 3.1 Operationalisation of constructs

We have presented the description of latent constructs in Table 1. We have considered constructs such as big data analytical intelligence assimilation—three items adapted from Zhang et al. (2020); organizational justice—seventeen items adapted from Liu et al. (2012); collaborative buyer–supplier relationships—eight items adapted from Heide and Miner (1992), and Lusch and Brown (1996), and three items from Heide (1994). Lastly, for social sustainability, eighteen items are adapted from Mani et al. (2018) (please refer to Table 2). The questionnaire consists of reflective constructs and their measures. Each item was measured on a Likert 7-point scale with anchors ranging from “1 = Strongly Disagree, 7 = Strongly Agree”. The questionnaire was sent to five academic experts from South African universities in logistics and supply chain management area. Simultaneously, we sent the same questionnaire to five general managers from the South African automotive parts manufacturing industry. We received recommendations for changing the wording for three questions related to social sustainability in the new normal era (COVID-19 pandemic). Accordingly, we moulded the

questionnaire to fit the context of the COVID-19 situation in South Africa. A similar approach was taken in previous studies by Mani et al. (2016) and Dubey et al. (2019) to develop the final survey instrument. We present the operationalization of constructs in Table 2 (“Appendix”).

### 3.2 Sampling and data collection

The study data for this research was collected from the survey method. The instrument was distributed across two groups: the researchers first targeted the automotive parts manufacturing “buyer firms”, and the second sample targeted automotive parts “supplier firms”. We selected the samples from the “National Association of Automotive Component and Allied Manufacturers” in South Africa and used a cross-sectional online survey across South Africa. We randomly selected fifty samples from South African automotive parts manufacturing firms (i.e., buyer–supplier) to conduct two separate pilot tests using the structured questionnaire. We emailed the questionnaire to them. We received thirty-eight responses and we checked the construct validity and reliability. We found the results satisfactory and proceeded with the final survey.

#### *Survey 1: capturing buyers’ perspectives*

The survey instrument was sent to 600 potential buyers’ firms by sharing an online google form link. The researchers requested them to indicate whether their automotive parts manufacturing firms focused on developing a collaborative relationship with a particular supplier. If the responses were positive, the respective respondents requested to complete the entire survey regarding the collaborative relationship with a supplier. The buyer survey produced only 152 buyer complete responses.

#### *Survey 2: capturing suppliers’ perspectives*

The survey instrument was sent to 784 potential automotive parts manufacturing suppliers. The supplier firms were requested to indicate whether their firms had a collaborative relationship with a buyer. If the answer was affirmative, then participants were instructed to complete the survey regarding collaborative relationships and social sustainability in the “new normal” era with a buyer. The researchers received 164 supplier responses. All the responses were based on the fact that all the supplier firms focused on collaborative relationships. We present the respondents’ demographic information in Table 3.

### 3.3 Common method bias

Note that the common method bias (CMB) is a problem in any survey-based research and there are many ways to control CMB. Based on MacKenzie and Podsakoff (2012), we adopted certain measures to reduce CMB. Firstly, we scientifically designed the questionnaire to avoid confusion among respondents. For this reason, we checked the questionnaire through academic and industry experts before rolling out the final survey. The questions were kept simple and no technical words were used.

Additionally, we made a note at the beginning of the questionnaire that no identification of participants would be required. We also mentioned that the results would be published exclusively in a journal article form without revealing any names of the participants and the organization; we indicated that most questions are formulated in a structured manner (estimated time: 15 to 20 min). Lastly, we also stated that there is no right or wrong answer; participants may leave the survey without facing any consequences. Apart from taking the

above precautions, we also performed Harman's single factor test and found that the first component indicated 29.23% of variance, which is much below the suggested critical value (50%) (Podsakoff et al., 2012). Additionally, Kock (2017a, 2017b) indicates that "full collinearity variance inflation factors" (VIFs) can also be applied for conducting the CMB tests and outperform the traditionally used tests relying on exploratory factor analyses. A VIFs score of 3.3 or below implies that there is "no multicollinearity in the model" and no CMB (Kock & Lynn, 2012). We found that all VIFs were below 3.3. We conclude that CMB was controlled during the data collection stage and CMB does not impact our data quality.

### 3.4 Non-response bias

We have performed a non-response bias test using the guideline of Armstrong and Overton (Armstrong & Overton, 1977). In survey research, non-response bias can affect the quality of data if the data is collected in various stages. Hence, it is essential for researchers to carefully check whether the data received in various stages are homogenous in nature. If the data is not homogenous, then it will lead to biased results. Since, we received the responses in two phases, i.e., 68 responses (early wave) and 84 responses (late wave) for buyers. Therefore, we checked if data received in two different phases are homogenous using Levene's homogeneity of variance test in SPSS software. The findings indicated that no values were significant, meaning there is no difference between the data received in the two stages. In addition, we received the responses in two phases, i.e., 88 responses (early wave) and 76 responses (late wave) from suppliers. The findings indicated that no values were significant, meaning there is no difference between the data received in the two stages. However, this is not a perfect test for non-response bias, as indicated by Fawcett et al. (2014) and therefore, we considered another approach to increase the confidence level of the late respondents by doing telephonic calls and reducing any chance of differences cropping in the data sets. Therefore, we can conclude that non-response bias is avoided in this study.

### 3.5 Control variable

When it comes to big data analytical intelligence assimilation in social sustainability, larger firms may differ from the medium and small firms' in terms of investments in collaborative relationships with suppliers and also the level of justice towards suppliers (Claro & Claro, 2010; Narayanan et al., 2015; Whipple et al., 2015). Therefore, the present research controlled firm size and age and considered them control variables. This study also included the length of the business relationship as another control variable that may impact the buyer-supplier relationship and social sustainability (Anderson & Weitz, 1989).

### 3.6 Data analysis method

The present study applied descriptive statistics along with t-test by using SPSS 21.0 software. The t-test was conducted to compare the mean values of the proposed variables for buyers and suppliers. Through the t-test the study intends to understand the primary reflection of buyers and suppliers' relationship in the same supply chain network and the extent of difference in collaborative buyers-supplier relationships, justice, big data analytical intelligence and social sustainability in new normal era. Afterwards, the researchers estimated two measurement models (buyer and supplier data) by applying confirmatory factor analyses via the AMOS 20.0

software package (Shek & Yu, 2014; Mishra, 2016). The full measurement model was tested based on the proposed conceptual model through CB-SEM AMOS 20.0 for Windows for both buyer and supplier data respectively. According to Hazen et al. (2015), CB-SEM is one of the dominant statistical techniques employed in prior studies in well-established journals in supply chain operations. In addition, CB-SEM was applied in this research due to the ability to evaluate and examine the complex relationships by using a parametric statistical approach (Hair et al., 2014). Hence, this method allows the researchers to justify the measurement and structural models with several Goodness-of-Fit (GoF) indexes such as “goodness of fit index (GFI), comparative fit index (CFI), root mean square of error approximation (RMSEA), and normed chi-square (Chisq/Df)” (Reinartz et al., 2009; Mia et al., 2019). Furthermore, moderation analysis was also performed from buyer and supplier perspectives. The influence (moderation effect) of justice and big data analytical intelligence on the relationship between collaborative buyers supply relationship and social sustainability in the new normal era was analyzed by exploring the “interaction effect” of the related latent variables (Hair et al., 2017a, 2017b; Cheah et al., 2020).

## 4 Results and discussion

This section reports the results of bivariate analysis, measurement model, and structural model.

