

Intellectual capital and sustainability practices of manufacturing firms in Uganda

Kassim Alinda, Sulait Tumwine and Twaha Kigongo Kaawaase
Department of Accounting, Makerere University Business School, Kampala, Uganda

Ståle Navrud
*School of Economics and Business, Norwegian University of Life Sciences,
As, Norway, and*

Arthur Sserwanga and Irene Nalukenge
Makerere University Business School, Kampala, Uganda

Abstract

Purpose – The primary objective of this study is to investigate the association between the dimensions of intellectual capital (IC) and sustainability practices (SP) within the context of manufacturing medium and large (ML) firms in Uganda. The study aims to shed light on whether and how different dimensions of IC contribute to the adoption and implementation of SP by these firms.

Design/methodology/approach – This study utilized a cross-sectional and quantitative approach, collecting data through a questionnaire survey from a sample of manufacturing ML firms. The collected data underwent analysis to identify patterns and relationships using the SmartPLS structural equation modeling (SEM) technique.

Findings – The findings demonstrated that the three categories of IC (human, structural and relational capital) influence the SP of ML manufacturing enterprises in Uganda. This suggests that IC is a critical component of SP.

Practical implications – Manufacturing enterprises should use their IC to create strategies for sustainable solutions, such as creating new, ecologically and socially responsible products and services and improving current ones to lessen their environmental effect.

Originality/value – This research advances knowledge of SP by revealing if all aspects of IC are significant for the SP of manufacturing enterprises in Uganda.

Keywords Sustainability practices, Intellectual capital, Human capital, Structural capital, Relational capital, Manufacturing firms, Uganda

Paper type Research paper

1. Introduction

In this study, we use data from a least-developed country where there are few empirical studies to examine whether all the dimensions of intellectual capital (IC) matter for the sustainability practices (SP) of manufacturing medium and large (ML) enterprises. Considering the importance of environmental conservation, IC is a significant factor needed for manufacturing (ML) to implement sustainable strategies (Bananuka, Taurigana, & Tumwebaze, 2023). As a result, manufacturing companies with higher IC have better odds



of engaging in actions that help the environment overall and the present generation without compromising the capacity of future generations to satisfy their demands (Ndagire & Nakabuye, 2021). Furthermore, during the last decade, sustainability literature has risen to prominence due to the increasing importance that corporations place on issues of environmental sustainability, social responsibility and economic growth (Kraus, Ribeiro-Soriano, Schüssler, & Brem, 2017). To ensure the well-being of present and future generations, researchers (Geissdoerfer, Savaget, Bocken, & Hultink, 2017) emphasized the importance of sustainability in achieving a balanced integration of the triple-bottom line (TBL), which combines economic prosperity, social inclusion and environmental resilience with their interdependence.

In response to the adverse environmental, societal and economic impacts associated with manufacturing firms, a range of SP has emerged. These practices aim to address these problems by putting various principles into practice, such as design innovation that follows R's principles (Earley, 2017), circularity (Lieder & Rashid, 2016; Moorhouse & Moorhouse, 2017), cradle-to-cradle design (Braungart, McDonough, & Bollinger, 2007), closed-loop design (Ara, Leen, & Hassan, 2019) and eco-design (Kozłowski, Searcy, & Bardecki, 2018). Scholarly literature by Jia and Jiang (2018) and Dos Santos and Campos (2020) highlights the potential benefits of implementing SP, such as the conservation of natural resources, reduction in waste generation and preservation of operational quality. Moreover, studies by Li, Liu, and Huan (2019) and Desore and Narula (2018) suggest that these practices can confer a competitive advantage and help address resource scarcity.

To that end, several countries are rethinking their sustainable-development-goal (SDG) strategies because their populations are growing, resources are running out, the environment is getting worse and people are generating more waste (Furstenau, de Melo, Varela, & Ferreira, 2020). According to Can and Alatas (2017), manufacturers should prioritize SDG 12 (which deals with both sustainable consumption and production). The SDG 12 agenda focuses on reducing how people use and produce things, which has an effect on the environment. This has put manufacturers under the scrutiny of environmentalists, carbon footprint researchers, and energy efficiency researchers. The manufacturing sector is a major cause of sustainability problems, contributing to the present environmental catastrophe on a worldwide scale (Tang, Liu, Wang, Zhu, & Wang, 2018; Schrettle, Hinz, Scherrer-Rathje, & Friedli, 2014). According to the IEA (2015), manufacturing businesses produced 38% of the world's carbon dioxide emissions and used 13% of the world's energy. While there has been a worldwide push to encourage sustainability initiatives, many Ugandan firms are still using methods that are harmful to both the environment and society (Baltacioglu, Gungor, Kaplan, & Simsek, 2017). Despite the fact that the country is already susceptible to climate change, this issue is of the utmost importance because unsustainable manufacturing practices are likely to make it worse (Hassan, Shukla, & Jug, 2019; Namanya & Luukkanen, 2020). Because of this, it is very important to look at the state of SP in Uganda's manufacturing sector and find ways to improve output in a sustainable way.

The United Nations Industrial Development Organization (UNIDO) (2018) reported that, even though SP could be good for the economy and the environment, only a small number of manufacturing businesses in Uganda have embraced it. These problems should not be ignored because manufacturing businesses in Uganda make up more than 10% of the country's gross domestic product (GDP) and employ more than 500,000 people (World Bank, 2022). Industrial emissions and waste threaten the quality of the air, water and soil all over the country. This is another big reason why the environment is getting worse (NEMA, 2019). Without enough resources like IC, Uganda's industrial sector will not use SP as much as it could.

In-depth research on IC has already been extensively published in the literature. [Al-Khoury et al. \(2022\)](#) conducted a study on the history and trends of IC and found that a significant majority of the articles, approximately 89%, originated from developed countries. This disproportionate focus on developed countries has led to a research gap in understanding IC in developing countries, particularly in Africa and other regions. Consequently, there is a lack of comprehensive studies and investigations on IC in these under-researched areas.

Moreover, [Alam, Rana, and Lodhi \(2020\)](#) noted the significant role of IC in influencing the adoption of sustainability strategies in manufacturing enterprises. Their findings suggest that businesses that actively engage in developing and managing IC are more likely to acquire the necessary expertise and knowledge to effectively implement SP. Similarly, [Jayashree, Venkatesh, and Arunachalam \(2021\)](#) demonstrated the influence of technological advancements and IC on SP in manufacturing enterprises. In contrast, [Yusoff, Jusoh, Mohd Noor, and Harun \(2019\)](#) highlighted the importance of structural and relational capital, as opposed to human capital, in ensuring cleaner production and supporting economic and environmental sustainability. This finding contradicts the analysis by [Massaro, Dumay, and Garlatti \(2018\)](#), which argues that all three aspects of IC impact SP in manufacturing.

Additionally, [Bananuka et al. \(2023\)](#) conducted a separate investigation and found a positive influence of human capital and relational capital on sustainability reporting practices within the financial institution sector in Uganda. However, they did not observe a significant impact of the structural capital element on these practices. It is important to acknowledge that their study focused specifically on sustainability reporting practices in the financial sector, limiting the generalizability of their findings to other sectors of the economy. Furthermore, [Bananuka et al.'s \(2023\)](#) study primarily examined the disclosure and communication aspects of sustainability efforts, while the present study aims to explore SP as a broader concept encompassing various actions and initiatives ([Nasreen, Baker, & Rezania, 2023](#)). Therefore, caution should be exercised when extrapolating their results to industries beyond the financial sector, as the specific contextual factors and characteristics of financial institutions may influence the relevance and applicability of their findings to other sub-sectors.

It is crucial to recognize that SP encompasses a wide range of actions and initiatives undertaken by organizations to minimize their negative impacts on the environment, society and economy while promoting long-term sustainable development ([Nave et al., 2021](#)). Despite the existing literature suggesting the importance of IC in supporting SP, there is a lack of empirical studies specifically focusing on manufacturing firms in Uganda. This research gap highlights the need for further investigations in this specific context.

The purpose of this research is to ascertain if all dimensions of IC are significant for the SP of manufacturing ML firms in Uganda. The results give insights into manufacturing businesses SP, which might stimulate ML manufacturing enterprises toward the implementation efforts of SP. Moreover, the third National Development Plan has the theme “Sustainable Industrialization for Inclusive Growth, Employment, and Wealth Creation” ([National Planning Authority Uganda \(NPA\), 2020](#)). In order to achieve this theme, it is inevitable to use SP. Moreover, SDG 9 focuses on fostering long-term economic growth and development via sustainable industrialization and infrastructure, including the deployment of ecologically sound technologies and practices by manufacturing businesses. This study helps to improve knowledge of both SDG 9 and SDG 12 (sustainable consumption and production). In addition, the African Agenda 2063 is a strategic framework for Africa’s socioeconomic development over the next 50 years. The [African Union \(AU\) \(2015\)](#) approved it in January with the goal of promoting equitable growth, sustainable development and regional integration across the continent. To that end, this study may be beneficial towards the attainment of this agenda.

