



# The moderating role of market turbulence beyond the Covid-19 pandemic and Russia-Ukraine crisis on the relationship between intellectual capital and business sustainability

Nagwan AlQershi<sup>a,\*</sup>, Roselina Binti Ahmad Saufi<sup>a</sup>, Noor Azizi Ismail<sup>a</sup>,  
Mohd Rosli Bin Mohamad<sup>a</sup>, T. Ramayah<sup>b,c,d,e,f,g</sup>, Nik Maheran Nik Muhammad<sup>h</sup>,  
Mohd Nor Hakim Bin Yusoff<sup>h</sup>

<sup>a</sup> Malaysian Graduate School of Entrepreneurship and Business, University Malaysia Kelantan, Malaysia

<sup>b</sup> School of Management, Universiti Sains Malaysia (USM), Malaysia

<sup>c</sup> Daffodil International University (DIU), Bangladesh

<sup>d</sup> Faculty of Economics and Business, Universiti Malaysia Sarawak (UNIMAS), Malaysia

<sup>e</sup> Fakulti Ekonomi dan Pengurusan (FEP), Universiti Kebangsaan Malaysia (UKM), Malaysia

<sup>f</sup> Department of Management, Sunway University Business School (SUBS), Malaysia

<sup>g</sup> University Center for Research & Development (UCRD), Chandigarh University (CU), India

<sup>h</sup> Faculty of Entrepreneurship & Business, University Malaysia Kelantan, Malaysia

## ARTICLE INFO

### Keywords:

Intellectual capital (IC)  
Market turbulence (MT)  
Business sustainability (BS)

## ABSTRACT

This paper examines the role of Intellectual Capital (IC) and its contribution to Business Sustainability (BS) among Large Manufacturing Firms (LMF) in Malaysia. It seeks to explain the relationship between them under turbulent market conditions. The study used the survey method to collect data from 203 large companies, and the hypotheses were tested using Partial-Least Squares-Structural Equation Modeling. Based on the findings, two dimensions of IC, namely Human capital (HC) and Structural Capital (SC), had a significant effect on business sustainability, but Relational Capital (RC) did not. Also results indicate that Market Turbulence (MT) moderates the relationship between two IC dimensions, HC and RC but not that between SC and BS. The study findings can be used as guidelines by CEOs of LMFs, policy makers and researchers to comprehend positive the influence of MT and IC on BS.

## 1. Introduction

National economies and global markets were severely shocked by an unexpected blow, the emergence of the Corona pandemic in early 2020 (Rajput et al., 2021; He and Harris, 2020; Ioannides and Gyimóthy, 2020). In 2019 economic activity was moving at a rapid rate in most parts of the world, and the global economy was expected to grow significantly (Lourenço and Rua, 2021). However, at the beginning of 2020 many things changed as a result of Covid-19 (De Sousa Jabbour et al., 2020) together with the escalation of trade tensions between the United States and China; both contributed to weakening global expansion led to the emergence of unprecedented turbulence in the markets (Cooray and Palanivel, 2021; Apcho-Ccencho et al., 2021; Wang and Sun, 2021).

The economic losses have been great and have made all countries, whether developed or developing, vulnerable to economic and financial turbulence; and may limit the capacity and effectiveness of political support at a time when it is most needed (Agovino and Musella, 2021; Chen et al., 2021; Lenzen et al., 2020). Even with this support, the economic repercussions of the Covid-19 pandemic are expected to be long term (Hoang et al., 2021; Kanda and Kivimaa, 2020; Jomo and Chowdhury, 2020).

The market turbulence led to severe recessions with permanent repercussions on potential output, through reducing investment rates, eroding the human capital of the unemployed, and interrupting supply chains (Li et al., 2022; So et al., 2021). The long-term damage from the pandemic will be especially severe in economies already experiencing financial crisis, and in energy-exporting countries with the collapse of oil

\* Corresponding author.

E-mail address: [nagwan.ma@umk.edu.my](mailto:nagwan.ma@umk.edu.my) (N. AlQershi).

<https://doi.org/10.1016/j.techfore.2022.122081>

Received 20 March 2022; Received in revised form 23 July 2022; Accepted 25 September 2022

Available online 30 September 2022

0040-1625/© 2022 Published by Elsevier Inc.

prices (Michail and Melas, 2020a, 2020b). On average in emerging markets and developing economies, over the coming years recession may result in an accompanying financial crisis (Alberola et al., 2021; Nemteanu and Dabija, 2021).

Although the world seemed to recover from some of these problems, especially the spread of the virus, the markets are still suffering severe turbulence (Kinatader et al., 2021), which is clearly affecting all governments and organizations, whether large or small firms. There are serious challenges for many countries, with a great deal of uncertainty in the short term, especially as the growth rates of advanced economies approach the limits of their long-term potential (Rebucci et al., 2022; Chudik et al., 2021; Song and Zhou, 2020).

Just as the repercussions from the spread of the Corona virus are being counted, the situation between Russia and Ukraine has emerged. Regardless of their 'position in the tension between Russia and the West over Ukraine, many countries find themselves facing a serious challenge through escalation of the conflict, for example the effect on the world's supply of raw materials and global supply chains (Paul and Chowdhury, 2020; Park et al., 2020; Ghadge et al., 2020).

Russia and Ukraine occupy an important position in the world (Tsygankov, 2015), and it is certain that the war will have very serious consequences for both countries and the rest of the world, not least the disruption that armed conflict has on supply chains; for example, the 2014 annexation by Russia of parts of Ukraine had an impact on the prices of raw materials, resulting in turmoil in the markets (Goncharuk, 2019; Piotrowicz, 2018; Urciuoli et al., 2014; Fellmann et al., 2014).

What makes the situation worse, according to Aljazeera (2022), is that the expected rise in prices as a result of the crisis comes at a time when the prices of raw materials have already reached their highest levels as a result of other conflicts, political grievances and increasing economic collapse.

In another scenario, intellectual capital is recognized as an important and vital ingredient for the success of companies in a competitive environment (Beltramino et al., 2021; AlQershhi et al., 2021; McDowell et al., 2018; Edvinsson, 1997; Sveiby, 1997). The main ingredients of a production-based economy have traditionally been land, labour, capital and physical assets. However, in the present knowledge-based economy, intellectual capital has become more important than physical assets in adding value (Barpanda and Bontis, 2021; Bayraktaroglu et al., 2019). Intellectual capital supports competitive advantage through increased innovation, business sustainability and national economic growth (Massaro et al., 2018). Intellectual capital is at the heart of a company. It relates to an employee's knowledge, "skills, competencies, innovation capability, attitude and intellectual agility. Competence includes skills and education; attitude covers the behavioural dimensions of the employee's work; while intellectual agility is based on innovativeness and solution of business problems" (AlQershhi et al., 2019a). Moreover, intellectual capital reporting leads to the promotion of confidence and pride in the employees, as a higher level reflects a better reputation and proficiency in creating value (Bontis et al., 2018). In this sense, value indicates something that is worthwhile for determining the creation of wealth. Thus, if an organization has superior intellectual capital, it could elicit pride among employees, boost their self-esteem and ultimately motivate them to improve the value and profitability of the firm (Ciambotti et al., 2021; Alvino et al., 2020).

Intellectual capital has been extensively accepted to have a positive influence on firms' business sustainability (Gross-Golacka et al., 2020), with evidence from both service and manufacturing sectors (Xu and Wang, 2018). However, analysis of the relationship between intellectual capital, business sustainability and market turbulence are still scarce, and accordingly this study adopts related theories and frameworks concerning the relationship as recommended by past researchers (e.g., Qiu et al., 2020; De Clercq et al., 2018). The few studies that do exist focused on SMEs rather than large manufacturing firms (Iqbal et al., 2021); this is particularly true when examining the moderating effect of market turbulence on the relationship between intellectual capital and

business sustainability in the Asian context, particularly Malaysia. This study is therefore an attempt to reduce the gap in the literature by testing the proposed model of the relationship between intellectual capital, market turbulence and business sustainability in the context of large manufacturing firms. A manufacturing firm makes use of raw materials and components to develop a finished good that can be directly sold to consumers or to other businesses, making it especially vulnerable in the conditions outlined above.

The remainder of this paper is organized as follows: first, it reviews the related concepts and premises of intellectual capital and market turbulence, and then proposes a model explaining the relationship between these and business sustainability in large manufacturing firms; hypotheses are proposed. The third section explains the methodology adopted. The results are presented and discussed in sections four and five. Finally, the managerial implications based on the results are presented, with recommendations for future research.

## 2. Literature review

### 2.1. Intellectual capital and business sustainability

Recent history has witnessed the importance of sustainability in general and institutional sustainability. Sustaining the planet's resources and energies, and ultimately human existence, requires vigorous institutional efforts (Shi et al., 2019; Hall et al., 2010).

Business sustainability is important as it is the only way for an organization and its resources to persist. In short, business sustainability is a strategy for surviving crises and providing new opportunities (Calabrese et al., 2021; Holliday et al., 2017). It is not surprising that most CEOs view a sustainability strategy as essential for their companies to be competitive in today's world and some argue, will be essential in the future (Charter and Tischner, 2017). The fundamental benefit of sustainability is its competitive advantage for the companies that adopt it as a basic business strategy.

Concern for the sustainability of institutional businesses focuses on all institutions in general and more specifically, the extent to which they have organizational structures capable of playing a pivotal and positive role in achieving the desired success for the companies (Nylund et al., 2021). The primary concern for the sustainability of organizations is to ensure the high performance of the various institutions, whether governmental or non-governmental (Slawinski and Bansal, 2015). One of the most important considerations in business sustainability is that organizations have a vision and realistic goals (Laszlo and Zhezhembayeva, 2017). Without these, many other activities in the organization will not be realistic either. The solution is not to keep trying to maximize profits but to reconsider the goals and vision (Paiola et al., 2021).

Business sustainability, which is a reflection of a firm's success and growth, is defined as the total value created by a firm through its activities. It is the sum of the utilities created for each legitimate stakeholder (Dyllick and Muff, 2016). Tukker and Tischner (2017) observed that business sustainability can be characterized as the firm's ability to create acceptable outcomes and actions. More deeply, business sustainability is a business strategy. Long-term value results from considerations of how a particular organization operates in the ecological, social, and economic environments. Sustainability is also built on the assumption that developing such strategies can extend the life of the company (Epstein et al., 2018). Business sustainability is generally regarded as a multidimensional construct measured using many indicators, including sales and profitability growth, return on investment, market share, new product development, and research and development activities (Dwivedi et al., 2021).

In another scenario, no universally acknowledged definition of intellectual capital has yet been proposed (Chen et al., 2005), perhaps because the concept is still in its infancy. Considering its classification and definition were first proposed only in the late 1990s (Zeghal and

Maaloul, 2010). Nevertheless, researchers refer to the same components, including knowledge, experience and skills of employees, satisfaction and loyalty of employees, customer satisfaction, customer loyalty, reputation of the firm, organizational routines, procedures, systems, culture and creation of value (Asiaei et al., 2020; AlQershi et al., 2020b, 2020a; Giampaoli et al., 2021; Osman and Ngah, 2016; AlQershi et al., 2019b).

Intangible resources are a significant part of intellectual capital, although there may be difficulty in determining them (Molodchik et al., 2019). More specifically, AlQershi et al. (2021) described intellectual capital as the set of intangible knowledge of the organization and its distinctive human capacity; it is the vision, knowledge and experience to address different situations in comparison to competitors, and a significant intangible asset that is utilized for the creation of value, achievement of high performance and realization of the firm's objectives. Zeghal and Maaloul (2010) provided a general definition by describing it as the sum of the entire firm's knowledge that can be used to conduct business and create value. Bratianu (2018) described it as intellectual material – knowledge, information, intellectual property, experience – that can be put to use to create wealth; it is especially important for firms to interact with employees as an asset rather than as a cost for the company, as intellectual capital is a valuable element in the performance of the firm. Other authors go so far as to say that the economic importance of intellectual capital is the main driver of a firm's success (Salvi et al., 2020; Kaawaase et al., 2019).