### 4.1 Bivariate analysis

Apart from the descriptive profile of the respondents, we also conducted a comparison test of the “mean values of the constructs for buyers’ and suppliers’ data” by applying a standard t-test. The results of t-test are reflected in Table 4. The results from the tests revealed that there are certain differences in the perception of social sustainability in post COVID-19 pandemic situation between the two groups (buyers and suppliers). The values of joint planning under CBS construct, BDAIA, distributive justice under JUS construct and societal responsibility under SUS construct all have reflected 0.50 and above mean difference between the two groups. Hence, all the corresponding mean difference values of the t-test are statistically significant on a 7-point scale. In the implication part, the researchers will explain the implications of these differences and the similarity among the dimensions. Overall, the results from the t-test indicates that all the dimensions examined in this study in regards to buyers and suppliers perception on social sustainability in post COVID-19 pandemic situation differ significantly, which substantially supports that buyers and suppliers “in the same supply chain network of relationship” possess significantly different perceptions towards the collaborative buyers–suppliers relationship, justice, big data analytical intelligence assimilation and social sustainability in new normal era.

### 4.2 Measurement model

All perceptual measures for both buyers and suppliers’ contexts were examined with respect to reliability as well as validity. The “psychometric properties” of the four latent constructs measurement variables (including 49 items) were examined with buyers and suppliers’ data through confirmatory factor analysis by using AMOS 20.0 (refer to Table 5 of “Appendix”). for all measurement items). Based on the recommendation of Bagozzi et al. (1991), Yuan

(2005), Barrett (2007) and Tabachnick and Fidell (2007) the goodness-of-fit indices with respect to two full measurement model involving all latent showed a good fit with the data: “Buyers’ data – Chi-square = 231.794,  $p = 0.02$ ,  $df = 229$ , Chi-square/ $df = 1.012$ , GFI = 0.910, NFI = 0.869, TLI = 0.904, CFI = 0.938, RMSEA = 0.050, and SRMR = 0.0506 and suppliers data – Chi-square = 271.827,  $p = 0.02$ ,  $df = 259$ , Chi-square/ $df = 1.049$ , GFI = 0.920, NFI = 0.879, TLI = 0.935, CFI = 0.941, RMSEA = 0.050, and SRMR = 0.0616”. In addition, the results of measurement model reliability and composite reliability (CR) values showed that for both the data set, the Cronbach’s alpha ( $\alpha$ ) values were higher than 0.70 that indicating satisfactory levels of internal consistency of the data (Hair et al., 2012; Nunnally & Bernstein, 1994). Meanwhile, CR values were also higher than 0.7, thus indicating desirable item reliability levels were achieved for both the data set (Hair et al., 2012). Hence, all the factor loadings are significant at  $p < 0.001$  and above 0.60, demonstrating convergent validity for both the data sets (Table 5). The study also tested the discriminant validity by exploring each construct’s “average variance extracted” (AVE) with its shared variance with other variables (Fornell & Larcker, 1981). Therefore, the “square root of AVE” for each variable must exceed the “correlations associated with the remaining variables” indicating that the latent construct explains “more of the variances” in its respective items than what it has shared with another variable (Fornell & Larcker, 1981). Note that the “diagonal values” in Tables 6 (buyers) and 7 (suppliers) are higher than the “correlation associated with the remaining constructs”, justifying that no discriminant validity problem exists for the data sets.

Moreover, the study also examined the standard factor loadings of the items under each latent variable to assess the validity of the observed variables (Koufteros, 1999). According to Bollen (1989), the greater the corresponding factor loadings or coefficients compared with their respective standard errors and t-values, the higher value indicates that the measured variables justify the underlying constructs (Bollen, 1989). CFA analysis revealed that all the t-values associated with each of the loadings of the items under buyers and supplier’s data are greater than 2.00 and above at the 0.010 significant levels (see Table 8). Hence, all the items are significantly related to their corresponding variables rationalise the theorized relationships among indicators and latent variables such as big data analytical intelligence assimilation (BDAIA) (3 items), justice (JUS) [distributive justice: DJ-5 items, procedural justice: PJ-4 items, interpersonal justice: InJ-4 items, informational justice-4items], collaborative buyer—supplier relationships (CBS) [joint planning-4 items, joint problem solving-4 items, flexibility to make adjustments-3 items], social sustainability in the post-COVID-19 pandemic situation (SUS) [labour rights-4 items, safety and health-4 items, societal responsibility-4 items, diversity practices-3 items, product responsibility-3 items].

Furthermore, to assess the validity of the set of indicators at the second-order latent constructs with first-order sub-dimensions’ level, the study primarily tested whether the AVE for the reflective items of the individual first order sub-dimensions is greater than 0.50 or not. The results show that all AVE values under the first-order sub-dimensions are greater than 0.50 (MacKenzie et al., 2011). Afterward, the researchers also assess the validity of the set of sub-dimensions constructed as formative indicators of the second-order latent construct by operationalizing Edward’s (2001) adequacy coefficient ( $R^2a$ ). The results squared correlations for the forty-nine items are listed accordingly, as Table 8 shows, all the  $R^2a$  are equal and above 0.50, and t-values are higher than 7.00, justifying the evidence of convergent validity. Furthermore, the study also examined the degree of explained variance of the second-order JUS, CBS, and SUS construct for both buyer and supplier data (Tables 9, 10) which are explained by its first-order dimensions, such as in buyer perspective JUS is explained by DJ

(29.8%), PJ (18.5%), InJ (27%) and IJ (17.3%). The findings also ensure that all the paths for both buyer and supplier contexts are significant at  $p < 0.001$ .

### 4.3 Structural model

The study applied structural equation modeling (SEM) with social sustainability in the new-normal era as the single dependent variable to test the hypotheses. In the analysis of SEM, two-equation analyses were carried out (i.e., one for buyers only and one for suppliers). The results of SEM analysis are also highlighted in Figs. 2 and 3 to show the path diagram for the structural relationship. The overall goodness-of-fit indices of the structural model for buyer and supplier data were also assessed to justify the model's fitness (Hair et al., 2012; Jöreskog & Sörbom, 1982). This analysis revealed both data set separately yielded acceptable fit with data (i.e., Buyer:  $X^2 = 83.076$ ,  $df = 59$ ,  $p = 0.006$ ,  $X^2/df = 1.408$ ,  $NFI = 0.904$ ,  $CFI = 0.960$ ,  $RMSEA = 0.050$ ,  $SMR = 0.065$ ; Supplier:  $X^2 = 89.078$ ,  $df = 68$ ,  $p = 0.006$ ,  $X^2/df = 1.309$ ,  $NFI = 0.891$ ,  $CFI = 0.940$ ,  $RMSEA = 0.050$ ,  $SMR = 0.066$ ) (Bollen & Stine, 1992; Hazen et al., 2015). The results from the beta coefficient based on the standardized estimates and corresponding critical ratios are presented in Table 11. The results support the research model indicating that in both cases, collaborative buyer–supplier relationships have a positive relationship with social sustainability in the new normal era. The predictive powers of the two models are also assessed by  $R^2$  values (Rai et al., 2006). Results show that collaborative buyer–supplier relationships have a positive effect on social sustainability in the new normal era and in turn, explain 39.7% (buyer) and 41.7% (supplier) variance in social sustainability in the new normal era. Thus, the findings from this research accepted hypothesis one.