The rest of the paper is organized as follows: [Section 2](#) reviews the literature and develops hypotheses. [Section 3](#) presents the research methodology. [Section 4](#) presents the results, and the discussion of the results follows in [Section 5](#). The final section delves into conclusions and areas for further research.

2. Literature review and hypothesis development

2.1 Theoretical underpinning

SPs in literature derive from IC as a firm's strategic resource. The latter may arise via human capital, structural capital and relational capital to motivate manufacturing enterprises to undertake sustainability efforts ([Sunday, 2017](#)). Corresponding with this knowledge gap, the major goal of this research is to explore SPs in Uganda via the resource-based theory (RBT) theoretical lens and to investigate the link between IC and SP quantitatively. The appropriate examination of this link necessitates the use of resource-based theory, which will be described further below.

This study is based on the RBT proposed by [Barney \(1991\)](#). According to [Barney \(1991\)](#), firms with valuable, rare, unique and nonsubstitutable internal resources and capabilities have a competitive edge over those without. The RBT emphasizes the value of assets and competencies in attaining a competitive edge. [Wernerfelt \(1984\)](#) defined resources as anything that could be considered a firm's strengths and weaknesses. According to [Barney \(1991\)](#), the concept includes all resources, organizational capabilities, procedures, knowledge and information within the control of the corporation that have the potential to increase its effectiveness and efficiency. In this study, it is anticipated that firms with internal resources including human capital, structural capital and relational capital would implement SP. A company's potential to create value will likely be constrained if it has a limited pool of general intellectual and knowledge-related resources.

2.2 Intellectual capital and sustainability practices

In this section, we present a complete assessment of the literature on the three facets of IC (human capital, structural capital and relational capital) and their relationship to SP, after which hypotheses are generated.

2.2.1 Human capital and sustainability practices. The term "human capital" in business refers to the body of information that employees have accumulated over the course of their careers, including knowledge, skills, attitudes and experience ([Cabrita & Bontis, 2008](#)). Studies suggest that human capital plays a significant role in the adoption and implementation of SP. [Corredor and Gomez \(2019\)](#) found that firms with higher levels of human capital are more likely to adopt SP, such as waste reduction, energy efficiency and eco-design. [Sunday \(2017\)](#) also revealed a substantial association between human capital and both economic and environmental social determinants. Additionally, studies ([Akhtar, Waseem, & Hussain, 2015](#); [Arshad et al., 2016](#); [Widodo & Shahab, 2015](#)) claimed that higher levels of human capital boosted sustained competitive advantage. In addition, [Malik, Cao, Mughal, Kundi, Mughal, & Ramayah \(2020\)](#) found a positive effect of human capital on a firm's sustainability. However, [Yusoff et al. \(2019\)](#) revealed that green human capital has minimal influence on corporate sustainability. The following hypothesis is thus formulated:

H1. There is a significant relationship between human capital and SP.

2.2.2 Structural capital and sustainability practices. [Arshad et al. \(2016\)](#) argued that a firm with a high level of structural capital has a strong organizational culture and staff who are willing to share knowledge and incorporate it into formal processes and structures. [Akhtar et al. \(2015\)](#) claim that structural capital is crucial for SP to take place. In addition, [Yusoff et al. \(2019\)](#), who

looked at whether all three parts of IC matter for sustainability, found evidence of a positive and significant effect of green structural capital on corporate sustainability. Relatedly, [Dal Mas \(2019\)](#) discovered a strong correlation between structural capital and each of the three aspects of sustainability in his research on the link between IC and sustainability based on an examination of practitioner thought. In their empirical study of corporate sustainability, [Malik, Khan, et al. \(2020\)](#) found that structural capital and sustainability have a strong and significant link. In contrast, [Jarrar and Abu-Zaid \(2016\)](#), in a study of 72 Jordanian companies, found that structural capital did not have a significant impact on corporate social responsibility (CSR) practices. Herein, the following hypothesis is formulated:

H2. There is a significant relationship between structural capital and SP.

2.2.3 Relational capital and sustainability practices. The link between relational capital and SPs is important because relational capital can help firms adopt SPs by giving them the resources, skills and relationships they need. Strong ties with suppliers, for example, may assist manufacturing enterprises in sourcing sustainable materials and reducing their carbon footprint, while good relationships with consumers can lead to increased demand for environmentally friendly products and services.

Several studies have explored the relationship between relational capital and SP in the manufacturing sector. A study by [Castka, Gölgeci, and Piterou \(2021\)](#) found that companies that prioritize SP tend to have higher levels of relational capital, which enables them to build stronger relationships with stakeholders and gain competitive advantages. Similarly, a study by [Santi, Figueiredo, Formentini, and Oliva \(2021\)](#) found that relational capital plays a key role in promoting sustainable supply chain management practices in manufacturing firms. However, it is important to note that the relationship between relational capital and SP is not always straightforward. A study by [Han, Shi, and Wang \(2020\)](#) found that while relational capital can facilitate the adoption of SP, it can also inhibit innovation and change if companies become too reliant on established relationships and fail to seek out new partnerships and opportunities. Overall, the relationship between relational capital and SP is complex and multifaceted. Manufacturing firms that prioritize both concepts and work to build strong relationships with stakeholders are likely to achieve long-term success and competitive advantages in today's rapidly changing business landscape.

Relational capital includes a company's intangible assets, like its relationships with customers, suppliers and the global business environment, as well as its stakeholders' sense of responsibility, trust and identity ([Cucculelli, Bettinelli, & Rialti, 2019](#); [Daspit & Long, 2014](#)). [Sun, Zhang, Li, and Xie \(2018\)](#) found that relational capital makes people more aware of the environment, including how to deal with waste, save resources and understand climate change. Researchers ([Tortoriello, Reagans, & McEvily, 2011](#); [Yu & Huo, 2019](#)) have shown that relational capital is very important for small and medium-sized enterprises (SMEs) to share environmental knowledge resources. This information transfer may help organizations address unsustainable practices. [Dal Mas \(2019\)](#) found via text mining of 1651 practitioner postings in one of the leading sustainability sources that relational capital is essential to SP realization. This shows how trust and collaboration may improve information sharing and organizational activities in a company's membership and employee connections. According to previous research, relational capital boosts SPs ([Yusoff et al., 2019](#)). Herein, the following hypothesis is formulated:

H3. There is a significant relationship between Relational capital and SP.

2.2.4 Intellectual capital and sustainability practices. Organizations that engage in human capital activities, such as staff training and development, are more likely to implement SP initiatives like energy efficiency, waste reduction and eco-design, according to research by [Farneti, Battisti, and Mora \(2021\)](#). Numerous studies have shown a correlation between IC and SP. For instance, research by [Kianto, Ritala, Spender, and Vanhala \(2019\)](#) found that

businesses are more likely to use SP if they invest in IC. According to the authors, businesses that invest in the education and training of their personnel are better able to provide creative and long-lasting solutions. In a similar vein, Lee and Kim's (2018) research discovered that businesses with higher levels of IC are more likely to adopt SP, such as lowering greenhouse gas emissions, incorporating renewable energy sources and enhancing waste management. While several studies have shown a link between IC and sustainability strategies, more recent research reveals that this connection may be more nuanced than first believed. For instance, a study by Taticchi, Garengo, Nudurupati, Tonelli, and Pasqualino (2018) discovered that organizational culture may act as a moderator in the relationship between IC and SP. Particularly, the authors discovered that businesses with an innovative culture are more likely to adopt SP. In addition, research by Gallardo-Vázquez, Suárez-Barraza, and Ramírez-Portilla (2020) discovered that the environment in which businesses operate may have an impact on the link between IC and SP. In particular, the researchers noted that organizations in developing countries can encounter distinct difficulties in adopting SP compared to companies in developed economies, such as a lack of resources and access to technology. We thus hypothesize that:

H4. There is a significant positive relationship between IC and SP.