A significant relationship has been found between intellectual capital and business sustainability, with the former described by researchers as an important and decisive factor for companies to be sustainable (Pedro et al., 2020; Matos and Vairinhos, 2017). Gross-Golacka et al. (2020), using a sample of 1041 Polish SMEs, found a significant correlation between the two, with interaction between the components generating higher value. Toniai et al. (2019) reported a significant relationship in Brazilian firms. However, Massaro et al. (2018) in his study of market trust and developing working contexts, found no significant relationship.

In addition, IC has been classified into sub-categories, according to the literature, most organizations have three types of embedded IC: people, structure and customers (Chatterjee et al., 2022; Onofrei et al., 2019; Lee and Lin, 2019). This study used the same three dimensions because they are comprehensive and strongly related to the main IC components of human, structure and relations. The first dimension, as already noted, is Human Capital (HC), and it has been defined by researchers in a similar way, generally containing the same words, like knowledge, experience and skills of employees (AlQershi et al., 2021). All these can be seen in prior studies, including Kryscynski et al. (2021); Flores et al. (2020); Tran and Vo (2020); Capozza and Divella (2019); Kucharčíková et al. (2018).

HC assets were revealed to significantly impact BS (Garrigos-Simon et al., 2018). Similarly, human resources (level of qualifications and experience of scientists and technicians) significantly influenced BS in Kucharčíková et al.'s (2018) study, and this is supported by Dal Mas (2019) and Xia et al. (2022) (2011), indicating that human capital plays a key role in improving different facets of BS.

It is important for firms to interact with employees as an asset rather than as a cost for the company, as HC is a valuable element in the performance of the firm. The economic importance of HC is the main driver of a firm's success (Piva and Rossi-Lamastra, 2018). Other studies, including Kianto et al. (2017) and Andreeva and Garanina (2016), have claimed that HC may be the most important capital component of IC as it is primarily responsible for developing both SC and RC.

Structural Capital (SC) is the second IC dimension; it refers to processes, systems, procedures and practices of employees (AlQershi et al., 2022b, 2022a). SC is sometimes synonymous with organizational capital, although it actually comprises the institutionalized knowledge and codified experience contained within databases, routines, patents, manuals, structures and similar storage systems (Cleary, 2015). Matos

et al. (2017) said that SC is competitive intelligence, patents, formulae, policies, information systems, organizational culture, etc., resulting from the products or systems the firm has created over time. Similarly, according to AlQershi et al. (2021), SC represents the organization's ability to meet external and internal challenges.

More importantly, SC comprises different elements (Gogan et al., 2015), and is often referred to as the organizational culture, providing a streamlined view of things, decision-making processes and value systems. In sum, it reflects the accrued intellectual resources within the firm (Costa et al., 2014), with the inclusion of knowledge, routines, products, internal procedures, capabilities and components of technology along with intellectual characteristics (Molodchik et al., 2014).

Structure capital is the infrastructure that firms develop to commercialize their human capital and to provides an environment that encourages the human resource to create and leverage its knowledge (Zangouinezhad and Moshabaki, 2009). Effective structure capital is capable of facilitating a good environment that promotes knowledge sharing, collective growth of knowledge, reduces lead times and results in productive individuals (Bontis, 2004). It consists of the entire non-human knowledge storehouse in firms, which encompasses policies, procedures, competitive formula, routine and databases.

Regardless of the influence of HC on SC, the latter exists independently of the former, as evidenced by Benevene and Cortini (2010). According to Chen et al. (2006), the IC disclosure framework contains SC attributes, comprising patents, trademarks, management philosophy, management processes, corporate culture, information systems, networking systems and finance-related aspects. SC is thus among the IC components considered in the present study for the assessment of its potential for value creation. It can be concluded from the literature that organizations' structure capital consists of infrastructure, system policies and procedures.

The third dimension, Relational Capital (RC), refers to the ability of an organization to interact with a wide range of external stakeholders (such as customers, suppliers, competitors, and trade and industry associations) as well as the knowledge embedded in these relationships (Aaltonen and Turkulainen, 2018). AlQershi et al. (2020b, 2020a) defined it as the sum of the entire firm relations that can be used to conduct business and create value – companies.

Previous studies investigated the relationship between the RC and sustainability. For instance, Dal Mas (2019) found a significant relationship between these variables. Zhang et al. (2022) investigated the impact of RC among manufacturing in business sustainability in China, and again found a significant relationship. Han and Li (2015) argued for and illustrated the relationship between RC and performance and sustainability, specifying boundary criteria and mechanisms in the relationship viewed from a knowledge-based dynamic capability perspective. The authors found RC to have positive effects on performance and sustainability, and knowledge-based dynamic capability to mediate but not moderate the RC-innovative performance relationship in a partial manner.

Moving on to another related study, Dzenopoljac et al. (2016) investigated whether RC contributes to the country's ICT sector. The study examined the level of effect of RC and its major components on ICT firms' performance and sustainability and compared it to the effects on their physical and financial capital. The sample consisted of 13,989 ICT firms in Serbia for the years 2009–2013. The study adopted the value-added intellectual coefficient (VAIC) to measure the contribution of RC to the creation of value and found that with firm size and leverage as control variables, capital employed efficiently was the only one to have a significant effect on financial performance and sustainability.

Knowledge assets comprise three intangible asset categories: employee competencies, internal structure and external structure (Obeidat et al., 2017). Other authors refer to human, structural and relational capital. For example, an investigation into Ugandan firms by Bananuka et al. (2021) revealed human and relational capital to have a significant relationship with sustainability, but not structural capital.

Similarly, the three primary elements of intellectual capital and their relationship with business sustainability were investigated among 123 SMEs in Indonesia (Srikalimah et al., 2020). The authors employed a two-step analysis (factor and regression) to determine the answers to the research questions, and found a positive relationship. The relationship was also investigated by Jordão (2017) in Brazilian firms, using data spanning the period 2005 to 2014; the author contended that intellectual capital improves the profitability and corporate return of these companies and contributes to improved performance.

The present study considers the three dimensions of intellectual capital separately, and offers the following hypotheses:

**H1a.** There is a significant relationship between human capital and business sustainability.

**H1b.** There is a significant relationship between structural capital and business sustainability.

**H1c.** There is a significant relationship between relational capital and business sustainability.

## 2.2. Market turbulence as moderator

Market turbulence indicates a situation in which there is disruption to all economic and commercial operations, whether for governments or private companies, which affects supply and demand chains on a regular basis and may cause great economic difficulties (Senbeto and Hon, 2020; Pudjiarti and Hutomo, 2020). It represents a state of severe weakness in the ability of markets to respond to change and often occurs as a result of an unexpected event or group of crises that harm the economy in general (Wang et al., 2015).

Organizations are under great pressure when markets are experiencing turbulence, instability or sharp changes in operation (Tsai and Yang, 2013). In many cases, organizations may resort to taking measures aimed at helping to restore stability to the markets, their programmes and plans, but the effectiveness of these measures is often limited (Ait-Sahalia et al., 2012). Times of crisis, such as the spread of the coronavirus in 2020, may push organizations and governments to take quick decisions, incurring heavy losses (Dwivedi et al., 2020; Cortez and Johnston, 2020).

The market turbulence associated with the 2020 pandemic has had wide-ranging and severe effects on markets globally (Conlon et al., 2020); the decline in demand and the lack of factory activity had a tremendous impact on the demand for goods, and in 2020 many researchers predicted that growth in the demand for manufactured goods would be at its lowest level for decades (Michail and Melas, 2020a, 2020b).

A turbulent market is characterized by rapid and unplanned changes, affecting the thinking of customers and changing their priorities (Senbeto and Hon, 2020). Organizations make great efforts to read the future and predict the changes that may occur in the markets, in order to prepare for change and avoid loss (Kachouie et al., 2018). As a result, we find companies striving to benefit from their human capital, which may be the only solution in facing crises and market turbulence. Human capital involves thinking and skills to analyze the current situation by reading the past, understanding the present and anticipating the future (Horchani and Zouaoui, 2021; Caputo et al., 2019).

The ultimate goal of any institution is to achieve profits, expansion and sustainability, which is determined by increasing the market share and avoiding losses that frequently occur as a result of through turbulence (Larbi-Siaw et al., 2022a, 2022b; Qiu et al., 2020; De Clercq et al., 2018). Thus, organizations can achieve sustainability by stabilizing their position in the market. Companies that follow a crisis management strategy prefer a collective framework for decisions and choices in response to a crisis (Booth, 2015).

The goal of strategy is to develop a plan to overcome crises, the first step in crisis management planning (Mattera et al., 2021). Companies

facing market turbulence and crisis find it difficult to protect themselves from market fluctuations that affect their market share, and therefore are forced to be vigilant in anticipating change in the market (Huang et al., 2020; Hilmersson, 2014). This dynamic emphasizes the necessity of searching and obtaining human talent with a high level of skills, one aspect of intellectual capital; the creativity and success or failure of an organization depends on intellectual capital before anything else (Li et al., 2020; Javalgi and Todd, 2011).

The relationship between market turbulence and business sustainability has been studied by a number of researchers, including Larbi-Siaw et al. (2022a, 2022b) who focused on eco-innovation and its effect on business performance sustainability, with turbulent market conditions tested as a moderating variable 683 responses were gathered from manufacturing firms in Ghana, and market turbulence was found to enhance the positive impact of product and organization eco-innovation on economic performance. Similarly, Ch'ng et al. (2021) looked into the impact of ecologically friendly innovation practices on business performance sustainability, with the moderating role of market turbulence. The empirical study obtained data from 109 local and foreign-owned technology companies in Malaysia. Market turbulence was found to be involved in increasing the positive effect of eco-organizational innovation on social performance.

In a related study, Iqbal et al. (2021) found that market turbulence had a significant moderating effect on the relationship between innovation and sustainable development. Other related studies include that of Rhee et al. (2020) which adopted two-wave panel data from 301 South Korean manufacturing firms to examine the relationship between high-performance work practices and organizational innovativeness, with market turbulence as the moderating variable. There was a positive and significant association between the two variables that was enhanced by the introduction of high market turbulence. They also found market turbulence had a significant moderating effect on the relationship between sustainable leadership and frugal innovation.

A sample of 500 Chinese manufacturing firms was used by Wang et al. (2015) in their examination of three internal capabilities (innovation, information and relational capabilities) as external collaboration strategy facilitators. Their findings indicated that the enabling effects of innovation and information capabilities were positively moderated by market turbulence. On the other hand, relational capital had a positive effect on the effectiveness of collaboration notwithstanding the level of the market turbulence.

Added to the above studies, intellectual capital-sustainability and performance studies also evidenced significant association between firm performance and intellectual capital, reported by Gross-Golacka et al. (2020), Dal Mas (2019) and Massaro et al. (2018). Other studies of the same calibre, however, reported weak or negative intellectual capital-firm performance relationship (e.g., Abdulsalam et al., 2011; Firer and Williams, 2003; Zeghal and Maaloul, 2010).

Overall, literature reports contradictory results about the intellectual capital-business sustainability relationship. Thus, this study proposes the following hypotheses for testing:

**H2a.** Market turbulence moderates the relationship between human capital and business sustainability.

**H2b.** Market turbulence moderates the relationship between relational capital and business sustainability.

**H2c.** Market turbulence moderates the relationship between structural capital and business sustainability.

## 3. Methods

Questionnaire design is a significant phase in any research, based on two primary objectives: first, it assists in capturing the number of targeted respondents; and second, it assists in minimizing and steering clear of potential errors in measurement (Brace, 2018). Questionnaire



development and design are considered the most challenging phases in designing a survey (Kumar, 2018). Two major issues have been highlighted: presentation and content. The questionnaire content should match the study questions and objectives, supported by the discussion with experts and a thorough review of the literature. An effective questionnaire format reflects the issues in sequential questions, response selection and the wording of the questions (Sekaran and Bougie, 2016). The questionnaire was also reviewed by academics to make sure that the wording was clear and the content validity established.