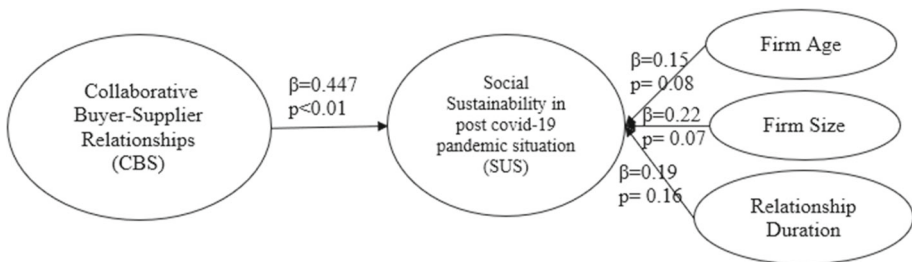


Fig. 2 Results of structural model: buyers' perspective

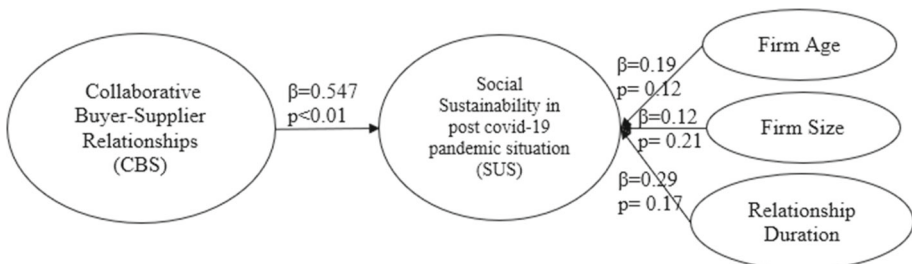


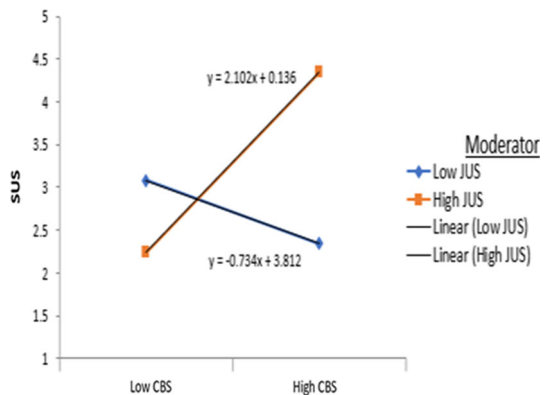
Fig. 3 Results of structural relationship: suppliers' perspective



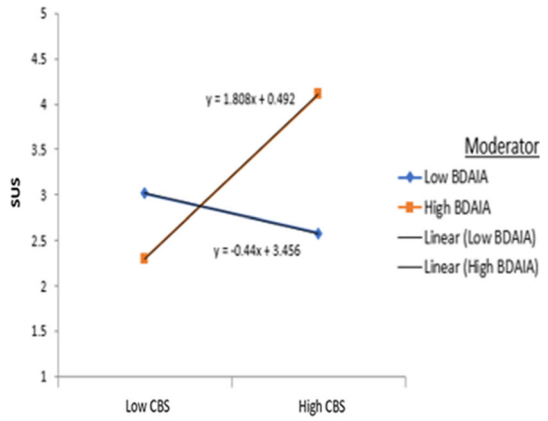
A regression analysis was applied for buyer and supplier data to test the moderating effects of justice and big data analytical intelligence assimilation on the relationship between collaborative buyer–supplier relationships and social sustainability in the post-COVID-19 pandemic (i.e., H2) set separately. To conduct the moderation test, each construct’s factor scores were computed. Checking the factor scores in the statistical regression can enhance our understanding regarding the weights associated with different items (see, e.g., DiStefano et al., 2009). Table 11 presents the findings derived from the moderation analysis. The results from the regression analysis reflect that in both cases, the moderating variable justice positively impacts the relationship between collaborative buyer–supplier relationships and social sustainability in the post-COVID-19 pandemic situation. Table 11 show that the interaction between buyer’s collaborative buyer–supplier relationships and justice is positively significant ( $\beta = 0.529$ ,  $p = 0.018$ ). To better demonstrate this effect, we have Fig. 4. As we can see in Fig. 4, a high perception of organizational justice (one standard deviation above the mean slope shows an upward trend) will strengthen the relationship between collaborative buyer–supplier relationships and social sustainability in the new normal era in buyers’ context. On the other hand, a low perception of organizational justice will weaken (one standard deviation below the mean and the line shows a negative slope) the relationship between collaborative buyer–supplier relationships and supplier social sustainability in the new normal era in the context of buyers. The study also finds that when the big data analytical intelligence assimilation level increases (to “one standard deviation above the mean”), the slope of the line exhibits a rising trend in the context of buyer perspective (see Table 11 and Fig. 5).

On the other hand, the results from moderation analysis revealed that a high perception of organizational justice and high big data analytical intelligence assimilation would strengthen the relationship between collaborative buyer–supplier relationships and social sustainability in the new normal era in the context of supplier perspective (see Figs. 6, 7). The results from moderation analysis explore that firm’s perception of organizational justice and big data analytical intelligence assimilation can serve as a supplemental mechanism that helps buyer–supplier firms better utilize collaborative buyer–supplier relationships to improve social sustainability in the new normal era. These findings support our proposed research model in which all four hypotheses (i.e., H2 and H3) were found to be statistically significant and they were well supported.

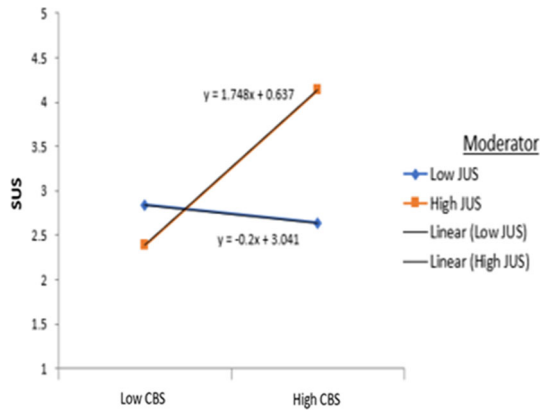
**Fig. 4** Moderating effect of justice in context of buyer perspective



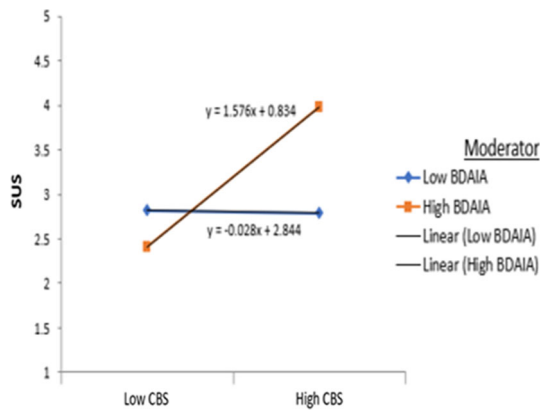
**Fig. 5** Moderating effect of big data analytical intelligence assimilation in context of buyer perspective



**Fig. 6** Moderating effect of justice in the context of supplier perspective



**Fig. 7** Moderating effect of big data analytical intelligence assimilation in the context of supplier perspective



## 5 Implications

### 5.1 Theoretical implications

The availability of excellent resources enables firms to stand out from the competition. According to the resource-based perspective, a firm's competitive advantage is derived from its distinctive resources. Therefore, companies' market performance differs due to unique resources that are inimitable, scarce, and precious. Companies may create and maintain a competitive edge by leveraging resources, making it harder for competitors to imitate. Resources play a crucial role in shaping sustainable supply chain management (Shibin et al., 2020). The essence of resource sharing between buyers and suppliers in this new normal age is demonstrated in this study. Collaborative relationships with suppliers and sub-supplier positively influence supplier social performance. Previous studies have revealed that collaborative buyer–supplier relationships improve firm performance; however, in this current study we have shown that it enhances social sustainability, which is a unique contribution to the literature.

Prior literature indicates that perceptions of organizational justice (distributive, procedural, interpersonal, and informational) impact buyer–supplier performance (Liu et al., 2012). However, in recent years, organizational justice did not receive much attention in buyer–supplier literature. Our findings revealed that the perception of organizational justice exerts a moderating effect on the path of collaborative buyer–supplier relationships and social sustainability in this new-normal age.