2.2.5 Summary of literature review. The existing body of literature on sustainability encompasses various aspects, although the predominant focus has been on specific areas such as sustainability reporting practices (Van der Zahn, 2023; Bananuka *et al.*, 2023), sustainability performance disclosures (Bananuka, Nkundabanyanga, Kaawaase, Mindra, & Kayongo, 2022), environmental practices in the wine industry (Bandinelli, Acuti, Fani, Bindi, & Aiello, 2020), environmental SP of multinational mining companies (Amoah & Eweje, 2022), sustainability implementation in the mining industry (Amoah & Eweje, 2023), business sustainability (Li, Bhutto, Waris, & Hu, 2023), stakeholder pressures and SP in manufacturing (Bello-Pintado *et al.*, 2023), the impact of digital technologies and SP on circular supply chain management (Romagnoli, Tarabu, Maleki Vishkaei, & De Giovanni, 2023), the operationalization of sustainable business models (Bonfanti, Mion, Brunetti, & Vargas-Sánchez, 2023), IC and sustainable development (Alvino, Di Vaio, Hassan, & Palladino, 2021), SP among manufacturing firms in Uganda (Alinda *et al.*, 2022). However, it is noteworthy that studies specifically focusing on the IC and SP of manufacturing firms are relatively scarce in the literature. This highlights the need for more research in this area to gain a comprehensive understanding of the relationship between IC and SP in the manufacturing sector.

3. Methodology

3.1 Research design, population and sample

This research used a positivist and objective epistemology. For this investigation, we used a quantitative approach. The positivist research paradigm is theory-driven, with the conviction that reality is presented objectively and may operate as a foundation for directing the behavior of enterprises, their staff and their clientele. The questionnaire used in this study, which was constructed based on a thorough review of the literature, largely included Likert-type questions with a 6-point scale. In order to measure SP, this research utilized a scale developed by Høgevoid *et al.* (2015). The reliability of the scale was assessed using Cronbach's alpha, with scores for each component ranging from 0.66 to 0.68. These values exceed the minimum threshold of 0.6, indicating satisfactory internal consistency for the measurement of SP.

According to the Uganda Bureau of Statistics (Uganda Bureau of Statistics (UBOS), 2018), the manufacturing subsector in Uganda encompasses a large number of small firms, approximately 3,859, with uncertain geographic distribution and limited contact information. Given this context, the present study focused specifically on the central region of Uganda, where 638 ML

manufacturing firms are situated. Employing [Krejcie and Morgan's \(1970\)](#) selection table, a sample size of 229 members from the Uganda Manufacturers' Association (UMA) would have been drawn from this target population. However, we collected data from a purposive sample of 102 firms, yielding a response rate of 44.5%. This response rate exceeded the minimum requirement of 30 businesses necessary for conducting reliable inferential statistics. The survey instruments were physically distributed and the gathered data from the 102 firms were considered appropriate for analysis in the study. The choice to focus on the central region of Uganda was motivated by its notable economic activity, as reported by [Uganda Bureau of Statistics \(UBOS\) \(2018\)](#). Furthermore, the central region was identified by the National Environment Management Authority ([NEMA, 2019](#)) as the area where the most significant environmental damage occurs. For the study, key personnel such as the Chief Financial Officer, Production Manager, Operations Manager, Environmental Manager and Human Resource Manager were purposefully selected as respondents and the data collected was aggregated at the firm level. These individuals were specifically chosen due to their presumed knowledge and expertise regarding sustainability issues within their respective organizational roles.

3.2 Demographic characteristics

[Table 1](#) indicates that the majority of respondents (59.2%) in ML manufacturing enterprises in Uganda are male. This finding suggests that there is a higher representation of men in

Gender	Frequency	(%)	Cumulative (%)
Male	189	59.2	59.2
Female	130	40.8	100.0
<i>Age Group</i>			
Less than 35 years	105	32.9	32.9
36–45 years	162	50.8	83.7
46–55 years	45	14.1	97.8
above 55 years	7	2.2	100.0
<i>Highest education level</i>			
Diploma	53	16.6	16.6
Bachelor's degree	178	55.8	72.4
Master's degree	81	25.4	97.8
PhD	5	1.6	99.4
Others	2	0.6	100.0
<i>Length of service in this firm</i>			
Less than 5 years	112	35.1	35.1
5–10 years	149	46.7	81.8
11–15 years	39	12.2	94.0
16 years and above	19	6.0	100.0
<i>Position in the organization</i>			
Environmental manager	21	6.6	6.6
Operations manager	51	16.0	22.6
Human Resource manager	144	45.1	67.7
Production manager	54	16.9	84.6
Chief finance officer	49	15.4	100.0

Note(s): [Table 1](#) provides an overview of the respondents' characteristics, including gender, age group, highest level of education, length of service in the firm and position held by each respondent. The table presents demographic information that helps contextualize the sample population and provides insights into the diversity and composition of the participants in the study

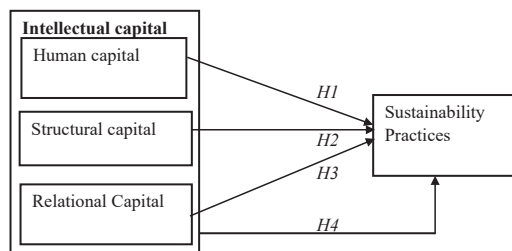
Source(s): Primary data

Table 1. Respondents' characteristics, total $n = 319$ respondents

these industries compared to women. The majority of respondents were between the ages of 36 and 45, indicating that persons who are mature, energetic and active enough to take on onerous duties in managing the operations of manufacturing organizations dominate. The education levels of the respondents show that the most have a bachelor's degree (55.7%) and the least have a PhD and other categories not defined (1.6% and 0.6%, respectively). Concerning their length of service in the firm, 46.7% have experience of 5-10 years and 6% have experience of 16 years or more in a manufacturing firm setting, implying that most managers have sufficient experience to integrate sustainability initiatives.

3.3 Questionnaire and variables measurement

We used a self-administered questionnaire with closed-ended items anchored on a six-point Likert scale to measure the extent to which the respondents agreed or disagreed with the items put forward to measure the study variables. [McBride and Adamson's \(2015\)](#) research supports a six-point Likert scale. The research examined the reliability and validity of a five- and six-point Likert scale used to gauge attitudes about education technology. The six-point Likert scale was more reliable and valid than the five-point scale because it offered more answers and eliminated neutral or midway responses. A questionnaire was used because we targeted a large sample and aimed at obtaining the mean ratings of the questionnaire items. We reviewed existing literature on IC and SP in order to develop the questionnaire. IC was operationalized in terms of human capital, structural capital and relational capital ([Kianto, Sáenz, & Aramburu, 2017](#); [Bontis, 1998](#)). On the other hand, SP were operationalized in terms of environmental, social and economic SP ([Høgevoid et al., 2015](#); [Chow & Chen, 2012](#); [Yacob, Zhou, & Shi, 2019](#)). In this study, [Figure 1](#) depicts the authors' conceptualization of the study variables and their interrelationships as derived from the existing literature as well as the direction of the hypotheses formulated.



Note(s): Figure 1 depict the study model, illustrating the interrelationships between the dimensions of intellectual capital (including human capital, structural capital, and relational capital) and sustainability practices. The figure provides a visual representation of the conceptual framework guiding the research, highlighting the hypothesized connections between these key variables. The arrows in the figure indicate the direction of the relationships, suggesting how the dimensions of intellectual capital influence sustainability practices. The model serves as a theoretical foundation for understanding the complex dynamics and mechanisms underlying the relationship between intellectual capital and sustainability practices. By visualizing these interconnections, Figure 1 offer a comprehensive overview of the proposed conceptual framework, guiding further analysis and interpretation of the study findings

Source(s): Authors conceptualization

Figure 1.
Study model

3.4 *Validity and reliability*

The idea of validity relates to how closely a particular statistic represents the main concept. The researchers asked a group of sustainability specialists (professors, government officials and academics) to assess the survey’s questions on a Likert scale of 1 (strongly disagree) to 6 (strongly agree). The estimated content validity indices (CVIs) for the experts’ responses for all variables were more than the cutoff value of 0.7 (Field, 2009). All estimated CVIs for research variables supported the survey’s dependability. In contrast, in this study, the Cronbach’s alpha coefficient was employed to assess the instrument’s reliability. Cronbach’s alpha was more than 0.7, above Nunnally’s (1978) suggested criterion, implying that the instrument showed internal consistency (see Table 2).

3.5 *Data analysis*

The collected data was input into SmartPLS Structural Equation Modeling (SEM) Version 3 for assembly, sorting, editing, coding, capturing and analysis. Before analyzing the data, it was cleaned in Statistical Software for the Social Sciences (SPSS) 23. SmartPLS version 3 software was utilized for analyzing the cleaned data. The valid sample size of 102 manufacturing firms made SmartPLS a suitable analytic tool. According to Fornell and Bookstein (1982), neither the measurement scale nor the population size is assumed in partial least squares (PLS) path modeling. Both the measurement and structural models should be addressed when analyzing and interpreting PLS-SEM data, with the structural model evaluating the relationship between the explanatory and criterion latent variables (Henseler, Ringle, & Sarstedt, 2014).