Responses to questions may be either closed or open-ended. In this study, the close-end format was chosen as it matches the study and the nature of the questions. This type of format has several advantages, including quicker response of respondents and easy coding of information for analysis of data in the later research stages (Sekaran and Bougie, 2016).

Primary data was collected from the CEOs of Malaysian large manufacturing firms, using a survey questionnaire. The administration of the questionnaire copies must be effective and organized in order to heighten the response rate (Cunningham et al., 2015), and as such, self-administration of the questionnaire was adopted, where responses were recorded on a numerical scale.

Despite the good rate of response and higher probability of response bias in self-administered questionnaires, the categorization of variables, wording of items and appearance of the questionnaire all work towards mitigating such bias and increasing the rate of response. Also, self-administered questionnaires enable respondents to take their time in providing their responses (Sekaran and Bougie, 2016).

Questionnaire administration calls for the consideration of several measures to improve the response rate and this is quite significant as a low rate of response could lead to biased or ungeneralizable findings (Patten, 2016). The response rate is described as the percentage of respondents that return the questionnaires, while the quality of responses is the level of data completeness and usefulness.

Sekaran and Bougie (2016) presented different procedures for delivering a questionnaire in order to increase the level of the respondents' interest, and these include the questionnaire's attractiveness, precision and professionalism. In addition, complex wording and long sentences must be avoided, with the items conforming to the scope and objectives of the study. A 25-day period was provided to the respondents for questionnaire completion, after which non-response was followed by visits, reminders and phone calls to maximize the rate of response (Fink, 2015).

All firms in the sample were approached and the questionnaire was self-administered, with details as reported above. The researcher established a connection with the firms to sort out any ambiguities and to increase the rate of response. Data was collected over a 4-month period from all the sample units.

In adopting a quantitative study, the researcher made sure that data could be translated into significant outcomes that are important for the development of the research, as explained by Nardi (2018).

In this study, a cross-sectional mail- and hand-distributed survey was adopted to obtain data from Malaysian large manufacturing firms, in different sectors. This type of cross-industry sample was opted for to strengthen the findings' generalizability, with the unit of analysis being the organization's CEOs, from whom data was gathered. They are chosen since they are involved directly or indirectly in the sustainability activities of their organization, and their knowledge, skills and experience make their perceptions more valid. The respondents are required to answer an in-depth questionnaire on the performance of their firms. Based on the sample size, Partial Least Squares-Structural Equation Modeling (PLS-SEM) analysis was deemed to be suitable.

In addition, the study used a random sampling method for selecting firms from the directory of the Federation of Malaysian Manufacturers (FMM Directory, 2019) listing of 661. Following the sample requirement table established by Krejcie and Morgan (1970), data was required from 248 sample units; given the poor response rate of surveys, 365

questionnaire copies were distributed. Of these, 229 were retrieved and 203 were deemed useable for data analysis.

First, non-response bias was tested through the wave analysis technique, whereby the early and late response waves of the returned surveys were compared. This method has its basis in Groves and Peytcheva's (2008) premise that the late respondents' opinions represent those of non-respondents. However, the *t*-tests resulted in a lack of statistically significant differences between early and late wave groups, indicating no bias issue in the responses. The responses were gauged using a 5-point Likert scale and the data analysis method used was the Partial Least Squares-Structural Equation Modeling (PLS-SEM). Lastly, measurement items in the questionnaire were adopted from past studies, in particular Senbeto and Hon (2020) and Peters et al. (2019) for market turbulence, Hassan et al. (2021) and Yong et al. (2020) and Li et al. (2020) for business sustainability and Sharabati et al. (2010) for intellectual capital. See Appendix 1.

The first section of the questionnaire requested respondents to provide their demographic details (i.e., working experience, gender, age, and level of education (refer to Table 1).

#### 4. Results

##### 4.1. Assessment of common method variance (CMV)

In the social science, research methods are combined with the common method bias test using a single source and single point of time data collection method (Podsakoff et al., 2003). The impact of CMV on the constructs of the study was estimated by Harman's (1976) one-factor test, as suggested by Podsakoff et al. (2003). All the items were thus subjected to principal component factor analysis, which showed that five factors explained the cumulative effect at the level of 76.08 % of the variable, the largest factor explaining 29.42 % of total variance; this is acceptable based on Podsakoff et al.'s (2003) statement that the explained variance by a single factor should remain below 50 %.

##### 4.2. Outliers

An outlier is a data point representing an unusually low/high/distinct observation compared to the remaining ones (Domingues et al., 2018). Such data points can affect the findings and lead to errors in sample generalization, unless the same outliers are present in the population. Domingues et al. (2018) suggest the use of Mahalonbis distance (D2) to identify and address any outlier issue; this study used it to check for multivariate outliers, and based on the four study variables, the chi-square threshold is 74.83 with *p* = 0.001, with the highest D2 value being 65.40 in SPSS; this indicated the absence of multivariate outliers, which made it suitable to all the cases in the multivariate analysis (*n* = 203).

**Table 1**  
Demographic characteristics of the respondents.

Age	1 = <26	0
	2 = 26 to 30 years	3
	3 = 31 to 35 years	26
	4 = Above 35	174
Working experience	1 = <5 years	2
	2 = 5 to 10 years	71
	3 = 11 to 20 years	93
	4 = Above 20 years	37
Gender	1 = Male	179
	2 = Female	24
Education	1 = School certificate	0
	2 = Diploma	0
	3 = Degree	122
	4 = Postgraduate degree	79
	Others	2

### 4.3. Discriminant validity

Discriminant validity is the level to which a specific latent construct is different from the remaining constructs (Henseler et al., 2009). The discriminant validity test results obtained from the HTMT criterion are presented in Table 2. The HTMT values exceed the pre-identified threshold (0.81) (Henseler et al., 2009) showing discriminant validity among the compared latent variables. On the basis of these results, the CV and Rand DV of the proposed study model are acceptable.

### 4.4. Non-response bias

This type of bias refers to errors likely to appear when estimating the population characteristics based on the survey data, and can result in the under-representation of distinct types of respondent. Such bias occurs when non-respondents differ from the other respondents (Sala and Lynn, 2009). In other words, non-response bias is described as the differences between the non-respondents' and respondents' answers (Studer et al., 2013), extrapolated from a time-trend estimation.

In this study, the early responses received were compared with the late responses, as late respondents tend to have characteristics in common with non-respondents. Following Lie et al.'s (2019) approach, *t*-tests generated no statistically significant differences between early-wave and late-wave groups, which mean non-response bias is not an issue.

### 4.5. Data analysis

The PLS models involve a two-step approach. The first step is assessment of the measurement model to determine the individual items' reliability, internal consistency, content validity, convergent validity and discriminant validity. The second step tests the structural model to determine the consistency of causal relationships in the data.

### 4.6. Assessment of measurement model

Three types of validity need to be established, namely content, convergent and discriminant validity. Content validity was already established as the items were adopted from validated scales. Cronbach's alpha was used to establish convergent validity and AVE to establish composite reliability, with 0.70 and 0.50 cut-off values respectively (Fornell and Larcker, 1981). The study found Cronbach's alpha values ranging from 0.701 to 0.849, and composite reliability values from 0.803 to 0.891, while AVE values ranged from 0.507 to 0.599, together establishing the reliability of the adopted measures. Except for two items, the constructs' factor loadings to the indicators were found to be above 0.60 (0.619–0.905), establishing individual reliability; the two items with unacceptable loading were dropped from the model. Table 4 present the values that confirm the convergent validity of the constructs.

Finally, discriminant validity, described as the level to which a particular latent construct differs from its counterpart constructs (Henseler et al., 2015), can be confirmed through the use of AVE (Fornell and Larcker, 1981), in which the correlations of the latent constructs and the squared AVE are compared. This validity can also be established using the criterion proposed by Alqershi et al. (2019c), whereby a comparison is made between the indicator loadings and other

**Table 2**  
Discriminant validity (HTMT ratio).

Construct	MT	HC	SC	RC	BS
MT					
HC	0.437				
SC	0.108	0.149	0.151		
RC	0.109	0.161	0.169	0.171	
BS	0.589	0.320	0.117	0.123	0.142

reflective indicators in the cross-loadings table. Fornell and Larcker's (1981) criteria validity were applied here with the results presented in Tables 3 and 4; it is evident that the latent AVE variables exceeded the required value of 0.50, and the AVE square roots were higher than the latent variables' correlation values, establishing discriminant validity. Discriminant validity was also confirmed by comparing the indicator loadings with cross-loadings (Henseler et al., 2015) (refer to Table 3).

### 4.7. Assessment of structural model

After the measurement model's validity was established, the structural model was assessed using the standard bootstrapping procedure, with 5000 bootstrap samples and 203 cases to identify the significance of the path coefficients. The guidelines established by Hair et al. (2017) were followed, and the structural model's full estimates are presented in Table 5.

Based on the values in Table 5, two IC dimensions were found to have a significant relationship with BS: HC ( $\beta = 0.528, t = 3.139, p < 0.001$ ) and SC ( $\beta = 0.452, t = 2.628, p < 0.000$ ), supporting hypotheses H1a and H1b. However, the proposed relationship between RC and BS was not significant ( $\beta = 0.452, t = 2.628, p < 0.000$ ), so H1c was rejected.

### 4.8. Testing moderation effect

In addition to the direct effects, this study tested for a moderating effect of MT on the relationships between each of the IC dimensions and BS, using PLS-SEM. Considering the accuracy of outcomes obtained using the product term approach and the group comparison approach evidenced by Henseler and Chin (2010), the former test was adopted. It required the development of product terms between the latent independent construct indicators and the latent moderating variable indicators, as dictated by the guidelines established by Lowry and Gaskin (2014). MT was found to have a moderating effect on the relationship between HC and BS ( $\beta = 0.204, t = 2.406, p < 0.000$ ) and between RC and BS ( $\beta = 0.268, t = 3.362, p < 0.002$ ), supporting hypotheses H2a and H2b. However, MT did not moderate the relationship between SC and BS ( $\beta = 0.031, t = 0.793, p < 0.681$ ), so H2c was rejected. See Table 6 and Fig. 1.

In addition, all the variables'  $R^2$  values were higher than the minimum value established by Chin (1998): see Table 7.

Finally, the effect size ( $f^2$ ) of individual variables was calculated, using Cohen's (1988) formula from which 0.02 is weak, 0.15 is moderate and 0.35 is strong effect size:

$$f^2 = \frac{R^2 \text{ included} - R^2 \text{ Excluded}}{1 - R^2 \text{ included}}$$

Table 8 presents the effect size ( $f^2$ ) values for the relationships between IC on BS, and MT on IC and BS.

To summarize, the measurement model constructs were confirmed through PLS-SEM and all met the validity and reliability constructs measured by Cronbach alpha and AVE. The PLS analysis was then used to examine the independent-dependent variables' relationships; four of the six hypotheses were supported, with high explanatory power amounting to 57 %, indicating the sufficient explanation of the model for the factors' influence over BS.

**Table 3**  
Fornell-Larcker criterion.

	MT	HC	SC	RC	BS
MT	<b>0.784</b>				
HC	0.163	<b>0.732</b>			
SC	0.453	0.320	<b>0.749</b>		
RC	0.318	0.471	0.238	<b>0.726</b>	
BS	0.491	0.328	0.617	0.051	<b>0.763</b>

Bolded values are square root of the Average Variance Extracted.