We have also used the loose coupling theory to explain the dynamics of buyer–supplier relationships. The association between buyers and suppliers is independent but has specific common goals. In such a relation, the perception of organizational justice can significantly impact the buyer–supplier relationship, resource sharing, and subsequent sustainability outcomes. This is a very interesting finding as the world is full of uncertainties since COVID-19 has hit this planet and many firms resorted to some malpractices that violated the ethical guidelines and negatively impacted the perceptions of organizational justice in the mind of suppliers and sub-suppliers, causing poor social sustainability performance. The moderating impact of justice on buyer–supplier relationships and social sustainability has not been examined in past studies. Hence, this finding is a unique contribution and will take the theoretical debate to the next level.

The study contributes to the buyer–supplier relationship literature by highlighting that the impact of the buyer–supplier collaborative relationships on social sustainability is contingent on the perception of organizational justice. Loose coupling is necessary between buyers and suppliers, but buyers should not cross the lines and do “injustice”. The consequences of injustice will impact the social sustainability performance and ultimately damage the image of the buying firm. This study provides scientifically sound and clear empirical evidence for the arguments and contributes to the knowledge base in buyer–supplier relationships with the focal point on justice.

Talwar et al. (2021) presented a review of big data in operations and supply chain management, with one of the key themes being sustainability and disaster management (pp. 3524); and one of the potential research questions that they further pointed out was “How can Big Data be used to identify risks and uncertainties in service and manufacturing supply chains to improve their sustainability?”. No doubt, this is a valid and important question that researchers must answer to help firms sustain in this new-normal era.

Also, Del Giudice et al. (2020) argued that big data analytics act as a moderating variable in the relationship between supply chain management and firm performance. They demonstrated that lowering supply chain costs significantly influences a company's profitability. This study also highlights that big data analytical intelligence assimilation plays a moderating role in the path of buyer–supplier collaborative relationships on supplier social sustainability. This research further looks into the possibilities of using big data analytical intelligence assimilation as a moderating variable to strengthen the relationship between buyer–supplier collaboration and social sustainability. Thus, the usefulness of big data analytical intelligence for collaborative relationship strengthening between buyer and supplier is highlighted.

## 5.2 Managerial implications

In this new-normal age, every business operation faces a crisis related to supply, product innovation, and logistics. Therefore, collaborative relationships can help the buying organization survive in the new normal. Thus, during the COVID-19 pandemic, business operations should put more effort into establishing collaborative relationships. One more critical aspect that has drawn every business's attention is the concern for social sustainability. Changes in many existing strategies and adopting new business strategies have led to the use of contractors/sub-contractors and third parties for supply and production-related activities. These have caused stress on the regular suppliers as well as the employees. Managers need to understand that social sustainability is vital for better organizational performance. Focal companies must audit their suppliers and ensure that they are socially responsible, i.e., with proper labor rights, safety and health, ethics, diversity practices, and product responsibility.

Secondly, the perception of organizational justice moderates the relationship between collaborative buyer–supplier relationships and social sustainability. Supply chain managers must focus on justice in managing collaborative relationships with suppliers. Therefore, managers must not get involved in any wrong actions since it can influence the effect of collaborative relationships on supplier social sustainability performance. A high level of justice would make collaborative relationships more effective and lead to better social sustainability performance. On the contrary, a low level of justice would make collaborative relationships ineffective and lead to inferior social sustainability performance. Recent literature has indicated that many textile companies have got involved in activities like using sub-contractors, violating labor laws, unethical treatment of workers, etc. These would create a negative perception of organizational justice for the suppliers and sub-suppliers, and naturally, this created a rift in the relationship and resource sharing during the COVID-19 pandemic (Majumdar et al., 2020). Unfair practices have resulted in the loss of suppliers' faith and distress among supply chain partners.

However, companies like the Tata group continue to have faith in their suppliers and maintain good relationships for success (Tata Communications, 2021). Tata group is a well-established Indian manufacturer of products like cars and airplanes. Tata group expects its suppliers to be candid and act honestly while doing business transactions. To better show this philosophy, Tata group's "Tata power" has circulated COVID-19 guidelines with employees and supply chain partners to manage susceptibilities under COVID-19. The company has provided advance money to contractors' workforce and taken many initiatives that benefit society (Tata Power Report, 2020). The initiatives are intended to support employees, supply chain partners, and society which can help generate a perception of organizational justice for the suppliers. This will improve collaborative relationships, leading to enhanced social sustainability performance. South African automotive industries should learn a lesson from

Tata Group and others to emphasize good corporate actions involving distributive justice, procedural justice, interpersonal justice, and informational justice.

Lastly, managers must remember that big data analytical intelligence assimilation plays a moderating role in the path of buyer–supplier collaborative relationships on supplier social sustainability. The use of big data analytical intelligence is helping to bridge the communication gap between buyers and suppliers and further develop their relationships. The management can use big data analytical intelligence to strengthen suppliers’ relationships and improve supplier social sustainability. Supplier social sustainability is necessary for businesses to stay competitive in the long run. In times of uncertainty, a buyer–supplier relationship based on social sustainability could be pretty advantageous.

In summary, the key takeaway points for operations managers are as follows.

- Firms must develop close partnerships with supplier firms in this highly uncertain new normal era.
- Close buyer–supplier collaboration can help minimize sustainability issues and improve social sustainability performance.
- Leaders must foster a fair workplace environment in the organization while ensuring that managers choose suitable corrective action for team members when necessary.
- High levels of justice (distributive, procedural, interpersonal, and informational) direct the attention of partnering firms toward social sustainability practices.
- High levels of big data analytical intelligence strengthen the effect of buyer–supplier relationships on social sustainability performance.
- Supplier relationship policies must clearly define roles and responsibilities, as well as information security policies. The policy must be reviewed at least once a year, and any necessary changes must be made on a regular basis.
- When discussing any new projects with suppliers, buyer firms must provide full information (drawings, specifications, deadlines, any additional customer requirements) to the supplier firm and both parties must consider the ecological and social impact of the product while making the raw material selection and deciding the manufacturing and logistics processes.

## 6 Conclusion

COVID-19 pandemic has made everything topsy-turvy and caused leaders in every organization to change their business and subsequently the operations and supply chain strategy, respectively. This pandemic has raised a massive concern concerning social responsibility (Liu et al., 2022). Many organizations have been trying to sustain it since the last year while focusing little on society and the surrounding environment. Naturally, this is causing damage to the community and environment and some of these damages are irreversible. Therefore, we must address the social sustainability issues of this new-normal age and produce research work that is impactful for society. In this research, we addressed three research questions. The first research question is: *RQ1: What is the role of buyer–supplier collaborative relationships in shaping social sustainability in this new-normal age?* Results indicate that H1 is supported and thus answers the first question. The second research question is: *RQ2: How does the perception of organizational justice moderate the relationship between buyer–supplier collaboration and supplier social sustainability?* Results indicate that H2 is supported and thus answers the second question.

Lastly, hypothesis H3 was also supported and addressed the third research question: *How big data analytical intelligence assimilation exerts a moderating effect on the relationship between buyer–supplier collaboration and social sustainability in the new-normal era?*

The unique contribution of this study is the findings from the dyadic perspective, which shows the higher importance of BDAI from the buyers' perspective and justice from the suppliers' perspective in this new-normal era.

The t-test comparison of constructs (Table 4) shows that when it comes to collaborative buyer–supplier relationships, the suppliers' mean is higher for joint planning, joint problem solving, and flexibility to make adjustments. Both buyers and suppliers can benefit from the insights into the understanding of the perceptions of the significant antecedents that contribute to the relationship's success. The results from the t-test generate a significant participatory role and functions along with resources may require for both sides to support the successful and sustainable relationships. This study generates important findings on the “expectations and perceptions” of collaborative relationships. For instance, buyers should consider the effectiveness of their joint planning, joint problem solving, and flexibility to adjust to the supplier. Hence, joint planning, joint problem solving, and flexibility to make adjustments are desirable for both parties but it is essential for the supplier. Therefore, suppliers also think buyers should pay more attention to joint planning; joint problem solving, and flexibility to make adjustments for stronger collaboration in this new-normal era.