4. **Results**

4.1 *The measurement models*

Construct validity was analyzed from two different angles: convergent validity and discriminant validity (Neuman, 2007). The concept of convergent validity describes the degree to which a measurement instrument closely tracks the target construct. We used the average variance extracted (AVE) to demonstrate convergence. Table 2 displays the results, which show that all the calculated AVE values are larger than the acceptable threshold of 0.5, indicating the presence of convergent validity (Henseler et al., 2014).

	Composite reliability	Average variance extracted (AVE)	Variance inflation factor
<i>Intellectual capital</i>			
Human capital	0.829	0.550	1.439
Relational capital	0.857	0.547	1.407
Structural capital	0.829	0.617	1.324
<i>Sustainability practices</i>			
Economic sustainability practices	0.825	0.703	1.161
Environmental sustainability practices	0.860	0.606	1.550
Social sustainability practices	0.768	0.531	1.466

Note(s): Table 2 presents the results of the reliability and validity analysis of the research instrument used in the study. The table provides an assessment of the instrument’s reliability, as measured by composite reliability, for the dimensions of human capital, structural capital, relational capital and sustainability practices. The findings demonstrate the soundness of the research instrument, ensuring the reliability and validity of the collected data for further analysis

Source(s): Primary data

Table 2. Reliability and validity of the research instrument

On the other hand, a measure's discriminant validity is how well it does not measure (or discriminates against) other things it was not made to measure. It is common to look at both convergent and discriminant validity for a group of related constructs at the same time. [Fornell and Larcker \(1981\)](#) suggested that the outer loadings of an indicator on a construct must be higher than the indicator's highest correlation with any other construct in order to show that it is discriminant. Since this requirement was met, discriminant validity was established (see [Table 3](#)).

We also tested the internal consistency of the scales used to assess the variables and validated the instrument's reliability using the SmartPLS Cronbach Alpha coefficient and composite reliability ([Cronbach, 1951](#)). [Table 2](#) displays the results of the reliability analysis, showing that the instrument was consistent and acceptable ([Fornell & Larcker, 1981](#); [Nunnally, 1978](#)) because all of the alpha coefficients and composite reliability values for individual test values were greater than the recommended threshold of 0.7. Yet, composite reliability was favored here since it considers various outer loadings of the indicator variables ([Hair, Hult, Ringle, & Sarstedt, 2017](#)).

4.2 Structural model

4.2.1 Test of hypothesis. In this study, we looked at the relationships between variables by using path coefficients and *t* statistics ([Wong, 2013](#)). This is called a "bootstrapping" method. The importance of loadings and path coefficients was examined by bootstrapping. The results of these tests of three hypotheses are shown in [Figure 2](#), [Tables 4](#) and [5](#).

[Figure 2](#) shows that all three measures of IC (structural capital, relational capital and human capital) have statistically significant estimates, which shows that they all play an important role in explaining IC. There is a significant relationship between structural capital and IC ($\beta = 0.448$, $p < 0.05$), relational capital and IC ($\beta = 0.352$, $p < 0.05$) and human capital and IC ($\beta = 0.314$, $p < 0.05$). There are three components to this construct that together explain 76.7% of the variation in IC. [Table 4](#) provides an additional illustration of estimated prediction values for IC.

According to [Table 4](#), structural capital accounts for the greatest share of unexplained variation in IC, followed by relational capital and finally human capital.

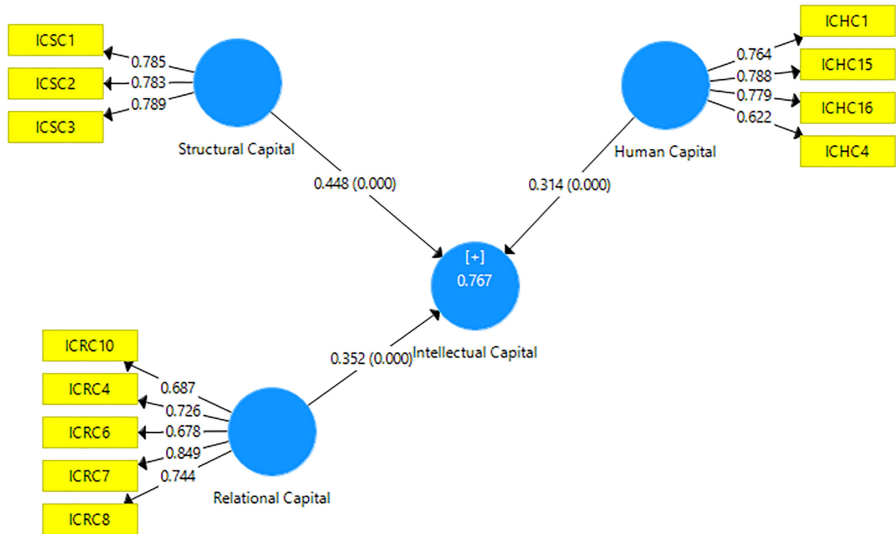
[Figure 3](#) shows that social, economic and environmental SP all produced statistically significant estimates, showing their importance in explaining SP. All outer model item

Intellectual capital	HC	RC	SC
Human capital [HC]			
Relational capital [RC]	0.734		
Structural capital [SC]	0.567	0.362	
Sustainability practices	EC	EV	SS
Economic sustainability practices [EC]			
Environmental sustainability practices [EV]	0.723		
Social sustainability practices [SS]	0.874	0.820	

Note(s): [Table 3](#) presents the results of the discriminant validity analysis using the heterotrait-monotrait (HTMT) ratio for the variables included in the study, namely human capital, structural capital, relational capital, and sustainability practices. The HTMT ratio is a widely used measure to assess the distinctiveness of constructs and determine whether they are sufficiently different from each other. The table displays the HTMT ratio values for each pair of variables, indicating the level of discriminant validity between them

Source(s): Primary data

Table 3. Discriminant validity for variables using the heterotrait-monotrait (HTMT) ratio



Note(s): Figure 2 presents the measurement model, illustrating the contribution of each dimension in explaining intellectual capital. The figure visually represents the relationships between the observed indicators and their respective latent variables, showcasing how each dimension of intellectual capital is measured and captured in the study. The arrows in the figure represent the indicators loading onto their corresponding dimensions, indicating the strength and direction of the relationships

Source(s): Authors estimation using SmartPLS 3

Figure 2.
Measurement model
for intellectual capital

Intellectual Capital	F-square	R-square	R-square adjusted
Human capital	0.189	0.767	0.759
Relational capital	0.243		
Structural capital	0.768		

Table 4.
F-square values and
prediction value
estimates for
intellectual capital

Note(s): Table 4 presents the F-square values and prediction value estimates for the independent variable, intellectual capital, in the study. The F-square values indicate the proportion of the variance in intellectual capital that can be explained by human capital, relational capital and structural capital

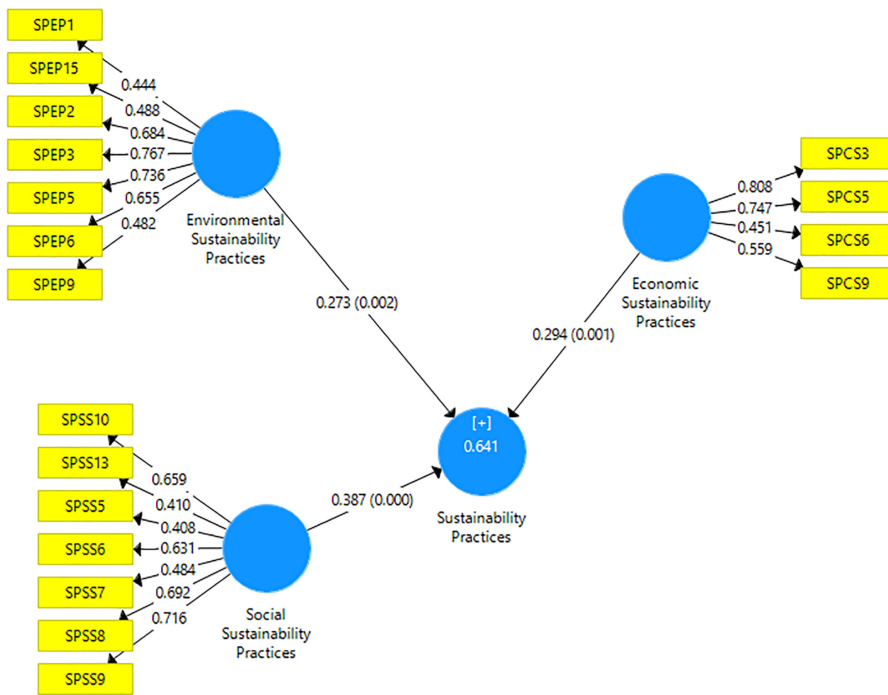
Source(s): Primary data

Sustainability practices	F-square	R-square	R-square adjusted
Economic sustainability practices	0.154	0.641	0.630
Environmental sustainability practices	0.128		
Social sustainability practices	0.232		