**Table 4**  
Loadings, composite reliability and average variance extracted.

Constructs	Items	Loadings	Cronbach's alpha	rho_A	Composite reliability	Average variance extracted (AVE)
	MT1	0.841	0.826	0.839	0.808	0.568
	MT2	0.783				
	MT3	0.806				
	MT4	0.634				
	MT5	0.612				
	MT6	0.788				
	HC1	0.672	0.849	0.912	0.891	0.599
	HC2	0.691				
	HC3	0.905				
	HC5	0.772				
	HC6	0.736				
	HC7	0.649				
	HC8	0.748				
	SC1	0.653				
	SC2	0.682				
	SC3	0.783				
	SC5	0.852				
	SC6	0.901				
	SC7	0.816				
	SC8	0.672				
	RC1	0.746	0.806	0.816	0.829	0.527
	RC2	0.819				
	RC3	0.840				
	RC4	0.821				
	RC5	0.873				
	RC6	0.703				
	RC7	0.845				
	RC8	0.613				
	BS1	0.791	0.701	0.827	0.803	0.507
	BS2	0.661				
	BS3	0.704				
	BS4	0.625				
	BS6	0.792				
	BS7	0.770				
	BS8	0.619				
	BS9	0.801				
	BS10	0.892				
	BS11	0.751				

**Table 5**  
Structural model (direct).

	Std. Beta	Std. Dev	t-Values	p-Values	Decision
HC -> BS	0.528	0.061	3.139	0.001	Supported
SC -> BS	0.452	0.118	2.628	0.000	Supported
RC ->BS	-0.314	0.091	1.016	0.518	Not Supported

**Table 6**  
Structural model (moderating effects).

Relationships	Std. Beta	Std. Error	t-Values	p-Values	Decision
(HC*MT) ->BS	0.204	0.093	2.406	0.000	Supported
(SC*MT) ->BS	0.031	0.061	0.793	0.681	Not supported
(RC*MT) ->BS	0.268	0.041	3.362	0.002	Supported

**5. Discussion**

The beginning of 2020 heralded widespread lockdowns preventing activities of both public and private entities along with the cancellation of gatherings and events in an effort to contain the spread of the Covid-19 pandemic. Large-scale travel restrictions were imposed, with closures and social distancing becoming an everyday part of consumers' and producers' lives and an overall significant effect on world trade and market fluctuations.

At a time when economies were at their most fragile, the Covid-19 pandemic made the situation even worse. Although the full magnitude of the impact, both human and economic, will not be accurately determined soon, the losses are bound to be critical. The present

macroeconomic vulnerability's results in market and national susceptibility to economic and financial turbulence, limiting the effectiveness of policies intended to provide support. Even with support, repercussions from the pandemic on the economy will be felt in the long term.

The economies of emerging markets and developing nations are likely to be affected especially badly, particularly those with weak healthcare systems, those largely dependent on trade, tourism or remittances from other countries or on the export of primary commodities, and those that are already financially weak. Emerging markets and developing economies are facing higher levels of debt than any seen prior to the global financial crisis, increasing their vulnerability to financial turbulence.

This study makes several contributions to theory in terms of the relationships between intellectual capital, market turbulence and business sustainability; more specifically, based on the findings, there is a significant relationship between human capital and business sustainability, similar to that of past findings, supporting the importance of human capital (Hamadamin and Atan, 2019; Kucharčíková et al., 2018). While human capital may be the most crucial element of intellectual capital, leading to superior performance and sustainability; structural capital was also found to have a significant relationship with business sustainability. On the other hand, no significant relationship was found between relational capital and business sustainability perhaps because of the requirement for supplier and customer interaction could not readily be met during the pandemic. This finding confirms that reported by Yaya et al. (2018), who indicated a negative relationship between relational capital and sustainability in light of decisions to enter foreign markets, especially during periods of crisis.

According to Iqbal et al. (2021) and Rhee et al. (2020), market

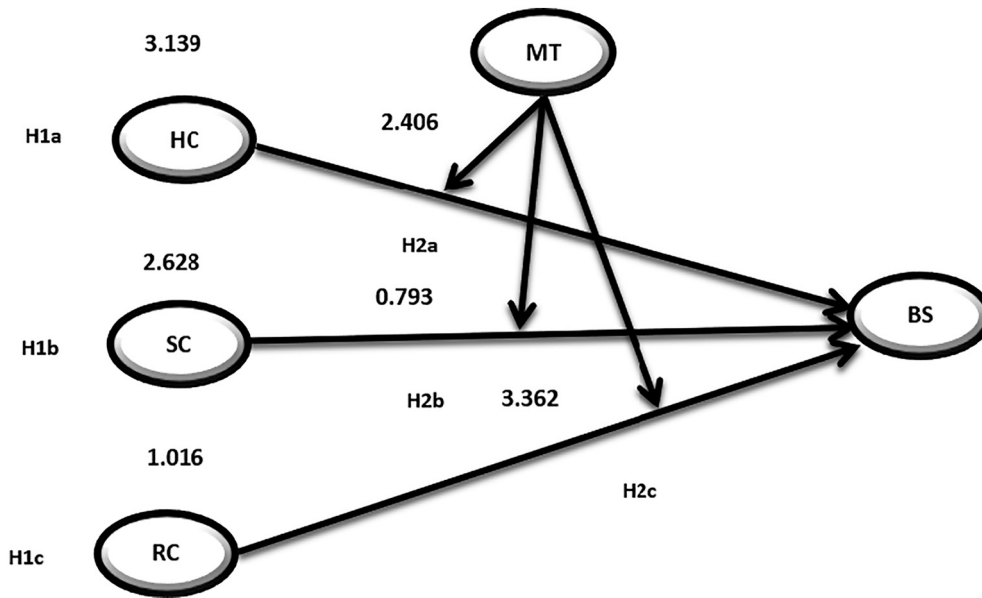


Fig. 1. Results.

**Table 7**  
Variance explained in the endogenous latent variable (R<sup>2</sup>).

	R Square
HC	0.132
SC	0.109
RC	0.124
MT	0.086
BS	0.507

**Table 8**  
Effect size (f<sup>2</sup>).

Constructs	F-Values	Effect size
HC	0.007	None
SC	0.068	Small
RC	0.004	None
MT	0.061	Small

turbulence moderates the relationship between intellectual capital and performance. This held true in our study, although the association of individual dimensions of intellectual capital (human and relational) with business sustainability was found to be moderated by market turbulence at different levels. Such significant moderating effects can be juxtaposed to actual difficulties faced by firms in expected demand and the need for accurate predictions in order to react to dynamic changes in the market. In this regard, the value of human capital is more critical in ensuring collaboration and in managing the relationship with customers, while enhancing the market situation forecasts to avoid turbulence. The effect of relational capital on effective collaboration is at an equal level in markets, regardless of the level of turbulence, and is thus meaningful in differentiating capabilities that have varying impacts on collaboration under different market conditions. The simple slope analysis results indicate that with highly turbulent markets, a firm's intellectual capital has the greatest positive effect on business sustainability. Nevertheless, the effect on sustainability of investment in human capital, as well as the other dimensions of intellectual capital, may become negligible in the face of high turbulence.

Moreover, although the direct relationship of human and structural capital with sustainability was found to be higher in times of greater

market turbulence, unlike relational capital, market turbulence can be said to affect the relationship between intellectual capital and business sustainability. This finding supports those of [Chen et al. \(2016\)](#) and [Santos-Vijande and Álvarez-González \(2007\)](#), who found resources to be experiential when linked to performance during times of market turbulence. In other words, during high market turbulence, intellectual capital functions more strongly to mitigate risks. Nevertheless, polarization affects the level of mitigation of risk through human capital. In markets with low turbulence, the human dimension is enhanced and risk to the firm is reduced. Regardless of high/low turbulence conditions, intellectual capital always mitigates risk, with an emphasis on low market turbulence.

The result indicates that MT supports the significant relationship between IC and BS, especially important for manufacturing companies. This is particularly true in enhancing innovation and productivity and in adopting proactive methods to seek resources and to enter into partnerships. In addition, the results of our study demonstrate the importance of human capital to create sustainability for organizations, which leads to the sustainability of their success. Organizations must pay great attention to developing their human capital by providing their employees with the latest means of education and training, and it must be understood that human capital is an investment that will generate profits by having qualified, productive and competitive employees to achieve a high position for the company. On the other hand, if the perspective of human capital is broadened, it will even be possible to understand the impact of this term in terms of increasing the market share.

In the current business environment, developments have led to the sustainability issue, significant for all organizations as sustainability brings about survival and thriving. New challenges faced by the BS of organizations, particularly manufacturing companies, urge them to consider economic and commercial dimensions in their management strategies. In fact, a majority of organizations have adopted the IC philosophy in order to achieve BS, enabling them to perform better than their rivals and to achieve market sustainability. IC adoption also leverages changes in the market and its mechanisms.

Lastly, the results show that in the past, market turbulence is regularly experienced, although over the last 3 years or more a tranquil market prevailed, characterized by low volatility, although it is a natural instinct to respond to instant turbulence in the market. Such an instinct is not only limited to periods of drawn-out turbulence but sudden



turbulence could also incur insurmountable costs. Based on other studies, short-term market turbulence is impossible to predict, and this holds true for sudden turbulence that may extend over the long term.

Inevitably, market turbulence is accompanied by considerable attention to economic statistics, analysis of government economic policies and their effects on the markets; it is natural to attempt to logically predict economic developments for investments. However, predicting economic conditions is difficult, and trend-based forecasts are frequently erroneous. With unpredictable market turbulence, the general market movements are not interrupted to the same extent.

## 6. Theoretical implications

This paper contributes to theory in several ways, specifically concerning the relationships among intellectual capital, market turbulence and sustainability in the context of large manufacturing companies in Malaysia. Empirically, the relationships proposed in the research framework highlight and support significant direct and moderating effects. The study supports the major role of market turbulence in moderating the intellectual capital-business sustainability relationship in our context. It also contributes to the literature by examining the set of variables in an Asian country, Malaysia.

The findings pave the way to investigating business sustainability further, because past studies have been limited to the direct effect of intellectual capital on business sustainability; the present study is therefore pioneering in looking into the indirect relationship between the two constructs through market turbulence as the moderating variable.

The study's concentration on large manufacturing firms in Malaysia is significant as intellectual capital is considered as a tool to obtain and maintain sustainability among businesses at a global level. In our context, it has been insufficiently examined in the face of market turbulence, making this study an attempt to reduce the literature gap.

The literature on market turbulence is also extended, especially in connection with intellectual capital, business sustainability and the relationships among the three. It has been proposed that effective intellectual capital stands out in some industries more than in others (Alqershi et al., 2021) in the present study, specific results for the dimensions of intellectual capital and other variables were presented, highlighting the differences in the major issues among large manufacturing firms in Malaysia.

The study findings also show that the one-way relationship between relational capital and business sustainability is weaker than it was believed to be (e.g., Alqershi et al., 2021); furthermore, only two of the proposed moderating relationships were supported, indicating the further need to support intellectual capital practices and processes among firms.

Intellectual capital is undeniably at the heart of knowledge, applied experience, technology and customer relationships in the organization, with professional skills representing the firm's competitive edge over its market rivals. In other words, its importance for business sustainability should be acknowledged and integrated into the research framework to raise awareness of its significance when considering market opportunities and skilled human resources. It is crucial for both CEOs and management to comprehend the potential for their firms' growth through enhancement of their intellectual capital.

Finally, most of the studies on the effect of market turbulence on large manufacturing firms have been carried out in the US and Europe, largely ignoring the Asian (and African continents, an omission that has been partially rectified by this study.

## 7. Managerial implications

This study can function as guidelines to management, policy makers and CEOs as to the opportunities from intellectual capital and the challenges of market turbulence. Based on the results, an organization

that ignores the former may be challenged by the presence of the latter. Nevertheless, the study does not suggest isolating IC activities, but highlights the fact that to achieve sustainability and superior performance its activities should be incorporated in the day-to-day business and given the importance they deserve. By promoting such an environment, employees are encouraged to propose new ideas and experimentation based on their own skills, even at the risk of failure to be accepted.