The t-test comparison of BDAIA construct reveals a higher supplier mean, indicating that suppliers perceive that BDAIA is important for gathering market-related data of their buyers that will help them make the right business decisions. In addition, in distributive justice and interpersonal justice, the supplier mean was higher and the buyer mean was higher for procedural justice. It indicates that suppliers think that buyers must demonstrate distributive justice and interpersonal justice towards them and on the other hand buyers think that suppliers must establish higher procedural justice. Finally, the social sustainability construct reveals that the supplier mean was higher for labour rights, safety and health, societal responsibility, diversity practices, and product responsibility. It indicates that suppliers think these practices are essential for the buyers. However, for diversity practices, the buyer mean was higher. It shows that buyers believe that suppliers' diversity practices are essential. From the buyer's perspective, knowing the respective supplier is a significant challenge for the firm. Therefore, this study provides a new and novel insight into a comparative range of relationship nature that both the parties require to improve or given a high level of importance. A greater understanding of how the two parties understand the application of social sustainability, collaborative relationships, justice, and the importance of big data analytical intelligence in their relationship, then it would allow both the firms to develop more effective relationship systems and to rationalize for investment resources for stronger relationships which the previous research might otherwise neglect. These research findings add value at a substantial level.

Table 11 further provides some additional insights. From the suppliers' perspective, the influence of the collaborative buyer–supplier relationship on social sustainability in the new normal era is stronger ( $\beta = 0.547$ ) than the buyers' perspective on the influence of collaborative buyer–supplier relationship on social sustainability in the new normal era ( $\beta = 0.447$ ). This could be due to increased incidents of supplier exploitation in this new-normal era which makes the suppliers more cautious of buyers' although, from buyers' perspective, they also think that collaborative relationships can enhance social sustainability.

One more interesting finding is that from the buyers' perspective; the moderation effect of justice on collaborative buyer–supplier relationships and social sustainability is stronger

( $\beta = 0.529$ ). This indicates that buyers perceive the importance of justice on supplier firms to be more important for strong collaboration and achieving social sustainability.

Lastly, from the buyers' perspective, the moderation effect of BDAIA on collaborative buyer–supplier relationships and social sustainability is stronger ( $\beta = 0.562$  s). This indicates that buyers perceive the importance of BDAIA to be more critical for strong collaboration and achieving social sustainability.

The limitations of this study include the use of small sample size and future researchers can use bigger data sets, as the scope remains to extend the investigation further. The future research directions can be an extension of the model by incorporating some mediating variables such as buyer altruism; secondly, future researchers can use moderating variables like culture, environmental dynamism, investment, competition, etc.

## Declarations

**Conflict of interest** On behalf of all authors, the corresponding author states that there is no conflict of interest.

## Appendix

See Tables 1, 2, 3, 4, 5, 6, 7, 8, 9 and 10.

**Table 1** Description of latent constructs

Latent constructs	Definition
Big data analytical intelligence (Zhang et al., 2020)	Big data analytical intelligence refers to the vital information and insights retrieved from large-scale datasets utilizing a variety of statistical and analytical methodologies
Justice (Liu et al., 2012)	“Justice (or fairness), a long-studied notion in the organizational study, is the foundation for all social and economic exchanges and interactions”. Theoretical evolution of the justice concept over the last few decades has expanded to include four dimensions: distributive, procedural, interpersonal, and informational
Collaborative buyer–supplier relationships (Heide & Miner, 1992; Lusch & Brown, 1996; Humphreys et al., 2001)	Collaborative buyer–supplier relationships refer to a collaborative partnership or closer cooperation between buyers and suppliers
Social Sustainability in post COVID-19 pandemic situation (Hutchins & Sutherland, 2008; Mani et al., 2018, 2020)	As people live differently in this new normal period, new social sustainability standards arise. “Social sustainability indicators for supply chain decision-making (labor equity, healthcare, safety, and philanthropy)” are helpful to estimate a company’s overall social imprint

**Table 2** Operationalization of construct

Constructs	Item No.	Items
Big data analytical intelligence assimilation (BDAIA) (Zhang et al., 2020)	BDAIA1	BDAI is used as an important tool in the procurement department
	BDAIA2	BDAI is employed for making decisions in every major functional area
	BDAIA3	BDAI is used in developing new products and other purchasing related activities
Justice (JUS) (Liu et al., 2012)	Distributive justice (Liu et al., 2012)	
	JUS1	Our gain consistent with effort and investment
	JUS2	Our gain commensurate with role and responsibilities
	JUS3	Our gain comparable to others' gain
	JUS4	Our gain comparable to our counterpart's gain
	JUS5	Our gain proportionate to our performance
	Procedural justice (Liu et al., 2012)	
	JUS6	The counterpart does not discriminate
	JUS7	The counterpart uses consistent procedures
	JUS8	The counterpart takes our concerns and feedback
	JUS9	The counterpart knows situations and processes
	Interpersonal justice (Liu et al., 2012)	
	JUS10	Representatives respect each other
	JUS11	Representatives are friendly
	JUS12	Representatives socialize
	JUS13	Representatives treat each other fairly
	Informational justice (Liu et al., 2012)	
JUS14	Routinely exchange timely information	
JUS15	Develop and share channel information	
JUS16	View transparent communication as key	
JUS17	Inform the other side whenever needed	
Collaborative buyer–supplier relationships (CBS) <sup>a</sup>	Joint planning (Heide & Miner, 1992)	
	CBS1	“Our company plans volume demands for the next seasons together with this buyer (supplier)”



**Table 2** (continued)

Constructs	Item No.	Items
	CBS2	“Our company plans the new products and varieties demands for the next seasons together with this buyer (supplier)”
	CBS3	“This buyer (supplier) provides us with sale forecasts for the products our company sells to them”
	CBS4	“Our company shares long-term plans for our products with this buyer (supplier)”
	Joint problem solving (Heide & Miner, 1992; Lusch & Brown, 1996)	
	CBS5	“This buyer (supplier) and our company deal with problems that arise in the course of the relationship together”
	CBS6	“This buyer (supplier) and our company do not mind owing each other favors”
	CBS7	“In most aspects of the relationship with this buyer (supplier), the responsibility for getting things done is shared”
	CBS8	“This buyer (supplier) and our company are committed to improvements that may benefit the relationship as a whole”
	Flexibility to make adjustments (Heide, 1994)	
	CBS9	“Our company is flexible in response to changes in the relationship with this buyer (supplier)”
	CBS10	“This buyer (supplier) makes adjustments to maintain the relationship with our company”
	CBS11	“When some unexpected situation arises, this buyer (supplier) and our company work out a new deal”
Social sustainability in post COVID-19 pandemic situation (SUS) (Mani et al., 2018, 2020)	Labour rights (Mani et al., 2018)	
	SUS1	We ensure appropriate labor working conditions in supplier and sub-supplier locations
	SUS2	We have a strict policy for the prohibition of child and forced labor and ensure that suppliers and sub-suppliers adhere to it
	SUS3	We conduct periodic labor audits in supplier and sub-supplier locations in supplier and sub-supplier locations
	SUS4	We maintain strict vigil on labor rights violations in supplier and sub-supplier locations
	Safety and health (Mani et al., 2018)	

Table 2 (continued)