Table 5.
F-square values and
prediction value
estimates for
sustainability practices

Note(s): Table 5 presents the F-square values and prediction value estimates for the dependent variable, sustainability practices, in the study. The F-square values indicate the proportion of variance in the sustainability practices that can be explained by the three dimensions of environmental, social and economic sustainability practices

Source(s): Primary data



Note(s): Figure 3, the measurement model, provides a visual representation of the contribution of each dimension in explaining sustainability practices (SP). It depicts the relationships between the observed indicators and their latent variables, showcasing how each dimension of SP is measured and captured in the study. The arrows in the figure illustrate the indicators loading onto their respective dimensions, indicating the strength and direction of the relationships. Overall, Figure 3 helps to elucidate the measurement validity of SP and provides a clear understanding of how the different dimensions are assessed in the research

Source(s): Authors estimation using SmartPLS 3

Figure 3. Measurement model for sustainability practices

loadings were greater than 0.400, the threshold set by Hair, Sarstedt, Ringle, and Mena (2012). Hence, all the manifest variables may be relied upon as reliable indicators of their latent variables. The highest loading on SP is found for social SP ($\beta = 0.387, p < 0.05$), indicating that this variable best explains the observed variation in SP. A total of 64.1% of the variation in SP may be attributed to these factors when taken together. Table 5 provides SP prediction values.

From Table 5 we note that social SP offer the highest explanation of the variance in SP followed by economic and finally environmental SP.

From Table 6 we present the structural model prediction results for SPs in the study.

Results show a positive and statistically significant relationship between human capital and SP ($\beta = 0.174, t$ -statistic 2.601, p -values < 0.05). This lends credence to H1. When individuals with the necessary competencies are brought into the organization, implementing SP becomes relatively simple. In addition, if all workers are kept up-to-date on the company's sustainability-friendly actions, it will be easy to reduce the amount of air pollution caused by

Table 6.
Structural Model for
prediction of the
sustainability practices

	<i>R</i> square	<i>R</i> square adjusted		
Sustainability practices	0.699	0.689		
	β	Std. Error	<i>T</i> -statistics	<i>P</i> -value
Human capital \rightarrow Sustainability practices	0.174	0.067	2.601	0.009
Relational capital \rightarrow Sustainability practices	0.501	0.061	8.234	0.000
Structural capital \rightarrow Sustainability practices	0.306	0.077	3.973	0.000

Note(s): Table 6 presents the structural model for predicting the sustainability practices in the study. The structural model showcases the relationships between intellectual capital dimensions and the dependent variable, sustainability practices. The table displays the estimated path coefficients, which indicate the strength and direction of the relationships between the variables. Additionally, the table provides information on the significance levels of the path coefficients, which determine the statistical significance of the relationships. The findings in Table 6 offer insights into the extent to which intellectual capital dimensions contribute to the prediction of sustainability practices

Source(s): Primary data

the manufacturing firm's operations, with companies prioritizing community safety. In addition, increased investment in training and development programs that focus on sustainability issues such as environmental conservation, social inclusion and economic prosperity will help develop the knowledge and skills of employees necessary for promoting these sustainability initiatives.

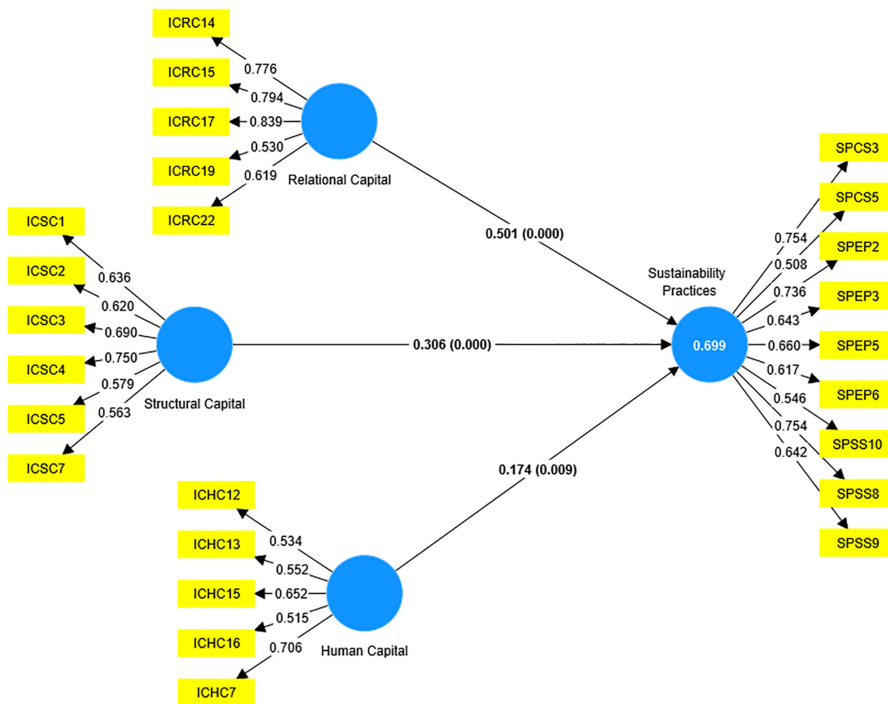
Moreover, structural capital and SP exhibit a positive and statistically significant relationship ($\beta = 0.306$, *t*-statistic 3.973, *p*-values < 0.05). As a consequence, H2 was supported. This indicates that when a firm incurs the lowest cost of conducting business for long-term advantage in contrast to others in the sector, the deployment of techniques like SP becomes apparent. Furthermore, a company with a clear system for capturing information related to SP streamlines manufacturing firms' activities to be focused on environmental conservation through pollution control, waste minimization and improving efficiency and productivity, all with the goal of saving money for the firm in order to survive in the market place.

Additionally, the findings show a positive and significant connection between relational capital and SP ($\beta = 0.501$, *t*-statistic 8.234, *p*-values < 0.05). This means that H3 was supported. This implies that when the company and its suppliers collaborate to solve challenges associated with sustainability initiatives, it becomes easier for the spread of SP across the entire supply chain because of increased support for local suppliers by purchasing from them and increased use of easily degradable materials. This is because teamwork offers a fresh perspective on one's decisions. Improved reputation-sustainability is valued by both clients and partners. You may increase your positive market presence by ensuring that the company operates in a sustainable way. As a consequence, some members of the community may gather recyclable waste and sell it to the corporation, thus boosting their own well-being.

Ultimately, results in Figure 4 demonstrated that the coefficient of determination r^2 is 69.9% and the adjusted *r* square is 68.9% for the endogenous latent variable SP. This suggests that the three dimensions of IC account for 68.9% of the variation in the SP of Ugandan manufacturing enterprises. This indicates that H4 was supported. All the dimensions of IC matter for the SP of manufacturing ML firms in Uganda.

5. Discussion

The RBT that the structural model of this study is based on supports the idea that IC dimensions matter in SP. Moreover, IC significantly predicts SP. This suggests that more IC results in more SP. Hence, it follows that changes in IC will have substantial effects on the degree to which SP is reduced or enhanced. Bananuka *et al.* (2023) backs up these findings by



Note(s): Figure 4 illustrates the hypothesis testing process conducted in the study. The figure visually represents the relationships between the variables and the corresponding hypotheses that were formulated based on the research objectives. The arrows in the figure indicate the hypothesized relationships, showcasing the expected directions of influence between the variables. The figure provides a clear overview of the hypothesized pathways and allows for a visual assessment of whether the observed data supports or rejects the formulated hypotheses. The results of hypothesis testing provide important insights into the relationships between the variables and contribute to the overall understanding of the research topic. Figure 4 serves as a visual representation of the hypothesis testing process, aiding in the interpretation and discussion of the study findings

Source(s): Authors estimation using SmartPLS 3

Figure 4. Structural model for prediction of the sustainability practices

adding that investing in human capital via means like training and development will lead to long-term success for any firm. Human capital is favorably and strongly related to the SP of Uganda’s manufacturing enterprises, according to the study’s findings. These results are in line with those of prior studies that indicated a favorable and substantial correlation between human capital and sustainability strategies, including waste minimization, energy efficiency and eco-design among industrial companies (Corredor & Gomez, 2019).

Also, our results show a positive and statistically significant link between relational capital and SP. Solid stakeholder connections give a company better access to the networks, experience and resources it needs to make long-lasting breakthroughs. Our findings are in line with those of Capaldo, Messeni Petruzzelli, and Petti (2019), who discovered that a company’s relational capital level improves its capacity for sustained innovation. Ritala and

Huotari (2017) also found that corporations can help society and the environment in ways that are good for both parties when they have access to relational capital. In addition, Kazemi and Aghdasi (2020) found that companies are more likely to adopt policies that are good for the environment, society and the economy when they have strong relationships with their constituents, which increases their credibility and standing in the market. Through this process, stakeholders are met and the company's goals for sustainability are moved forward.