The current Covid-19 pandemic has brought about considerable shocks to management and businesses, with broken supply chains disrupting production, and demand being reduced through consumers' and businesses' reluctance to spend.

In more detail, viewed from the supply side, there is direct decrease in the labour supply because of the health issues, particularly among breadwinners. A serious effect on economic activity was experienced because of the efforts to confine the pandemic, but adopting these measures led to decreased capacity for production. Additionally, supply-chain dependent firms were unable to receive required parts and resources, both from domestic and international sources. This held true for Malaysia, a significant intermediate goods suppliers to other countries. The turbulence has been felt on other firms' complementary processes and the disruptions added to the rising business costs, reducing productivity, and in turn, minimizing economic activities.

Viewed from the demand side, there was a notable decline in the level of spending because of losses in income, concern about the contagion and through uncertainty about risks. Companies dismissed workers as they were not making enough to cover their salaries. This severely affected specific sectors, like Malaysian tourism and hospitality, while adding to the negative perceptions of consumers and businesses and leading to lower demand, reduced spending and investment, in a vicious circle of business closures and loss of employment.

Practical contributions of the study include providing insight into the significant direct and indirect relationships among the examined constructs. The empirical findings form practical recommendations to the relevant stakeholders. CEOs, for instance, are encouraged to address market turbulence and strengthen their human, relational and structural capital to maintain sustainability. This entrepreneurial orientation can resolve market turbulence and enhance business sustainability, meaning that CEOs have to concentrate on promoting high-quality training to workers. As for policy makers, they are urged to adopt strategic entrepreneurial orientation in order to be prepared to face market turbulence.

In addition, IC encourages a firm to innovate and use skills and knowledge, supporting the organization especially in the market place. Such skills are especially necessary if organizations are to contend in highly competitive markets. Introducing new skills to support sustainability requires investment in the internal R&D and employee training; this should improve their creative process. Manufacturing firms must also proactively explore external and internal human wealth, for instance participation in technical workshops, forming strategic partnerships with institutes to exchange experience and knowledge.

The study contributes to practice by shedding light on the significant relationship among the study variables and the moderating constructs. The empirical results contribute by forming practical recommendations to stakeholders. Specifically, CEOs and managers are made aware of the implications of their commitment to MT and IC when it comes to the sustainability of manufacturing firms.

The empirical findings of this study reveal that the HC and SC, significantly relates to the BS of firms. This shows that large manufacturing managers have to be more focused on promoting HC and SC to enhance their BS. With regards to policy makers, this study highlights the need for their assurance of entrepreneurial orientation that could only lead to enhanced BS.

This study contributes in practice by outlying the implications for IC practices among large manufacturing firms in Malaysia. Evidence points to the fact that IC significantly relates to the BS of large manufacturing firms. Thus, firms' CEOs and leaders have to show greater concern for IC

in attempting to enhance BS. In line with this, policy makers should place more stress on IC to resolve low BS among Malaysian manufacturing firms.

Lastly, this study provides an outline of the implications for intellectual capital practices among Malaysian large manufacturing firms, with evidence showing that its dimensions have significant relationships with sustainability. That is, CEOs need to consider intellectual capital in relation to their sustainability in business, while policy makers need to emphasize it in resolving market turbulence and its effects on large manufacturing firms.

## 8. Recommendations, limitations and future studies

As the Covid-19 pandemic gradually subsides, policy makers need to adopt extensive reform initiatives to support their institutions and frameworks, leading to robust growth and improving the long-term perspective. Global emergence from the pandemic calls for strengthening preparedness, prevention and response methods, in anticipation of the next one. While international response has had some success in confining the spread of the virus, expansion of healthcare capacity needs cooperation and coordination of international policies.

In the context of businesses, disruption to supply and demand can focus on financing, wage support and tax relief to assistant businesses to meet their commitments and maintain their market status.

Several government measures could be adopted, including:

- Extending deadlines of payment of corporation tax in the worst affected areas, and extending Wage Supplement Fund coverage to support workers who have been laid off;
- Subsidizing wages for small businesses, increasing labour welfare subsidies and temporarily cancelling restrictions on social security payments from the enterprises;
- Providing support to low and middle-income organizations with insufficient resources to meet expenses (e.g., employees' wages);
- Temporarily increasing unemployment insurance for laid-off employees by extending its period, increasing benefits, or easing conditions for eligibility. Family leave and sickness should be funded, allowing ill workers or their caregivers to stay at home without worrying about being laid off during the pandemic;
- Working on implementing measures for low-skilled, low-paid workers and other vulnerable sectors of the population;
- Allowing Central Banks to maintain liquidity for commercial banks and firms, in order that loans can be granted to SMEs, which may be unable to survive turbulence in the market.
- Focusing on vulnerable sectors and creating new job opportunities in fast-developing sectors.

In addition, any generalizability of the findings is limited, but would pave the way for future exploration. The first limitation concerns the Malaysian sample, because according to Alqershi et al. (2021), the organizational practices applied to enhance intellectual capital may vary from one country to another. Future studies might examine how intellectual capital practices are leveraged in the face of market

turbulence for business sustainability in different countries and contexts, with some cross-cultural comparison.

The second limitation is the adoption of a cross-sectional research design that fails to reflect lag or long-term effects in the relationships investigated here; future studies should instead adopt a longitudinal approach.

The third limitation relates to the moderating effect of market turbulence on the intellectual capital-business sustainability relationship; future studies might explore causal effects of market turbulence on other aspects, such as innovation capital.

Fourth, the study sample is confined to large manufacturing firms, but other economic sectors, such as service industries, could be examined in future studies to enrich the literature and form a basis for comparison.

Finally, the study's respondents were CEOs, with the analysis conducted at the organizational level. Hence, future studies might analyze other study variables at group or individual levels.

## CRediT authorship contribution statement

Please indicate the specific contributions made by each author (list the authors' initials followed by their surnames, e.g., Y.L. Cheung). The name of each author must appear at least once in each of the three categories below.

### Category 1

Conception and design of study: N. Alqershi; RA Saufi; N. M. N Muhammad.

acquisition of data: M. N. H. B Yusoff; R. Thurasamy.

analysis and/or interpretation of data: R. Thurasamy; NA Ismail

### Category 2

Drafting the manuscript: N. Alqershi; NA Ismail; MM Rosli.

revising the manuscript critically for important intellectual content: MM Rosli; N. Alqershi.

### Category 3

Approval of the version of the manuscript to be published (the names of all authors must be listed):

N. Alqershi; RA Saufi; NA Ismail; MM Rosli; R. Thurasamy; N. M. N Muhammad; M. N. H. B Yusoff.

## Data availability

Data will be made available on request.

## Acknowledgements

All persons who have made substantial contributions to the work reported in the manuscript (e.g., technical help, writing and editing assistance, general support), but who do not meet the criteria for authorship, are named in the Acknowledgements and have given us their written permission to be named. If we have not included an Acknowledgements, then that indicates that we have not received substantial contributions from non-authors.

## Appendix 1

### Study measurement

#### 1- Intellectual capital measurement items used in the study

##### a. Human capital items

- Our organization gets the most out of its employees when they cooperate with one another in team tasks.
- Our organization's employees undergo continuous training programmes every year.
- Our organization's employees continuously learn from others.

(continued on next page)

(continued)

- 
- The company devotes a lot of time and effort to updating and developing employees' knowledge and skills.
  - Our organization's employees are experts in their respective areas.
  - Our organization's employees generally give it their all, which makes the company different from others in the industry.
  - Our organization's staff is highly professional.
- b. Relational capital items**
- Our organization is currently working on joint projects with many other organizations.
  - Our organization has diverse distribution channels.
  - A high ratio of the organization's business is done with strategic alliances.
  - People from outside the organization are consulted when decisions are made within the company.
  - Our organization has greatly reduced the time it takes to resolve a customer's problem.
  - Our organization gets feedback from customers under different circumstances.
  - Our organization has relatively complete data about the suppliers.
  - Our organization continually meets customers to find out what they want.
- c. Structural capital items**
- Our organization has a well-developed reward system related to performance.
  - Our organization supports employees constantly, by upgrading their skills whenever necessary.
  - Employees have sufficient influence over decisions made within the organization.
  - Our organization continuously develops work processes.
  - Our organization continuously develops and re-organizes itself based on research and development.
  - The systems and procedures of our organization support innovation.
  - Our organization determines an appropriate and adequate budget for research and development.
- 
- 2- Market turbulence measurement items used in the study**
- The manufacturing market is changing rapidly.
  - It is very difficult to predict any customer changes in this marketplace.
  - There are many, diverse market events that impact our business's operations.
  - There are many, diverse technological events that impact our business's operations.
  - It is very difficult to predict any changes in who might be our future competitors.
  - There are many, diverse competitor events that impact our business's.
- 
- 3- Business Sustainability measurement items used in the study**
- Significant increase in the general level of revenues.
  - Significant increase in the general level of market shares.
  - Significant improvement in the general level of profitability.
  - Significant improvement in the general level of sales growth.
  - Significant increase in the general level of investment.
  - Significant increase in overall income.
  - Significant improvement in its overall environmental situation.
  - Decrease in costs for materials purchasing.
  - Improved occupational health and safety of employees.
  - Increases the social reputation.
  - Develops community economic activities and provide more employment opportunities.
- 