Constructs	Item No.	Items
	SUS5	Our suppliers and sub-suppliers have a strict policy on health and safety at the workplace
	SUS6	Our suppliers and sub-suppliers ensure health and hygiene
	SUS7	Our suppliers and sub-suppliers ensure “clean drinking water and sanitation”
	SUS8	We guide suppliers and sub-suppliers in “implementing occupational health and safety measures”
	Societal responsibility (Mani et al., 2018)	
	SUS9	Our suppliers support and help to “develop local suppliers (i.e., supplier’s suppliers)”
	SUS10	“Our suppliers engage in philanthropic activities”
	SUS11	“We collaborate actively with our suppliers in conducting health camps and awareness programs”
	SUS12	“We actively collaborate with our suppliers to conduct skill development programs for unemployed youths”
	Diversity practices (Mani et al., 2018)	
	SUS13	We appreciate hiring locals, women, people with disabilities, the marginalized, and minorities at the supplier’s workplace
	SUS14	Our suppliers promote every employee equally based on merit
	SUS15	Our suppliers avoid discrimination, i.e., “denying any rights and privileges to employees because of their age, sex, race, community, religion, or nationality”
	Product responsibility (Mani et al., 2018)	
	SUS16	Our suppliers avoid sub-standard materials in manufacturing
	SUS17	Our suppliers avoid and sub-suppliers restricted usage of hazardous materials
	SUS18	Our supplier and sub-suppliers’ compliance with local regulations

<sup>a</sup>This part follows the respective cited references (Heide, 1994; Heide & Miner, 1992; Lusch & Brown, 1996)

**Table 3** Respondents' profile (n = 152 buyers and 164 suppliers)

Respondent title	Buyers	Percentage (%)	Suppliers	Percentage (%)
General Manager/CEO	16	10.53	4	2.44
Senior Manager	60	39.47	72	43.90
Manager	58	38.16	65	39.63
Junior Manager	18	11.84	23	14.02
Others	0	0.00	0	0.00
Your work experience (in years)				
Above 20	117	76.97	124	75.61
10 to 20	22	14.47	33	20.12
6 to 9	13	8.55	7	4.27
Below 5	0	0.00	0	0.00
Nature of business activities				
Manufacturer	7	4.61	6	3.66
Distributor	112	73.68	118	71.95
Wholesaler	26	17.11	31	18.90
Retailer	7	4.61	9	5.49
Relationship duration (years)				
Above 20	87	57.24	92	56.10
10 to 20	54	35.53	64	39.02
6 to 9	11	7.24	8	4.88
Below 5	0	0.00	0	0.00
Age of your firm				
Above 20	90	59.21	94	57.32
10 to 20	43	28.29	52	31.71
6 to 9	19	12.50	18	10.98
Below 5	0	0.00	0	0.00
Annual turnover (in South African ZAR)				
< 10 million	2	1.32	2	1.22
< 50 million	48	31.58	52	31.71
> 50 million	102	67.11	110	67.07

**Table 4** t-test comparison of constructs

Constructs	Buyer mean	Supplier mean	Mean difference	T-value	Degrees of freedom	Significance level
<b>CBS</b>						
Joint planning	5.34	6.76	− 1.02	− 4.227	267	0.000
Joint problem solving	5.79	5.87	− 0.08	− 0.526	253	0.000
Flexibility to make adjustments	5.46	5.48	− 0.02	− 0.487	248	0.000
BDAIA	5.08	6.59	− 1.51	− 8.729	258	0.000
<b>JUS</b>						
Distributive justice	5.13	5.97	− 0.84	− 0.879	239	0.000
Procedural justice	5.62	5.40	0.22	0.789	246	0.000
Interpersonal justice	5.24	5.69	− 0.45	− 3.487	262	0.000
Informational justice	5.10	3.69	1.41	9.030	228	0.000
<b>SUS</b>						
Labour rights	5.46	5.69	− 0.23	− 1.247	195	0.000
Safety and health	5.24	5.88	− 0.64	− 4.218	266	0.000
Societal responsibility	5.56	5.73	− 0.17	− 1.249	192	0.000
Diversity practices	5.49	5.37	0.12	0.873	242	0.000
Product responsibility	5.72	5.86	− 0.14	− 0.916	231	0.000

Big data analytical intelligence assimilation (BDAIA); justice (JUS) [distributive justice, procedural justice, interpersonal justice]; collaborative buyer–supplier relationships (CBS) [joint planning, joint problem joint problem solving, flexibility to make adjustments]; social sustainability in post COVID-19 pandemic situation (SUS) [labour rights, safety and health, societal responsibility, diversity practices, product responsibility]

Table 5 The constructs' psychometric properties at the first order level

Constructs	Sub-constructs items	Loadings		Alpha ( $\alpha$ )		CR		AVE	
		Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier
JUS	Distributive justice (DJ)								
	JUS1	0.876	0.776	0.869	0.859	0.885	0.887	0.607	0.611
	JUS2	0.724	0.792						
	JUS3	0.806	0.807						
	JUS4	0.751	0.789						
JUS5	0.729	0.746							
Procedural justice (PJ)	JUS6	0.812	0.778	0.867	0.848	0.884	0.870	0.657	0.627
	JUS7	0.726	0.789						
	JUS8	0.856	0.757						
	JUS9	0.843	0.841						
	Interpersonal justice (InJ)			0.849	0.827	0.870	0.869	0.628	0.625
JUS10	0.791	0.762							
JUS11	0.725	0.793							
JUS12	0.803	0.786							
JUS13	0.847	0.821							
Informational justice (IJ)	JUS14	0.862	0.712	0.883	0.843	0.910	0.859	0.717	0.604
	JUS15	0.831	0.793						
	JUS16	0.793	0.780						

Table 5 (continued)

Constructs	Sub-constructs items	Loadings		Alpha ( $\alpha$ )		CR		AVE	
		Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier
CBS	JUS17	0.898	0.829						
	Joint planning (JP)			0.835	0.847	0.865	0.874	0.617	0.636
	CBS1	0.781	0.771						
	CBS2	0.752	0.749						
	CBS3	0.761	0.787						
	CBS4	0.845	0.879						
	Joint problem joint problem solving (JPJPS)			0.821	0.805	0.855	0.846	0.596	0.579
	CBS5	0.747	0.729						
BDAIA	CBS6	0.756	0.721						
	CBS7	0.762	0.767						
	CBS8	0.823	0.824						
	Flexibility to make adjustments (FMA)			0.809	0.832	0.829	0.849	0.619	0.653
	CBS9	0.803	0.798						
	CBS10	0.823	0.768						
	CBS11	0.732	0.857						
	BDAIA1	0.801	0.827	0.816	0.786	0.858	0.836	0.669	0.630
SUS	BDAIA2	0.862	0.830						
	BDAIA3	0.790	0.721						
	Labour rights (LR)			0.802	0.798	0.838	0.838	0.565	0.565

Table 5 (continued)

Constructs	Sub-constructs items	Loadings		Alpha ( $\alpha$ )		CR		AVE	
		Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier
	SUS1	0.781	0.759						
	SUS2	0.712	0.726						
	SUS3	0.751	0.742						
	SUS4	0.763	0.780						
	Safety and health (SH)			0.802	0.789	0.863	0.843	0.613	0.573
	SUS5	0.789	0.772						
	SUS6	0.810	0.752						
	SUS7	0.729	0.723						
	SUS8	0.803	0.782						
	Societal responsibility (SR)			0.869	0.857	0.885	0.868	0.660	0.623
	SUS9	0.873	0.843						
	SUS10	0.752	0.743						
	SUS11	0.798	0.769						
	SUS12	0.824	0.801						
	Diversity practices (DP)			0.794	0.825	0.841	0.843	0.639	0.643
	SUS13	0.842	0.852						
	SUS14	0.751	0.772						
	SUS15	0.803	0.780						
	Product responsibility (PR)			0.782	0.796	0.824	0.842	0.610	0.640