Concerning the relationship between structural capital and SP in manufacturing ML, our results revealed that structural capital is positively and significantly related to SP. This research lends credence to the idea that there is a connection between structural capital and SP. Findings corroborated H3. This suggests that there is a connection, contrary to the null hypothesis. These results are in tandem with those of Liao, Lin, Chen, and Wang (2021), who found that structural capital positively affected the environmental performance of Chinese industrial enterprises. Moreover, Liao *et al.* (2021) claimed that SP may be adopted and implemented via the use of organizational structures, systems and processes by providing resources, incentives and coordinating mechanisms.

6. Summary and conclusions

The primary objective of this study was to examine the impact of IC on the SPs of ML manufacturing firms in Uganda. Additionally, the study aimed to investigate the individual significance of different dimensions of IC, as identified in existing literature, on SP. To achieve these objectives, a questionnaire survey was conducted, involving 102 manufacturing firms in Uganda. The units of inquiry were key personnel including the production manager, operations manager, environmental manager, human resource manager and chief finance officer. The findings indicate a significant relationship between IC and SP. Notably, relational capital and structural capital exhibited the strongest predictive potential, while human capital displayed the lowest predictive potential for SP among ML manufacturing firms in Uganda.

This work contributes to the theory (RBT) and literature on SP and suggests that human, social and structural IC can help Ugandan manufacturing ML firms operate sustainably. All IC components are strategic resources and SP toolkits that may inspire other research.

In terms of managerial and practical implications, the current study highlights the importance of managing IC effectively within manufacturing firms. To improve SP, companies should invest in strategies that promote knowledge creation, sharing and utilization. This can be achieved through initiatives such as employee training programs, knowledge-sharing platforms and the establishment of cross-functional teams. Sharing information and best practices can boost sustainability efforts and stakeholder engagement can expose sustainability issues and solutions. Manufacturing enterprises should use their IC to create sustainable solutions, such as creating new ecologically and socially responsible goods and services and improving current ones to lessen their environmental effect. More so, by actively managing IC, firms can foster innovation, improve decision-making and gain a competitive edge.

The study further emphasizes the need for manufacturing firms to adopt a culture of continuous improvement and measurement in their SP. This involves setting clear goals, tracking key performance indicators (KPIs) and regularly monitoring progress. Manufacturing firms should establish mechanisms for collecting and analyzing relevant sustainability data, which can guide decision-making and enable benchmarking against industry peers. By continuously improving and measuring sustainability efforts, firms can identify areas for optimization, demonstrate their commitment to sustainability and communicate their achievements effectively.

Our study emphasizes the need for manufacturing firms to integrate SP into their core business operations. This includes adopting environmentally friendly manufacturing processes, reducing waste generation and optimizing resource utilization. Companies can explore opportunities to implement cleaner production technologies, engage in eco-design

practices and establish partnerships with suppliers that prioritize sustainability. By embedding sustainability into their operations, firms can minimize their environmental footprint and contribute to long-term ecological preservation.

The study accentuates the significance of collaboration and stakeholder engagement for SP within the manufacturing domain. Manufacturing firms should actively involve their employees, customers, suppliers and local communities in sustainability initiatives. This can be achieved through regular communication, feedback mechanisms and collaborative projects. By engaging stakeholders, firms can foster a culture of sustainability, gain insights into emerging sustainability trends and build mutually beneficial relationships.

This study acknowledges several limitations that warrant consideration. The reliance on self-reported questionnaires introduces potential biases, such as social desirability or recall bias, which may affect the accuracy and reliability of the collected data. Furthermore, the small sample size and geographic limitation to the central region of Uganda limit the generalizability of the findings to the broader manufacturing industry. Caution should be exercised when extrapolating the results to the entire population of manufacturing firms in Uganda. Additionally, given the evolving nature of SP and IC, researchers must carefully assess the scope, methodology and interpretation of their data before drawing cautious conclusions. Future research endeavors should consider employing mixed-methods approaches, incorporating qualitative methods to provide deeper insights and adopting longitudinal designs to examine SP and IC over time. Comparative studies across industries and countries, as well as multi-level analyses, would offer valuable insights into contextual factors and industry-specific nuances that shape and influence these practices. By addressing these limitations and pursuing these avenues of inquiry, scholars can enhance their understanding of IC and SP in the manufacturing industry, contributing to more robust theoretical frameworks and practical implications.

References

- African Union (AU) (2015). *Agenda 2063: The Africa we want*. Addis Ababa: African Union. Available from: <https://au.int/en/agenda2063/about>
- Akhtar, P., Waseem, M., & Hussain, M. (2015). Intellectual capital and sustainability: An empirical study of the Pakistani cement industry. *Journal of Cleaner Production*, 107, 432–444. doi: 10.1016/j.jclepro.2015.05.076.
- Al-Khoury, A., Hussein, S. A., Abdulwhab, M., Aljuboori, Z. M., Haddad, H., Ali, M. A., ... & Flayyih, H. H. (2022). Intellectual capital history and trends: A bibliometric analysis using scopus database. *Sustainability*, 14(18), 11615.
- Alam, M., Rana, M. P., & Lodhi, S. A. (2020). Intellectual capital and sustainability practices in manufacturing firms: A developing country perspective. *Sustainability*, 12(8), 3266.
- Alinda, K., Tumwine, S., Kaawaase, T., Navrud, S., Nalukenge, I., & Sserwanga, A. (2022). Sustainability practices among manufacturing firms in Uganda: An overview of challenges and opportunities. *Advances in Research*, 23(1), 1–21.
- Alvino, F., Di Vaio, A., Hassan, R., & Palladino, R. (2021). Intellectual capital and sustainable development: a systematic literature review. *Journal of Intellectual Capital*, 22(1), 76–94. doi: 10.1108/JIC-11-2019-0259.
- Amoah, P. & Eweje, G. (2022). Barriers to environmental sustainability practices of multinational mining companies in Ghana: An institutional complexity perspective. *Corporate Governance: The International Journal of Business in Society*, 22(2), 364–384.
- Amoah, P., & Eweje, G. (2023). Organisational drivers and sustainability implementation in the mining industry: A holistic theoretical framework. *Business Strategy and the Environment*, 1–13. doi: 10.1002/bse.3438.

- Ara, H., Leen, J. Y. A., & Hassan, S. H. (2019). GMS for sustainability performance in the apparel manufacturing industry: A conceptual framework. *Vision: The Journal of Business Perspective*, 23(2), 170–179.
- Arshad, R., Yousafzai, S., & Syed, F. (2016). Role of human capital in gaining sustainable competitive advantage: Mediating role of relational capital. *International Journal of Human Resource Management*, 27(1), 109–126. doi: [10.1080/09585192.2015.1025468](https://doi.org/10.1080/09585192.2015.1025468).
- Baltacioglu, T., Gungor, A., Kaplan, M., & Simsek, A. (2017). Sustainability in manufacturing and its impact on profitability. In *Sustainability in Engineering Design and Construction* (pp. 89–98). Springer.
- Bananuka, J., Nkundabanyanga, S. K., Kaawaase, T. K., Mindra, R. K., & Kayongo, I. N. (2022). Sustainability performance disclosures: The impact of gender diversity and intellectual capital on GRI standards compliance in Uganda. *Journal of Accounting in Emerging Economies*, 12(5), 840–881. doi: [10.1108/JAEE-09-2021-0301](https://doi.org/10.1108/JAEE-09-2021-0301).
- Bananuka, J., Taurigana, V., & Tumwebaze, Z. (2023). Intellectual capital and sustainability reporting practices in Uganda. *Journal of Intellectual Capital*, 24(2), 487–508. doi: [10.1108/JIC-01-2021-0019](https://doi.org/10.1108/JIC-01-2021-0019).
- Bandinelli, R., Acuti, D., Fani, V., Bindi, B., & Aiello, G. (2020). Environmental practices in the wine industry: An overview of the Italian market. *British Food Journal*, 122(5), 1625–1646.
- Barney, J. (1991). Firm resources and sustained competitive advantage. *Journal of Management*, 17(1), 99–120. doi: [10.1177/014920639101700108](https://doi.org/10.1177/014920639101700108).
- Bello-Pintado, A., Machuca, J. A., & Danese, P. (2023). Stakeholder pressures and sustainability practices in manufacturing: Consideration of the economic development context. *Business Strategy and the Environment*, 1–19. doi: [10.1002/bse.3355](https://doi.org/10.1002/bse.3355).
- Bonfanti, A., Mion, G., Brunetti, F., & Vargas-Sánchez, A. (2023). The contribution of manufacturing companies to the achievement of sustainable development goals: An empirical analysis of the operationalization of sustainable business models. *Business Strategy and the Environment*, 32(4), 2490–2508.
- Bontis, N. (1998). Intellectual capital: An exploratory study that develops measures and models. *Management Decision*, 36(2), 63–76.
- Braungart, M., McDonough, W., & Bollinger, A. (2007). Cradle-to-cradle design: Creating healthy emissions: a strategy for eco-effective product and system design. *Journal of Cleaner Production*, 15, 1337–1348.
- Cabrita, M. R. & Bontis, N. (2008). Intellectual capital and business performance in the Portuguese banking industry. *International Journal of Technology Management*, 44(1-3), 77–98, doi: [10.1504/ijtm.2008.015733](https://doi.org/10.1504/ijtm.2008.015733).
- Can, E. F. & Alatas, B. (2017). Sustainable development goals and their implication for business. *European Scientific Journal*, 13(34), 15–24.
- Capaldo, A., Messeni Petruzzelli, A., & Petti, C. (2019). Investigating the effect of relational capital on sustainable innovation performance. *Journal of Cleaner Production*, 208, 1265–1277.
- Castka, P., Gölgeci, I., & Piterou, A. (2021). Relational capital and sustainability practices: A dynamic capabilities perspective. *Journal of Business Research*, 126, 624–634.
- Chow, W. S. & Chen, Y. (2012). The effects of internal resources and external network on the innovation performance of SMEs. *Technovation*, 32(5), 284–295.
- Corredor, P. & Gomez, J. (2019). Human capital and sustainable manufacturing practices. *Journal of Cleaner Production*, 222, 411–421. doi: [10.1016/j.jclepro.2019.03.081](https://doi.org/10.1016/j.jclepro.2019.03.081).
- Cronbach, L. J. (1951). Coefficient alpha and the internal structure of tests. *Psychometrika*, 16(3), 297–334. doi: [10.1007/BF02310555](https://doi.org/10.1007/BF02310555).
- Cucculelli, M., Bettinelli, C., & Rialti, R. (2019). Relational capital and firm performance: The effect of intangibles drivers. *International Journal of Entrepreneurial Behavior and Research*, 25(3), 490–510.