## References

- Aaltonen, K., Turkulainen, V., 2018. Creating relational capital through socialization in project alliances. *Int. J. Oper. Prod. Manag.* 38 (6), 1387–1421.
- Abdulsalam, F., Al-Qaheri, H., Al-Khayyat, R., 2011. The intellectual capital performance of Kuwaiti banks: an application of VAIC model. *IBusiness* 3 (1), 88–96.
- Agovino, M., Musella, G., 2021. Economic losses in tourism during the COVID-19 pandemic. The case of Sorrento. *Curr. Issue Tour.* 1–25.
- Ait-Sahalia, Y., Andritzky, J., Jobst, A., Nowak, S., Tamerisa, N., 2012. Market response to policy initiatives during the global financial crisis. *J. Int. Econ.* 87 (1), 162–177.
- Alberola, E., Arslan, Y., Cheng, G., Moessner, R., 2021. Fiscal response to the COVID-19 crisis in advanced and emerging market economies. *Pac. Econ. Rev.* 26 (4), 459–468.
- Aljazeera, 2022. <https://www.aljazeera.com/news/2021/12/16/what-you-should-know-about-the-conflict-between-russia-ukraine>.
- AlQershi, N., Abas, Z.B., Mokhtar, S.S.M., 2019a. Investment in the hidden wealth of intellectual capital and its effect on competitive advantage. *Anwesh* 4 (1), 17.
- AlQershi, N., Abas, Z.B., Mokhtar, S.S.M., 2019b. The mediating effect of human capital on the relationship between strategic innovation and the performance of manufacturing SMEs in Yemen. *Organ. Mark. Emerg. Econ.* 10 (1), 57–77.
- AlQershi, N., Abas, Z.B., Mokhtar, S.S.M., 2019c. Prospecting for structure capital: proactive strategic innovation and the performance of manufacturing SMEs in Yemen. *Int. J. Entrep.* 23 (3), 1–19.
- AlQershi, N.A., Mokhtar, S.S.M., Abas, Z.B., 2020. CRM dimensions and performance of SMEs in Yemen: the moderating role of human capital. *J. Intellect. Cap.* 23 (3), 516–537.
- AlQershi, N., Mokhtar, S.S.M., Abas, Z.B., 2020. Innovative CRM and performance of SMEs: the moderating role of relational capital. *J. Open Innov. Technol. MarketComplex.* 6 (4), 155.
- Alqershi, N.A., Yusoff, W.F.W., Masrom, M.A.N.B., Hamid, N.B.A., Mokhtar, S.S.M., AlDoghan, M., 2021. Intellectual capital and performance of automotive manufacturers: the role of strategic thinking. *Int. J. Product. Perform. Manag.* 71 (6), 2534–2557.
- AlQershi, N., Abas, Z., Mokhtar, S., 2021. The intervening effect of structural capital on the relationship between strategic innovation and manufacturing SMEs' performance in Yemen. *Manag.Sci.Lett.* 11 (1), 21–30.
- AlQershi, N.A., Ali, G.A., Al-Rejal, H.A., Al-Ganad, A., Busenan, E.F., Ahmed, A., 2022. The power of strategic knowledge management in the relationship between innovation and the performance of large manufacturing firms in Malaysia. *Int. J. Innov. Sci.* <https://doi.org/10.1108/IJIS-01-2021-0019>.
- AlQershi, N., Mokhtar, S.S.M., Abas, Z., 2022. The influence of structural capital on the relationship between CRM implementation and the performance of manufacturing SMEs. *Int.J.Syst.Assur.Eng.Manag.* 13 (3), 1205–1218.
- Alvino, F., Di Vaio, A., Hassan, R., Palladino, R., 2020. Intellectual capital and sustainable development: a systematic literature review. *J. Intellect. Cap.* 22 (1), 76–94.
- Andreeva, T., Garanina, T., 2016. Do all elements of intellectual capital matter for organizational performance? Evidence from Russian context. *J. Intellect. Cap.* 17 (2), 397–412.
- Apcho-Cencho, L.V., Cuya-Velásquez, B.B., Rodríguez, D.A., de las Mercedes Anderson-Seminario, M., Alvarez-Risco, A., Estrada-Merino, A., Młodzianowska, S., 2021. The impact of international price on the technological industry in the United States and China during times of crisis: commercial war and COVID-19. In: *Advances in Business And Management Forecasting*. Emerald Publishing Limited.
- Asiaei, K., Barani, O., Bontis, N., Arabahmadi, M., 2020. Unpacking the black box: how intrapreneurship intervenes in the intellectual capital-performance relationship? *J. Intellect. Cap.* 21 (6), 809–834.
- Bananuka, J., Taurigana, V., Tumwebaze, Z., 2021. Intellectual capital and sustainability reporting practices in Uganda. *J. Intellect. Cap.* <https://doi.org/10.1108/JIC-01-2021-0019>.
- Barpanda, S., Bontis, N., 2021. Human resource practices and performance in microfinance organizations: do intellectual capital components matter? *Knowl. Process. Manag.* 28 (3), 209–222.
- Bayraktaroglu, A.E., Calisir, F., Baskak, M., 2019. Intellectual capital and firm performance: an extended VAIC model. *J. Intellect. Cap.* 20 (3), 406–425.
- Beltramino, N.S., Garcia-Perez-de-Lema, D., Valdez-Juarez, L.E., 2021. The role of intellectual capital on process and products innovation. Empirical study in SMEs in an emerging country. *J. Intellect. Cap.* 23 (4), 741–764.

- Benevene, P., Cortini, M., 2010. Interaction between structural capital and human capital in Italian NPOs: leadership, organizational culture and human resource management. *J. Intellect. Cap.* 23 (4), 741–764.
- Bontis, N., 2004. National intellectual capital index: a United Nations initiative for the Arab region. *J. Intellect. Cap.* 5 (1), 13–39.
- Bontis, N., Ciambotti, M., Palazzi, F., Sgro, F., 2018. Intellectual capital and financial performance in social cooperative enterprises. *J. Intellect. Cap.* 19 (4), 712–731.
- Booth, S.A., 2015. *Crisis Management Strategy: Competition And Change in Modern Enterprises*. Routledge.
- Brace, I., 2018. *Questionnaire Design: How to Plan, Structure And Write Survey Material for Effective Market Research*. Kogan Page Publishers.
- Bratianu, C., 2018. Intellectual capital research and practice: 7 myths and one golden rule. *Management & Marketing. Chall. Knowl. Soc.* 13 (2), 859–879.
- Calabrese, A., Costa, R., Ghiron, N.L., Tiburzi, L., Pedersen, E.R.G., 2021. How sustainable-orientated service innovation strategies are contributing to the sustainable development goals. *Technol. Forecast. Soc. Chang.* 169, 120816.
- Capozza, C., Divella, M., 2019. Human capital and firms' innovation: evidence from emerging economies. *Econ. Innov. New Technol.* 28 (7), 741–757.
- Caputo, F., Giacosa, E., Mazzoleni, A., Ossorio, M., 2019. Ambidextrous workforces for managing market turbulence. *Career Dev. Int.* 24 (5), 491–507.
- Charter, M., Tischner, U. (Eds.), 2017. *Sustainable Solutions: Developing Products And Services for the Future*. Routledge.
- Chatterjee, S., Chaudhuri, R., Thrassou, A., Sakka, G., 2022. Impact of firm's intellectual capital on firm performance: a study of Indian firms and the moderating effects of age and gender. *J. Intellect. Cap.* 23 (1), 103–126.
- Chen, M.C., Cheng, S.J., Hwang, Y., 2005. An empirical investigation of the relationship between intellectual capital and firms' market value and financial performance. *J. Intellect. Cap.* 6 (2), 159–176.
- Chen, Y.S., James Lin, M.J., Chang, C.H., 2006. The influence of intellectual capital on new product development performance—the manufacturing companies of Taiwan as an example. *Total Qual. Manag. Bus. Excell.* 17 (10), 1323–1339.
- Chen, K.H., Wang, C.H., Huang, S.Z., Shen, G.C., 2016. Service innovation and new product performance: the influence of market-linking capabilities and market turbulence. *Int. J. Prod. Econ.* 172, 54–64.
- Chen, X., Gong, W., Wu, X., Zhao, W., 2021. Estimating economic losses caused by COVID-19 under multiple control measure scenarios with a coupled infectious disease—economic model: a case study in Wuhan, China. *Int. J. Environ. Res. Public Health* 18 (22), 11753.
- Chin, W.W., 1998. Commentary: issues and opinion on structural equation modeling. *MIS Q.* vii–xvi.
- Ch'ng, P.C., Cheah, J., Amran, A., 2021. Eco-innovation practices and sustainable business performance: the moderating effect of market turbulence in the Malaysian technology industry. *J. Clean. Prod.* 283, 124556.
- Chudik, A., Mohaddes, K., Pesaran, M.H., Raisi, M., Rebucci, A., 2021. A counterfactual economic analysis of COVID-19 using a threshold augmented multi-country model. *J. Int. Money Financ.* 119, 102477.
- Ciambotti, G., Sgrò, F., Bontis, N., Zaccone, M.C., 2021. Local relationships matter! The impact of intellectual capital on entrepreneurial bricolage in African social entrepreneurs. *Knowl. Process. Manag.* 28 (4), 321–330.
- Cleary, P., 2015. An empirical investigation of the impact of management accounting on structural capital and business performance. *J. Intellect. Cap.* 16 (3), 566–586.
- Cohen, J., 1988. *Statistical Power Analysis for the Behavioral Sciences*, 2nd.
- Conlon, T., Corbet, S., McGee, R.J., 2020. Are cryptocurrencies a safe haven for equity markets? An international perspective from the COVID-19 pandemic. *Res. Int. Bus. Financ.* 54, 101248.
- Cooray, N.S., Palanivel, T., 2021. The impact and implication of the COVID-19 on the trade relationship between China and the United States: the political economy perspectives. *Transnatl. Corp. Rev.* 1–13.
- Cortez, R.M., Johnston, W.J., 2020. The coronavirus crisis in B2B settings: crisis uniqueness and managerial implications based on social exchange theory. *Ind. Mark. Manag.* 88, 125–135.
- Costa, R.V., Fernández-Jardon Fernández, C., Figueroa Dorrego, P., 2014. Critical elements for product innovation at Portuguese innovative SMEs: an intellectual capital perspective. *Knowl. Manag. Res. Pract.* 12 (3), 322–338.
- Cunningham, C.T., Quan, H., Hemmelgarn, B., Noseworthy, T., Beck, C.A., Dixon, E., Jetté, N., 2015. Exploring physician specialist response rates to web-based surveys. *BMC Med. Res. Methodol.* 15 (1), 1–8.
- Dal Mas, F., 2019. The relationship between intellectual capital and sustainability: an analysis of practitioner's thought. In: *Intellectual Capital Management as a Driver of Sustainability*. Springer, Cham, pp. 11–24.
- De Clercq, D., Thongpapanl, N., Voronov, M., 2018. Sustainability in the face of institutional adversity: market turbulence, network embeddedness, and innovative orientation. *J. Bus. Ethics* 148 (2), 437–455.
- De Sousa Jabbour, A.B.L., Jabbour, C.J.C., Hingley, M., Vilalta-Perdomo, E.L., Ramsden, G., Twigg, D., 2020. Sustainability of supply chains in the wake of the coronavirus (COVID-19/SARS-CoV-2) pandemic: lessons and trends. *Mod. Supply Chain Res. Applic.* 2 (3), 117–122.
- Domingues, R., Filippone, M., Michiardi, P., Zouaoui, J., 2018. A comparative evaluation of outlier detection algorithms: experiments and analyses. *Pattern Recogn.* 74, 406–421.
- Dwivedi, Y.K., Hughes, D.L., Coombs, C., Constantiou, I., Duan, Y., Edwards, J.S., Upadhyay, N., 2020. Impact of COVID-19 pandemic on information management research and practice: transforming education, work and life. *Int. J. Inf. Manag.* 55, 102211.
- Dwivedi, A., Agrawal, D., Jha, A., Gastaldi, M., Paul, S.K., D'Adamo, I., 2021. Addressing the challenges to sustainable initiatives in value chain flexibility: implications for sustainable development goals. *Glob. J. Flex. Syst. Manag.* 22 (2), 179–197.
- Dyllick, T., Muff, K., 2016. Clarifying the meaning of sustainable business: introducing a typology from business-as-usual to true business sustainability. *Organ. Environ.* 29 (2), 156–174.
- Dzenopoljac, V., Janosevic, S., Bontis, N., 2016. Intellectual capital and financial performance in the Serbian ICT industry. *J. Intellect. Cap.* 17 (2), 373–396.
- Edvinsson, L., 1997. Developing intellectual capital at Skandia. *Long Range Plan.* 30 (3), 366–373.
- Epstein, M.J., Elkington, J., Herman, B., 2018. *Making Sustainability Work: Best Practices in Managing And Measuring Corporate Social, Environmental And Economic Impacts*. Routledge.
- Fellmann, T., Hélaïne, S., Nekhay, O., 2014. Harvest failures, temporary export restrictions and global food security: the example of limited grain exports from Russia, Ukraine and Kazakhstan. *Food Secur.* 6 (5), 727–742.
- Fink, A., 2015. *How to Conduct Surveys: A Step-by-step Guide*. Sage Publications.
- Firer, S., Williams, S.M., 2003. Intellectual capital and traditional measures of corporate performance. *J. Intellect. Cap.* 4 (3), 348–360.
- Flores, E., Xu, X., Lu, Y., 2020. Human Capital 4.0: a workforce competence typology for Industry 4.0. *J. Manuf. Technol. Manag.* 31 (4), 687–703.
- FMM Directory, 2019. *Federation of Malaysia Manufacturers Directory*. Malaysia.
- Fornell, C., Larcker, D.F., 1981. Structural equation models with unobservable variables and measurement error: algebra and statistics. *J. Mark. Res.* 382–388.
- Garrigos-Simon, F.J., Botella-Carrubi, M.D., Gonzalez-Cruz, T.F., 2018. Social capital, human capital, and sustainability: a bibliometric and visualization analysis. *Sustainability* 10 (12), 4751.
- Ghadge, A., Wurtmann, H., Seuring, S., 2020. Managing climate change risks in global supply chains: a review and research agenda. *Int. J. Prod. Res.* 58 (1), 44–64.
- Giampaoli, D., Sgrò, F., Ciambotti, M., Bontis, N., 2021. Integrating knowledge management with intellectual capital to drive strategy: a focus on Italian SMEs. *VINE J. Inf. Knowl. Manag. Syst.* <https://doi.org/10.1108/VJKMS-04-2021-0059>.
- Gogan, L.M., Duran, D.C., Draghici, A., 2015. Structural capital—a proposed measurement model. *Procedia Econ. Finance* 23, 1139–1146.
- Goncharuk, A.G., 2019. Winemaking performance: whether the crisis is over. *Br. Food J.* 121 (5), 1064–1077.
- Gross-Golacka, E., Kusterka-Jefmańska, M., Jefmański, B., 2020. Can elements of intellectual capital improve business sustainability?—the perspective of managers of SMEs in Poland. *Sustainability* 12 (4), 1545.
- Groves, R.M., Peytcheva, E., 2008. The impact of nonresponse rates on nonresponse bias: a meta-analysis. *Public Opin. Q.* 72 (2), 167–189.
- Hair Jr., J.F., Sarstedt Jr., M., Ringle Jr., C.M., Gudergan Jr., S.P., 2017. *Advanced Issues in Partial Least Squares Structural Equation Modeling*. SAGE Publications.
- Hall, J.K., Daneke, G.A., Lenox, M.J., 2010. Sustainable development and entrepreneurship: past contributions and future directions. *J. Bus. Ventur.* 25 (5), 439–448.
- Hamadamin, H.H., Atan, T., 2019. The impact of strategic human resource management practices on competitive advantage sustainability: the mediation of human capital development and employee commitment. *Sustainability* 11 (20), 5782.
- Han, Y., Li, D., 2015. Effects of intellectual capital on innovative performance: the role of knowledge-based dynamic capability. *Manag. Decis.* 53 (1), 40–56.
- Harman, D., 1967. A single factor test of common method variance. *J. Psychol.* 35 (1967), 359–378.
- Hassan, N.A., Zailani, S., Rahman, M.K., 2021. Impact of integrated audit management effectiveness on business sustainability in manufacturing firms. *Manag. Res. Rev.* 44 (12), 1599–1622.
- He, H., Harris, L., 2020. The impact of COVID-19 pandemic on corporate social responsibility and marketing philosophy. *J. Bus. Res.* 116, 176–182.
- Henseler, J., Chin, W.W., 2010. A comparison of approaches for the analysis of interaction effects between latent variables using partial least squares path modeling. *Struct. Equ. Model.* 17 (1), 82–109.
- Henseler, J., Ringle, C.M., Sinkovics, R.R., 2009. The use of partial least squares path modeling in international marketing. In: *New Challenges to International Marketing*. Emerald Group Publishing Limited, pp. 277–319.
- Henseler, J., Ringle, C.M., Sarstedt, M., 2015. A new criterion for assessing discriminant validity in variance-based structural equation modeling. *J. Acad. Mark. Sci.* 43 (1), 115–135.
- Hilmersson, M., 2014. Small and medium-sized enterprise internationalisation strategy and performance in times of market turbulence. *Int. Small Bus. J.* 32 (4), 386–400.
- Hoang, A.T., Nizetić, S., Olcer, A.I., Ong, H.C., Chen, W.H., Chong, C.T., Nguyen, X.P., 2021. Impacts of COVID-19 pandemic on the global energy system and the shift progress to renewable energy: opportunities, challenges, and policy implications. *Energy Policy* 154, 112322.
- Holliday, C.O., Schmidheiny, S., Watts, P., 2017. *Walking the Talk: The Business Case for Sustainable Development*. Routledge.
- Horchani, S.C., Zouaoui, M., 2021. Environment turbulence effect on the dynamics of intellectual capital accumulation and ambidextrous innovation. *Int. J. Innov. Manag.* 25 (05), 2150058.
- Huang, S., Pickernell, D., Battisti, M., Soetanto, D., Huang, Q., 2020. When is entrepreneurial orientation beneficial for new product performance? The roles of ambidexterity and market turbulence. *Int. J. Entrep. Behav. Res.* 27 (1), 79–98.
- Ioannides, D., Gyimóthy, S., 2020. The COVID-19 crisis as an opportunity for escaping the unsustainable global tourism path. *Tour. Geogr.* 22 (3), 624–632.
- Iqbal, Q., Ahmad, N.H., Li, Z., 2021. Frugal-based innovation model for sustainable development: technological and market turbulence. *Leadersh. Org. Dev. J.* 42 (3), 396–407.