Table 5 (continued)

Constructs	Sub-constructs items	Loadings		Alpha ( $\alpha$ )		CR		AVE	
		Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier
	SUS16	0.759	0.784						
	SUS17	0.779	0.790						
	SUS18	0.806	0.826						

Big data analytical intelligence assimilation (BDAlA) (3 items); justice (JUS) [distributive justice-5 items, procedural justice-4 items, interpersonal justice-4 items, informational justice-4 items]; collaborative buyer-supplier relationships (CBS) [joint planning-4 items, joint problem solving-4 items, flexibility to make adjustments-3 items]; social sustainability in post COVID-19 pandemic situation (SUS) [labour rights-4 items, safety and health-4 items, societal responsibility-4 items, diversity practices-3 items, product responsibility-3 items] CR = composite reliability, CA = Cronbach's alpha, average variance extracted (AVEs)



**Table 6** Correlations of the latent variables for the first order constructs (buyers)

Constructs	BDAIA	DJ	PJ	InJ	IJ	JP	JPJS	FMA	LR	SH	SR	DP	PR
BDAIA	<b>0.817</b>												
DJ	0.451	<b>0.779</b>											
PJ	0.468	0.412	<b>0.810</b>										
InJ	0.531	0.410	0.410	<b>0.792</b>									
IJ	0.433	0.503	0.521	0.410	<b>0.846</b>								
JP	0.429	0.471	0.475	0.423	0.402	<b>0.785</b>							
JPJS	0.427	0.373	0.436	0.403	0.407	0.519	<b>0.772</b>						
FMA	0.451	0.507	0.424	0.410	0.492	0.516	0.508	<b>0.787</b>					
LR	0.573	0.423	0.467	0.400	0.410	0.515	0.538	0.402	<b>0.751</b>				
SH	0.412	0.474	0.478	0.425	0.424	0.413	0.522	0.418	0.406	<b>0.782</b>			
SR	0.472	0.562	0.491	0.423	0.473	0.417	0.477	0.420	0.512	0.409	<b>0.812</b>		
DP	0.468	0.562	0.410	0.411	0.410	0.412	0.502	0.419	0.501	0.429	0.410	<b>0.799</b>	
PR	0.401	0.398	0.425	0.473	0.428	0.367	0.483	0.479	0.424	0.470	0.416	0.473	<b>0.781</b>

square root of AVE in the diagonal (in bold)

Big data analytical intelligence assimilation (BDAIA) (3 items); justice (JUS) (distributive justice: DJ-5 items, procedural justice: PJ-4 items, interpersonal justice: InJ-4 items, informational justice-4 items); collaborative buyer-supplier relationships (CBS) [joint planning-4 items, joint problem solving-4 items, flexibility to make adjustments-3 items]; social sustainability in post COVID-19 pandemic situation (SUS) [labour rights-4 items, safety and health-4 items, societal responsibility-4 items, diversity practices-3 items, product responsibility-3 items]

**Table 7** Correlations of the latent variables for the first order constructs (Suppliers)

Constructs	BDAIA	DJ	PJ	InJ	IJ	JP	JPJS	FMA	LR	SH	SR	DP	PR
BDAIA	<b>0.793</b>												
DJ	0.430	<b>0.781</b>											
PJ	0.470	0.492	<b>0.791</b>										
InJ	0.503	0.398	0.403	<b>0.790</b>									
IJ	0.403	0.403	0.423	0.393	<b>0.777</b>								
JP	0.408	0.491	0.419	0.428	0.399	<b>0.797</b>							
JPJS	0.469	0.503	0.406	0.439	0.407	0.503	<b>0.760</b>						
FMA	0.479	0.507	0.405	0.429	0.502	0.516	0.508	<b>0.808</b>					
LR	0.408	0.513	0.437	0.459	0.513	0.514	0.505	0.408	<b>0.750</b>				
SH	0.403	0.474	0.428	0.446	0.493	0.408	0.547	0.409	0.488	<b>0.756</b>			
SR	0.456	0.467	0.412	0.438	0.426	0.473	0.498	0.466	0.525	0.498	<b>0.789</b>		
DP	0.449	0.439	0.412	0.425	0.403	0.408	0.429	0.489	0.505	0.429	0.488	<b>0.801</b>	
PR	0.447	0.448	0.445	0.446	0.448	0.447	0.443	0.441	0.442	0.441	0.442	0.448	<b>0.800</b>

square root of AVE in the diagonal (in bold)

Square root of AVE on the diagonal; big data analytical intelligence assimilation (BDAIA) (3 items); justice (JUS) [distributive justice: DJ-5 items, procedural justice: PJ-4 items, interpersonal justice: InJ-4 items, informational justice-4 items]; collaborative buyer-supplier relationships (CBS) [joint planning-4 items, joint problem joint problem solving-4 items, flexibility to make adjustments-3 items]; social sustainability in post COVID-19 pandemic situation (SUS) [labour rights-4 items, safety and health-4 items, societal responsibility-4 items, diversity practices-3 items, product responsibility-3 items]

**Table 8** Parameter estimates, error terms, t-values, and R<sup>2</sup> a for CFA model using the validation sample

Constructs	Sub-constructs items	Loadings		Error term		t-values		R <sup>2</sup> a		
		Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	
JUS	Distributive justice (DJ)									
	JUS1	0.876	0.776	- a	- a	- a	- a	0.767	0.602	
	JUS2	0.724	0.792	0.05	0.03	19.32	24.72	0.524	0.627	
	JUS3	0.806	0.807	0.03	0.04	26.24	23.23	0.649	0.651	
	JUS4	0.751	0.789	0.02	0.03	28.09	26.39	0.564	0.622	
JUS5	0.729	0.746	0.04	0.04	18.39	19.79	0.531	0.556		
JUS	Procedural justice (PJ)									
	JUS6	0.812	0.778	- a	- a	- a	- a	0.659	0.605	
	JUS7	0.726	0.789	0.04	0.03	25.43	28.13	0.527	0.622	
	JUS8	0.856	0.757	0.03	0.05	27.13	17.93	0.732	0.573	
	JUS9	0.843	0.841	0.05	0.04	22.72	20.12	0.710	0.707	
JUS	Interpersonal justice (InJ)									
	JUS10	0.791	0.762	- a	- a	- a	- a	0.625	0.580	
	JUS11	0.725	0.793	0.11	0.05	11.34	18.24	0.525	0.628	
	JUS12	0.803	0.786	0.09	0.08	08.19	07.83	0.644	0.617	
	JUS13	0.847	0.821	0.10	0.05	10.92	15.72	0.717	0.674	
JUS	Informational justice (IJ)									
	JUS14	0.862	0.712	- a	- a	- a	- a	0.743	0.506	
	JUS15	0.831	0.793	0.05	0.04	21.13	25.27	0.690	0.628	
	JUS16	0.793	0.780	0.04	0.03	27.29	28.19	0.628	0.608	

Table 8 (continued)