- Dal Mas, F. (2019). Intellectual capital and sustainability: An empirical investigation of the relationship between intellectual capital components and sustainability. *Journal of Intellectual Capital*, 20(1), 43–67. doi: [10.1108/JIC-08-2018-0150](https://doi.org/10.1108/JIC-08-2018-0150).
- Daspit, J. J. & Long, R. G. (2014). The influence of relational capital on strategic decision-making transparency in small and medium-sized enterprises. *Journal of Business Research*, 67(5), 778–784.
- Desore, A., & Narula, S. A. (2018). An overview on corporate response towards sustainability issues in textile industry. *Environment, Development and Sustainability*, 20(4), 1439–1459.
- Dos Santos, P. S., & Campos, L. M. S. (2020). Green practices in the fashion supply chain: A literature review. In Leal Filho, W., Tortato, U., & Frankenberger, F. (Eds), *Universities and sustainable communities: Meeting the goals of the agenda 2030 (1)*, pp. 115–132). Springer.
- Earley, R. (2017). Designing fast & slow. Exploring fashion textile product life cycle speeds with industry designers. *The Design Journal*, 20, 2645–2656.
- Farneti, F., Battisti, F., & Mora, C. (2021). The role of human capital in the adoption of sustainable practices by firms. *Journal of Cleaner Production*, 279, 123813. doi: [10.1016/j.jclepro.2020.123813](https://doi.org/10.1016/j.jclepro.2020.123813).
- Field, A. (2009). *Discovering statistics using SPSS* (3rd ed., 896). Sage Publications.
- Fornell, C. & Bookstein, F. L. (1982). Two structural equation models: LISREL and PLS applied to consumer exit-voice theory. *Journal of Marketing Research*, 19(4), 440–452.
- Fornell, C. & Larcker, D. F. (1981). Evaluating structural equation models with unobservable variables and measurement error. *Journal of Marketing Research*, 18(1), 39–50. doi: [10.1177/002224378101800104](https://doi.org/10.1177/002224378101800104).
- Furstenau, L. B., de Melo, M. T., Varela, E. R., & Ferreira, P. M. (2020). Sustainable development goals: A review of the measures for economic, social, and environmental impact. *Business Strategy and the Environment*, 29(5), 2023–2042.
- Gallardo-Vázquez, D., Suárez-Barraza, M. F., & Ramírez-Portilla, A. (2020). Intellectual capital and sustainability practices in emerging economies: Evidence from Mexico. *Sustainability*, 12(7), 2905.
- Geissdoerfer, M., Savaget, P., Bocken, N. M. P., & Hultink, E. J. (2017). The Circular Economy – a new sustainability paradigm? *Journal of Cleaner Production*, 143, 757–768. doi: [10.1016/j.jclepro.2016.12.048](https://doi.org/10.1016/j.jclepro.2016.12.048).
- Hair, J. F., Sarstedt, M., Ringle, C. M., & Mena, J. A. (2012). An assessment of the use of partial least squares structural equation modeling in marketing research. *Journal of the Academy of Marketing Science*, 40(3), 414–433. doi: [10.1007/s11747-011-0261-6](https://doi.org/10.1007/s11747-011-0261-6).
- Hair, J. F., Hult, G. T. M., Ringle, C. M., & Sarstedt, M. (2017). *A primer on partial least squares structural equation modeling (PLS-SEM)* (2nd ed.). Thousand Oaks, CA: Sage Publications.
- Han, K., Shi, Y., & Wang, Y. (2020). Relational capital and sustainability innovation: The mediating role of organizational learning. *Journal of Cleaner Production*, 244, 118670.
- Hassan, M. K., Shukla, N., & Jug, M. N. (2019). Sustainability practices and their impact on firm performance: Evidence from the manufacturing sector in Uganda. *Sustainable Production and Consumption*, 20, 200–212.
- Henseler, J., Ringle, C. M., & Sarstedt, M. (2014). A new criterion for assessing discriminant validity in variance-based structural equation modeling. *Journal of the Academy of Marketing Science*, 43(1), 115–135.
- Høgevold, N. M., Svensson, G., Klopper, H. B., Wagner, B., Valera, J. C. S., Padin, C., . . . Petzer, D. (2015). A triple bottom line construct and reasons for implementing sustainable business practices in companies and their business networks. *Corporate Governance*, 15(4), 427–443.
- IEA (2015). Energy and climate change. Available from: <https://www.iea.org/reports/energy-and-climate-change>