- Javalgi, R.R.G., Todd, P.R., 2011. Entrepreneurial orientation, management commitment, and human capital: the internationalization of SMEs in India. *J. Bus. Res.* 64 (9), 1004–1010.
- Jomo, K.S., Chowdhury, A., 2020. COVID-19 pandemic recession and recovery. *Development* 63 (2), 226–237.
- Jordão, R.V.D., 2017. Performance measurement, intellectual capital and financial sustainability. *J. Intellect. Cap.* 18 (3), 643–666.
- Kaawaase, T.K., Bananuka, J., Kwizina, T.P., Nabaweesi, J., 2019. Intellectual capital and performance of small and medium audit practices: the interactive effects of professionalism. *J. Account. Emerg. Econ.* 10 (2), 165–189.
- Kachouie, R., Mavondo, F., Sands, S., 2018. Dynamic marketing capabilities view on creating market change. *Eur. J. Mark.* 52 (5/6), 1007–1036.
- Kanda, W., Kivimaa, P., 2020. What opportunities could the COVID-19 outbreak offer for sustainability transitions research on electricity and mobility? *Energy Res. Soc. Sci.* 68, 101666.
- Kianto, A., Sáenz, J., Aramburu, N., 2017. Knowledge-based human resource management practices, intellectual capital and innovation. *J. Bus. Res.* 81, 11–20.
- Kinaterder, H., Campbell, R., Choudhury, T., 2021. Safe haven in GFC versus COVID-19: 100 turbulent days in the financial markets. *Financ. Res. Lett.* 43, 101951.
- Krejcie, R.V., Morgan, D.W., 1970. Determining sample size for research activities. *Educ. Psychol. Meas.* 30 (3), 607–610.
- Kryscynski, D., Coff, R., Campbell, B., 2021. Charting a path between firm-specific incentives and human capital-based competitive advantage. *Strateg. Manag. J.* 42 (2), 386–412.
- Kucharčíková, A., Mičiak, M., Hitka, M., 2018. Evaluating the effectiveness of investment in human capital in e-business enterprise in the context of sustainability. *Sustainability* 10 (9), 3211.
- Kumar, R., 2018. *Research Methodology: A Step-by-step Guide for Beginners*. Sage.
- Larbi-Siaw, O., Xuhua, H., Owusu, E., Owusu-Agyeman, A., Fulgence, B.E., Frimpong, S. A., 2022. Eco-innovation, sustainable business performance and market turbulence moderation in emerging economies. *Technol. Soc.* 68, 101899.
- Larbi-Siaw, O., Xuhua, H., Owusu, E., Owusu-Agyeman, A., Fulgence, B.E., Frimpong, S. A., 2022. Eco-innovation, sustainable business performance and market turbulence moderation in emerging economies. *Technol. Soc.* 68, 101899.
- Laszlo, C., Zhexembayeva, N., 2017. *Embedded Sustainability: The Next Big Competitive Advantage*. Routledge.
- Lee, C.C., Lin, C.K., 2019. The major determinants of influencing the operating performance from the perspective of intellectual capital: evidence on CPA industry. *Asia Pac. Manag. Rev.* 24 (2), 124–139.
- Lenzen, M., Li, M., Malik, A., Pomponi, F., Sun, Y.Y., Wiedmann, T., Yousefzadeh, M., 2020. Global socio-economic losses and environmental gains from the coronavirus pandemic. *PLoS one* 15 (7), e0235654.
- Li, L., Msaad, H., Sun, H., Tan, M.X., Lu, Y., Lau, A.K., 2020. Green innovation and business sustainability: new evidence from energy intensive industry in China. *Int. J. Environ. Res. Public Health* 17 (21), 7826.
- Li, X., Voorneveld, M., de Koster, R., 2022. Business transformation in an age of turbulence—lessons learned from COVID-19. *Technol. Forecast. Soc. Chang.* 176, 121452.
- Lie, H.C., Rueegg, C.S., Fosså, S.D., Loge, J.H., Ruud, E., Kiserud, C.E., 2019. Limited evidence of non-response bias despite modest response rate in a nationwide survey of long-term cancer survivors—results from the NOR-CAYACS study. *J. Cancer Surviv.* 13 (3), 353–363.
- Lourengo, N., Rua, A., 2021. The daily economic indicator: tracking economic activity daily during the lockdown. *Econ. Model.* 100, 105500.
- Lowry, P.B., Gaskin, J., 2014. Partial least squares (PLS) structural equation modeling (SEM) for building and testing behavioral causal theory: when to choose it and how to use it. *IEEE Trans. Prof. Commun.* 57 (2), 123–146.
- Massaro, M., Dumay, J., Garlatti, A., Dal Mas, F., 2018. Practitioners' views on intellectual capital and sustainability: from a performance-based to a worth-based perspective. *J. Intellect. Cap.* 19 (2), 367–386.
- Matos, F., Vairinhos, V.M., 2017. Intellectual capital management as a driver of competitiveness and sustainability. *J. Intellect. Cap.* 18 (3), 466–469.
- Matos, F., Vairinhos, V.M., Dameri, R.P., Durst, S., 2017. Increasing smart city competitiveness and sustainability through managing structural capital. *J. Intellect. Cap.* 18 (3), 693–707.
- Mattera, M., Gonzalez, F.S., Ruiz-Morales, C.A., Gava, L., 2021. Facing a global crisis—how sustainable business models helped firms overcome COVID. *Corp. Gov.* 21 (6), 1100–1116.
- McDowell, W.C., Peake, W.O., Coder, L., Harris, M.L., 2018. Building small firm performance through intellectual capital development: exploring innovation as the “black box”. *J. Bus. Res.* 88, 321–327.
- Michail, N.A., Melas, K.D., 2020. Shipping markets in turmoil: an analysis of the COVID-19 outbreak and its implications. *Transp. Res. Interdiscip. Perspect.* 7, 100178.
- Michail, N.A., Melas, K.D., 2020. Shipping markets in turmoil: an analysis of the COVID-19 outbreak and its implications. *Transp. Res. Interdiscip. Perspect.* 7, 100178.
- Molodchik, M.A., Shakina, E.A., Barajas, A., 2014. Metrics for the elements of intellectual capital in an economy driven by knowledge. *J. Intellect. Cap.* 15 (2), 206–226.
- Molodchik, M.A., Jardon, C.M., Bykova, A.A., 2019. The performance effect of intellectual capital in the Russian context: industry vs company level. *J. Intellect. Cap.* 20 (3), 335–354.
- Nardi, P.M., 2018. *Doing Survey Research: A Guide to Quantitative Methods*. Routledge.
- Nemteanu, M.S., Dabija, D.C., 2021. The influence of internal marketing and job satisfaction on task performance and counterproductive work behavior in an emerging market during the COVID-19 pandemic. *Int. J. Environ. Res. Public Health* 18 (7), 3670.
- Nylund, P.A., Brem, A., Agarwal, N., 2021. Innovation ecosystems for meeting sustainable development goals: the evolving roles of multinational enterprises. *J. Clean. Prod.* 281, 125329.
- Obeidat, B.Y., Tarhini, A., Masa'deh, R.E., Aqqad, N.O., 2017. The impact of intellectual capital on innovation via the mediating role of knowledge management: a structural equation modelling approach. *Int. J. Knowl. Manag. Stud.* 8 (3–4), 273–298.
- Onofrei, G., Prester, J., Fynes, B., Humphreys, P., Wiengarten, F., 2019. The relationship between investments in lean practices and operational performance: exploring the moderating effects of operational intellectual capital. *Int. J. Oper. Prod. Manag.* 39 (3), 406–428.
- Osman, C.A., Ngah, R., 2016. Assessing sustainable competitive advantage in relation with intellectual capital, knowledge management and innovativeness in women-owned SMEs in Malaysia. *J. Int. Bus. Econ. Entrep.* 1 (1), 46–51.
- Paola, M., Schiavone, F., Grandinetti, R., Chen, J., 2021. Digital servitization and sustainability through networking: some evidences from IoT-based business models. *J. Bus. Res.* 132, 507–516.
- Park, C.Y., Kim, K., Roth, S., 2020. Global Shortage of Personal Protective Equipment Amid COVID-19: Supply Chains, Bottlenecks, And Policy Implications (No. 130). Asian Development Bank.
- Patten, M., 2016. *Questionnaire Research: A Practical Guide*. Routledge.
- Paul, S.K., Chowdhury, P., 2020. A production recovery plan in manufacturing supply chains for a high-demand item during COVID-19. *Int. J. Phys. Distrib. Logist. Manag.* 51 (2), 104–125.
- Pedro, E.D.M., Leitão, J., Alves, H., 2020. Bridging intellectual capital, sustainable development and quality of life in higher education institutions. *Sustainability* 12 (2), 479.
- Peters, M.D., Gudergan, S., Booth, P., 2019. Interactive profit-planning systems and market turbulence: a dynamic capabilities perspective. *Long Range Plan.* 52 (3), 386–405.
- Piotrowicz, W.D., 2018. In-kind donations, cash transfers and local procurement in the logistics of caring for internally displaced persons: the case of polish humanitarian NGOs and Ukrainian IDPs. *J. Humanit. Logist. Supply Chain Manag.* 8 (3), 374–397.
- Piva, E., Rossi-Lamastra, C., 2018. Human capital signals and entrepreneurs' success in equity crowdfunding. *Small Bus. Econ.* 51 (3), 667–686.
- Podsakoff, P.M., MacKenzie, S.B., Lee, J.Y., Podsakoff, N.P., 2003. Common method biases in behavioral research: a critical review of the literature and recommended remedies. *J. Appl. Psychol.* 88 (5), 879–903.
- Pudjiarti, E.S., Hutomo, P.T.P., 2020. The critical role of effective organizational learning to improve firm's innovation and performance in a market turbulence condition. *Int. J. Innov. Sci.* 12 (3), 237–254.
- Qiu, L., Hu, D., Wang, Y., 2020. How do firms achieve sustainability through green innovation under external pressures of environmental regulation and market turbulence? *Bus. Strateg. Environ.* 29 (6), 2695–2714.
- Rajput, H., Changotra, R., Rajput, P., Gautam, S., Gollakota, A.R., Arora, A.S., 2021. A shock like no other: coronavirus rattles commodity markets. *Environ. Dev. Sustain.* 23 (5), 6564–6575.
- Rebucci, A., Hartley, J.S., Jiménez, D., 2022. An Event Study of COVID-19 Central Bank Quantitative Easing in Advanced And Emerging Economies. Emerald Publishing Limited.
- Rhee, S.Y., Park, J., Shin, H.D., 2020. High-performance work practices and organizational innovativeness: the roles of relational coordination competencies and market turbulence as a mediator or moderator. *J. Open Innov. Technol. MarketComplex.* 6 (3), 83.
- Sala, E., Lynn, P., 2009. The potential of a multi-mode data collection design to reduce non response bias. The case of a survey of employers. *Qual. Quant.* 43 (1), 123–136.
- Salvi, A., Vitolla, F., Raimo, N., Rubino, M., Petruzzella, F., 2020. Does intellectual capital disclosure affect the cost of equity capital? An empirical analysis in the integrated reporting context. *J. Intellect. Cap.* 21 (6), 985–1007.
- Santos-Vijande, M.L., Álvarez-González, L.L., 2007. Innovativeness and organizational innovation in total quality oriented firms: the moderating role of market turbulence. *Technovation* 27 (9), 514–532.
- Sekaran, U., Bougie, R., 2016. *Research Methods for Business: A Skill Building Approach*. John Wiley & Sons.
- Senbeto, D.L., Hon, A.H., 2020. Market turbulence and service innovation in hospitality: examining the underlying mechanisms of employee and organizational resilience. *Serv. Ind. J.* 40 (15–16), 1119–1139.
- Sharabati, A.A.A., Naji Jawad, S., Bontis, N., 2010. Intellectual capital and business performance in the pharmaceutical sector of Jordan. *Manag. Decis.* 48 (1), 105–131.
- Shi, L., Han, L., Yang, F., Gao, L., 2019. The evolution of sustainable development theory: types, goals, and research prospects. *Sustainability* 11 (24), 7158.
- Slawinski, N., Bansal, P., 2015. Short on time: intertemporal tensions in business sustainability. *Organ. Sci.* 26 (2), 531–549.
- So, M.K., Chu, A.M., Chan, T.W., 2021. Impacts of the COVID-19 pandemic on financial market connectedness. *Financ. Res. Lett.* 38, 101864.
- Song, L., Zhou, Y., 2020. The COVID-19 pandemic and its impact on the global economy: what does it take to turn crisis into opportunity? *ChinaWorld Econ.* 28 (4), 1–25.
- Srikalimah, S., Wardana, L.W., Ambarwati, D., Sholihin, U., Shobirin, R.A., Fajariah, N., Wibowo, A., 2020. Do creativity and intellectual capital matter for SMEs sustainability? The role of competitive advantage. *J. Asian Finance Econ. Bus.* 7 (12), 397–408.
- Studer, J., Baggio, S., Mohler-Kuo, M., Dermota, P., Gaume, J., Bertholet, N., Gmel, G., 2013. Examining non-response bias in substance use research—are late respondents proxies for non-respondents? *Drug Alcohol Depend.* 132 (1–2), 316–323.
- Sveiby, K.E., 1997. The intangible assets monitor. *J. Hum. Resour. Cost. Account.* 2 (1), 73–97.