Constructs	Sub-constructs items	Loadings		Error term		t-values		R <sup>2</sup> a	
		Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier
CBS	JUS17	0.898	0.829	0.05	0.04	19.02	20.12	0.806	0.687
	Joint planning (JP)								
	CBS1	0.781	0.771	- a	- a	- a	- a	0.609	0.594
	CBS2	0.752	0.749	0.17	0.19	8.27	9.27	0.565	0.561
	CBS3	0.761	0.787	0.84	0.64	7.96	7.46	0.579	0.619
CBS4	0.845	0.879	0.05	0.04	19.15	20.10	0.714	0.772	
Joint problem joint problem solving (JPJPS)									
	CBS5	0.747	0.729	- a	- a	- a	- a	0.558	0.531
	CBS6	0.756	0.721	0.16	0.18	7.97	5.27	0.571	0.519
	CBS7	0.762	0.767	0.14	0.15	8.98	8.18	0.580	0.588
	CBS8	0.823	0.824	0.06	0.04	15.75	20.71	0.677	0.678
Flexibility to make adjustments (FMA)									
	CBS9	0.803	0.798	- a	- a	- a	- a	0.644	0.636
	CBS10	0.823	0.768	0.08	0.18	14.70	6.69	0.677	0.589
	CBS11	0.732	0.857	0.16	0.06	7.36	13.96	0.535	0.734
	BDAIA1	0.801	0.827	- a	- a	- a	- a	0.641	0.683
BDAIA2	0.862	0.830	0.04	0.04	21.14	21.39	0.743	0.688	
BDAIA3	0.790	0.721	0.05	0.06	18.06	17.12	0.624	0.519	
SUS	Labour rights (LR)								

Table 8 (continued)

Constructs	Sub-constructs items	Loadings		Error term		t-values		R <sup>2</sup> a	
		Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier
	SUS1	0.781	0.759	- a	- a	- a	- a	0.609	0.576
	SUS2	0.712	0.726	0.15	0.12	7.85	8.79	0.506	0.527
	SUS3	0.751	0.742	0.09	0.09	8.09	8.97	0.564	0.550
	SUS4	0.763	0.780	0.08	0.08	10.07	11.06	0.582	0.608
	Safety and health (SH)								
	SUS5	0.789	0.772	- a	- a	- a	- a	0.622	0.595
	SUS6	0.810	0.752	0.08	0.12	13.77	8.97	0.656	0.565
	SUS7	0.729	0.723	0.12	0.14	8.58	7.59	0.531	0.522
	SUS8	0.803	0.782	0.09	0.11	8.97	9.27	0.644	0.611
	Societal responsibility (SR)								
	SUS9	0.873	0.843	- a	- a	- a	- a	0.762	0.710
	SUS10	0.752	0.743	0.11	0.12	9.57	8.37	0.565	0.552
	SUS11	0.798	0.769	0.09	0.10	10.18	9.98	0.636	0.591
	SUS12	0.824	0.801	0.04	0.05	19.27	17.32	0.678	0.641
	Diversity practices (DP)								
	SUS13	0.842	0.852	- a	- a	- a	- a	0.708	0.725
	SUS14	0.751	0.772	0.12	0.11	8.52	10.19	0.564	0.595
	SUS15	0.803	0.780	0.10	0.10	11.35	8.10	0.644	0.608
	Product responsibility (PR)								

Table 8 (continued)

Constructs	Sub-constructs items		Loadings		Error term		t-values		R <sup>2</sup> a	
	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier	Buyer	Supplier
SUS16	0.759	0.784	- a	- a	- a	- a	- a	- a	0.576	0.614
SUS17	0.779	0.790	0.17	0.16	7.76	7.92	7.76	7.92	0.606	0.624
SUS18	0.806	0.826	0.08	0.07	12.61	13.10	12.61	13.10	0.649	0.682

a-refer a parameter fixed at the level of 1.00 in the original solution. Buyers' data - Chi-square = 231.794,  $p = 0.02$ ,  $df = 229$ , Chi-square/ $df = 1.012$ , GFI = 0.910, NFI = 0.869, TLI = 0.904, CFI = 0.938, RMSEA = 0.050, and SRMR = 0.0506 and suppliers data- Chi-square = 271.827,  $p = 0.02$ ,  $df = 259$ , Chi-square/ $df = 1.049$ , GFI = 0.920, NFI = 0.879, TLI = 0.935, CFI = 0.941, RMSEA = 0.050, and SRMR = 0.0616

**Table 9** Assessment of reflective-formative model for buyers

Second-order formative constructs	Relationships with first-order dimensions	$\beta$	t-stat
JUS	DJ	0.298	3.189
	PJ	0.185	2.176
	InJ	0.270	2.549
	IJ	0.173	2.093
CBS	JP	0.171	2.015
	JPJS	0.393	3.818
	FMA	0.287	2.868
SUS	LR	0.252	2.682
	SH	0.217	2.017
	SR	0.141	2.083
	DP	0.195	2.112
	PR	0.180	2.108

Justice (JUS) [distributive justice: DJ-5 items, procedural justice:PJ-4 items, interpersonal justice:InJ-4 items, informational justice-4items]; collaborative buyer–supplier relationships (CBS) [joint planning-4 items, joint problem solving-4 items, flexibility to make adjustments-3 items]; social sustainability in post COVID-19 pandemic situation (SUS) [labour rights-4 items, safety and health-4 items, societal responsibility-4 items, diversity practices-3 items, product responsibility-3 items]

**Table 10** Assessment of reflective-formative model for suppliers

Second-order formative constructs	Relationships with first-order dimensions	$\beta$	t-stat
JUS	DJ	0.193	2.089
	PJ	0.284	2.185
	InJ	0.171	2.048
	IJ	0.273	2.114
CBS	JP	0.361	3.815
	JPJS	0.297	2.618
	FMA	0.257	2.416
SUS	LR	0.251	2.682
	SH	0.221	2.218
	SR	0.157	2.103
	DP	0.188	2.162
	PR	0.120	2.105

Justice (JUS) [distributive justice: DJ-5 items, procedural justice:PJ-4 items, interpersonal justice:InJ-4 items, informational justice-4 items]; collaborative buyer–supplier relationships (CBS) [joint planning-4 items, joint problem joint problem solving-4 items, flexibility to make adjustments-3 items]; social sustainability in post COVID-19 pandemic situation (SUS) [labour rights-4 items, safety and health-4 items, societal responsibility-4 items, diversity practices-3 items, product responsibility-3 items]

**Table 11** Path analysis standardised regression weights, C.R. (t-value), (buyer n = 152; supplier n = 164)

Path	Coefficient ( $\beta$ )	S.E	CR	R <sup>2</sup>
Buyer: results of main effects				
Social sustainability in post COVID-19 pandemic situation (SUS)				0.397
Collaborative buyer–supplier relationships (CBS)- → social sustainability in post COVID-19 pandemic situation (SUS)	0.447	0.09	7.849	
DV: social sustainability in post COVID-19 pandemic situation (SUS)				
	Coefficient ( $\beta$ )	S.E		<i>p</i>
Buyer: results of moderating effects				
Collaborative buyer–supplier relationships (CBS)	0.342		0.06	0.051
Justice (JUS)	0.178		0.08	0.038
Big data analytical intelligence assimilation (BDAIA)	0.204		0.07	0.021
Collaborative buyer–supplier relationships (CBS) justice (JUS)	0.529		0.093	0.018
Collaborative buyer–supplier relationships (CBS) big data analytical intelligence assimilation (BDAIA)	0.562		0.128	0.015
Path				
	Coefficient ( $\beta$ )	S.E	CR	R <sup>2</sup>
Supplier: results of main effects				
Social sustainability in post COVID-19 pandemic situation (SUS)				0.417
Collaborative buyer–supplier relationships (CBS)- → social sustainability in post COVID-19 pandemic situation (SUS)	0.547	0.08	8.841	
DV: social sustainability in post COVID-19 pandemic situation (SUS)				
	Coefficient ( $\beta$ )	S.E.		<i>p</i>
Supplier: results of moderating effects				
Collaborative buyer–supplier relationships (CBS)	0.387		0.07	0.052
Justice (JUS)	0.259		0.09	0.049
Big data analytical intelligence assimilation (BDAIA)	0.198		0.08	0.052
Collaborative buyer–supplier relationships (CBS) justice (JUS)	0.487		0.084	0.019
Collaborative buyer–supplier relationships (CBS)* big data analytical intelligence assimilation (BDAIA)	0.401		0.028	0.017



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