- Tonial, G., Cassol, A., Selig, P.M., Giugliani, E., 2019. Intellectual capital management and sustainability activities in Brazilian organizations: a case study. In: *Intellectual Capital Management as a Driver of Sustainability*. Springer, Cham, pp. 119–138.
- Tran, N.P., Vo, D.H., 2020. Human capital efficiency and firm performance across sectors in an emerging market. *Cogent Bus.Manag.* 7 (1), 1738832.
- Tsai, K.H., Yang, S.Y., 2013. Firm innovativeness and business performance: the joint moderating effects of market turbulence and competition. *Ind. Mark. Manag.* 42 (8), 1279–1294.
- Tsygankov, A., 2015. Vladimir Putin's last stand: the sources of Russia's Ukraine policy. *Post-Soviet Aff.* 31 (4), 279–303.
- Tukker, A., Tischner, U. (Eds.), 2017. *New Business for Old Europe: Product-service Development, Competitiveness And Sustainability*. Routledge.
- Urciuoli, L., Mohanty, S., Hintsa, J., Boekesteijn, E.G., 2014. The resilience of energy supply chains: a multiple case study approach on oil and gas supply chains to Europe. *Supply Chain Manag.* 19 (1), 46–63.
- Wang, Z., Sun, Z., 2021. From globalization to regionalization: the United States, China, and the post-COVID-19 world economic order. *J.Chin.Polit.Sci.* 26 (1), 69–87.
- Wang, G., Dou, W., Zhu, W., Zhou, N., 2015. The effects of firm capabilities on external collaboration and performance: the moderating role of market turbulence. *J. Bus. Res.* 68 (9), 1928–1936.
- Xia, C., Qamruzzaman, M., Adow, A.H., 2022. An asymmetric nexus: remittance-led human capital development in the top 10 remittance-receiving countries: are FDI and gross capital formation critical for a road to sustainability? *Sustainability* 14 (6), 3703.
- Xu, J., Wang, B., 2018. Intellectual capital, financial performance and companies' sustainable growth: evidence from the Korean manufacturing industry. *Sustainability* 10 (12), 4651.
- Yayla, S., Yeniurt, S., Uslay, C., Cavusgil, E., 2018. The role of market orientation, relational capital, and internationalization speed in foreign market exit and re-entry decisions under turbulent conditions. *Int. Bus. Rev.* 27 (6), 1105–1115.
- Yong, J.Y., Yusliza, M.Y., Ramayah, T., Chiappetta Jabbour, C.J., Sehnem, S., Mani, V., 2020. Pathways towards sustainability in manufacturing organizations: empirical evidence on the role of green human resource management. *Bus. Strateg. Environ.* 29 (1), 212–228.
- Zangouinezhad, A., Moshabaki, A., 2009. The role of structural capital on competitive intelligence. *Ind. Manag. Data Syst.* 109 (2), 262–280.
- Zeghal, D., Maaloul, A., 2010. Analysing value added as an indicator of intellectual capital and its consequences on company performance. *J. Intellect. Cap.* 11 (1), 39–60.
- Zhang, D., Wang, H., Wang, W., 2022. The influence of relational capital on the sustainability risk: findings from Chinese non-state-owned manufacturing enterprises. *Sustainability* 14 (11), 6904.

**Nagwan AlQershhi** is an assistant professor of strategic management and marketing. Currently, he is Senior Lecturer at the Faculty of Entrepreneurship & Business, (UMK). To date, he has published academic papers in Scopus-indexed journals. His research interests include intellectual capital, competitive advantage, strategic innovation, CRM and performance in SMEs.

**Roselina Binti Ahmad Saufi** Dean of Malaysian Graduate School of Entrepreneurship and Business, (UMK). She has successfully supervised more than 50 Doctoral and Masters Students in the areas of Entrepreneurship. Prof. Roselina Binti Ahmad Saufi has presented in various International conferences and has published in numerous articles, among others in employee satisfaction and Business Excellence. She has several national and international publications to her credit. She is also actively involved in consultations on marketing and entrepreneurship to various organizations.

**Noor Azizi Ismail** is previous vice chancellor of UMK. He has successfully supervised more than 20 Doctoral and Masters Students in the areas of Entrepreneurship. Prof. Azizi has presented in various International conferences and has published in numerous articles, among others in HRM and Business Excellence. He has several national and international publications to her credit.

**Mohd Rosli Bin Mohamad** is previous deputy vice chancellor of UMK. He has successfully supervised more than 30 Doctoral and Masters Students in the areas of Marketing. Prof. Rosli has presented in various International conferences and has published in numerous articles, among others in marketing and management fields. He has several national and international publications to her credit.

**T. Ramayah** has taught courses in Statistics, Operations Management, Research Methods, Forecasting and Computer Literacy at the undergraduate level. He has supervised numerous MBA students in the fields of Information Systems, Operations Management, Marketing Management and Organizational Behavior. He is also currently supervising numerous students at the MA and PhD levels. He has also presented numerous papers at local and international conferences. He is also active in research publications having published research papers in several local and international journals of repute. Currently he is the Chief Editor of the *Asian Academy of Management Journal*, a peer reviewed international journal published by the USM Publishers. He is currently an Associate Professor and Head of the Operations Management Section, at the School of Management, Universiti Sains Malaysia.

**Nik Maheran Nik Muhammad** is Rector of University Malaysia Kelantan. She has successfully supervised more than 100 BBA, Masters and PhD students. Nik Maheran also does consultancy and training work. She has given training and consultation in the area of financial planning, investment planning and tax planning to and provide consultancy on Internal Control system and Human resource management for several companies. Furthermore, she has conducted seminars and workshops on image building and enhancement, customer service, and financial, tax and investment planning for corporations, government bodies, hospitals and women organizations.

**Mohd Nor Hakim Bin Yusoff** is Dean of Faculty of Entrepreneurship & Business, (UMK). He has successfully supervised more than 20 Doctoral and Masters Students in the areas of Entrepreneurship. Prof. Hakimin has presented in various International conferences and has published in numerous articles, among others in employee satisfaction and Business Excellence. He has several national and international publications to her credit.