- Jarrar, A. & Abu-Zaid, M. (2016). The influence of intellectual capital on corporate social responsibility and financial performance. *Journal of Intellectual Capital*, 17(1), 162–182. doi: [10.1108/JIC-02-2015-0015](https://doi.org/10.1108/JIC-02-2015-0015).
- Jayashree, S., Venkatesh, R., & Arunachalam, S. (2021). Impact of technological advancements and intellectual capital on sustainability practices of manufacturing enterprises: A review. *Journal of Cleaner Production*, 278, 123789. doi: [10.1016/j.jclepro.2020.123789](https://doi.org/10.1016/j.jclepro.2020.123789).
- Jia, F., & Jiang, Y. (2018). Sustainable global sourcing: a systematic literature review and bibliometric analysis. *Sustainability*, 10(3), 595–616.
- Kazemi, A. & Aghdasi, M. (2020). Investigating the effects of relational capital and organizational learning on sustainable manufacturing practices: A study of SMEs. *Journal of Cleaner Production*, 256, 120513.
- Kianto, A., Sáenz, J., & Aramburu, N. (2017). Intellectual capital and innovation in SMEs. *Journal of Intellectual Capital*, 18(1), 187–210.
- Kianto, A., Ritala, P., Spender, J. C., & Vanhala, M. (2019). Intellectual capital and sustainability in SMEs: A comprehensive literature review. *Journal of Cleaner Production*, 233, 1392–1406.
- Kozłowski, A., Searcy, C., & Bardecki, M. (2018). The reDesign canvas: Fashion design as a tool for sustainability. *Journal of Cleaner Production*, 183, 194–207.
- Kraus, S., Ribeiro-Soriano, D., Schüssler, M., & Brem, A. (2017). Foresight and sustainability: Antecedents, research methods, and future developments. *Futures*, 91, 1–6. doi: [10.1016/j.futures.2017.05.003](https://doi.org/10.1016/j.futures.2017.05.003).
- Krejcie, R. V. & Morgan, D. W. (1970). Determining sample size for research activities. *Educational and Psychological Measurement*, 30(3), 607–610.
- Lee, S., & Kim, H. (2018). The effect of intellectual capital on corporate sustainability: Evidence from the Korean manufacturing industry. *Sustainability*, 10(9), 3172.
- Li, W., Bhutto, M. Y., Waris, I., & Hu, T. (2023). The nexus between environmental corporate social responsibility, green intellectual capital and green innovation towards business sustainability: An empirical analysis of Chinese automobile manufacturing firms. *International Journal of Environmental Research and Public Health*, 20(3), 1851.
- Li, Y., Liu, B., & Huan, T.-C. (2019). Renewal or not? Consumer response to a renewed corporate social responsibility strategy: Evidence from the coffee shop industry. *Tourism Management*, 72, 170–179.
- Liao, Y., Lin, L., Chen, Y., & Wang, Y. (2021). How do innovation, technology and intellectual capital affect green productivity? Evidence from Chinese manufacturing firms. *Journal of Cleaner Production*, 298, 126837. doi: [10.1016/j.jclepro.2021.126837](https://doi.org/10.1016/j.jclepro.2021.126837).
- Lieder, M., & Rashid, A. (2016). Towards circular economy implementation: A comprehensive review in context of manufacturing industry. *Journal of Cleaner Production*, 115, 36–51.
- Malik, M. S., Khan, M. A., & Khalid, N. (2020). Sustainable development: An empirical investigation of the linkages between intellectual capital and sustainability. *Journal of Cleaner Production*, 253, 119972. doi: [10.1016/j.jclepro.2019.119972](https://doi.org/10.1016/j.jclepro.2019.119972).
- Malik, S., Cao, Y., Mughal, Y. H., Kundi, G. M., Mughal, M. H., & Ramayah, T. (2020). Pathways Towards Sustainability in Organizations: Empirical Evidence on the Role of Green Human Resource Management Practices and Green Intellectual Capital. *Sustainability*, 8(12), 3228.
- Massaro, M., Dumay, J., & Garlatti, A. (2018). Intellectual capital and sustainability in manufacturing companies: A systematic literature review. *Journal of Cleaner Production*, 172, 4325–4339. doi: [10.1016/j.jclepro.2017.11.178](https://doi.org/10.1016/j.jclepro.2017.11.178).
- McBride, R. B., & Adamson, K. A. (2015). Using a six-point Likert scale to evaluate attitudes toward the use of technology in education. *Journal of Educational Computing Research*, 52(2), 199–208. doi: [10.1177/0735633114562467](https://doi.org/10.1177/0735633114562467).

- Moorhouse, D., & Moorhouse, D. (2017). Sustainable design: Circular economy in fashion and textiles. *The Design Journal*, 20, S1948–S1959.
- Namanya, D. B. & Luukkanen, J. (2020). Environmental sustainability practices and firm competitiveness: Evidence from the manufacturing sector in Uganda. *Journal of Business Ethics*, 165(2), 307–325.
- Nasreen, T., Baker, R., & Rezanian, D. (2023). Sustainability reporting—a systematic review of various dimensions, theoretical and methodological underpinnings. *Journal of Financial Reporting and Accounting*, (ahead-of-print). doi: [10.1108/JFRA-01-2022-0029](https://doi.org/10.1108/JFRA-01-2022-0029).
- National Environment Management Authority (NEMA) (2019). State of the environment report for Uganda 2019. NEMA.
- National Planning Authority Uganda (NPA) (2020). National development plan III (2020/21-2024/25). Kampala: NPA. Kampala, Uganda. Available from: <https://www.npa.go.ug/ndp-iii/>
- Nave, A., do Paço, A., & Duarte, P. (2021). A systematic literature review on sustainability in the wine tourism industry: Insights and perspectives. *International Journal of Wine Business Research*, 33(4), 457–480.
- Ndagire, R. K. & Nakabuye, Z. (2021). The impact of intellectual capital on corporate sustainability: A case of selected Ugandan financial institutions. *Journal of Business and Management*, 23(8), 44–56.
- Neuman, W. L. (2007). *Basics of social research methods: Qualitative and quantitative approaches* (2nd ed.). Allyn and Bacon, Boston: Pearson Education.
- Nunnally, J. C. (1978). *Psychometric theory* (2nd ed.). New York: McGraw-Hill.
- Ritala, P. & Huotari, P. (2017). Relational capital for sustainability: Exploring complementarity in stakeholder interactions. *Journal of Cleaner Production*, 141, 148–157.
- Romagnoli, S., Tarabu, C., Maleki Vishkaei, B., & De Giovanni, P. (2023). The impact of digital technologies and sustainable practices on circular supply chain management. *Logistics*, 7(1), 1.
- Santi, S. V., Figueiredo, K. W., Formentini, M. A., & Oliva, F. L. (2021). The role of relational capital in promoting sustainable supply chain management practices in manufacturing firms. *Journal of Cleaner Production*, 306, 127321.
- Schrettle, S., Hinz, A., Scherrer-Rathje, M., & Friedli, T. (2014). Turning sustainability into action: Explaining firms' sustainability efforts and their impact on firm performance. *International Journal of Production Economics*, 147, 73–84.
- Sun, P., Zhang, X., Li, Z., & Xie, X. (2018). Does relational capital matter for environmental performance? Empirical evidence from China's energy-intensive firms. *Sustainability*, 10(10), 3511.
- Sunday, O. E. (2017). Sustainable manufacturing practices in developing countries: A conceptual framework from the intellectual capital perspective. *Journal of Cleaner Production*, 142, 2275–2288. doi: [10.1016/j.jclepro.2016.11.064](https://doi.org/10.1016/j.jclepro.2016.11.064).
- Tang, Y., Liu, X., Wang, J., Zhu, X., & Wang, W. (2018). CO2 emissions reduction in China's manufacturing industry: Evidence from nonparametric additive regression models. *Journal of Cleaner Production*, 189, 145–154.
- Taticchi, P., Garengo, P., Nudurupati, S. S., Tonelli, F., & Pasqualino, R. (2018). A review of decision-support tools and performance measurement and sustainable supply chain management. *International Journal of Production Research*, 56(1-2), 414–430.
- Tortoriello, M., Reagans, R., & McEvily, B. (2011). Bridging the knowledge gap: The influence of strong ties, network cohesion, and network range on the transfer of knowledge between organizational units. *Organization Science*, 22(4), 1024–1039.
- Uganda Bureau of Statistics (UBOS) (2018). The national business register: Manufacturing sector report 2018.

- United Nations Industrial Development Organization (UNIDO) (2018). *Uganda resource efficient and cleaner production demonstration programme*. Vienna: United Nations Industrial Development Organization.
- Van der Zahn, J.-L. W. M. (2023). Sustainability reporting regime transition and the impact on intellectual capital reporting. *Journal of Applied Accounting Research*, 24(3), 544–582. doi: [10.1108/JAAR-06-2021-0143](https://doi.org/10.1108/JAAR-06-2021-0143).
- Wernerfelt, B. (1984). A resource-based view of the firm. *Strategic Management Journal*, 5(2), 171–180. doi: [10.1002/smj.4250050207](https://doi.org/10.1002/smj.4250050207).
- Widodo, B. & Shahab, Y. (2015). Human capital and competitive advantage: An empirical study in Indonesian retail industry. *Procedia Economics and Finance*, 31, 712–722. doi: [10.1016/s2212-5671\(15\)01251-2](https://doi.org/10.1016/s2212-5671(15)01251-2).
- Wong, K. K. (2013). Partial least squares structural equation modeling (PLS-SEM) techniques using SmartPLS. *Marketing Bulletin*, 24(1), 1–32.
- World Bank (2022). Uganda. World Bank Group. Washington, DC: World Bank Publications, The World Bank Group. Available from: <https://www.worldbank.org/en/country/uganda>
- Yacob, T., Zhou, J., & Shi, Y. (2019). An integrated framework for sustainable development in manufacturing firms. *Journal of Cleaner Production*, 226, 317–326.
- Yu, J. & Huo, B. (2019). Relational capital and environmental performance: A moderating effect of environmental dynamism. *Journal of Business Research*, 100, 156–164.
- Yusoff, R. M., Jusoh, R., Mohd Noor, N. F., & Harun, A. (2019). Intellectual capital and sustainability in manufacturing companies: Evidence from Malaysia. *Journal of Cleaner Production*, 226, 1178–1190. doi: [10.1016/j.jclepro.2019.04.127](https://doi.org/10.1016/j.jclepro.2019.04.127).

Further reading

- Connelly, L. M. (2008). Pilot studies. *Journal of Midwifery and Women's Health*, 53(6), 525–530.
- Grewal, R., Michalski, T., & Purbey, S. (2019). Sustainable development and learning organizations: An exploration of the role of training and development in building sustainability capability. *Journal of Cleaner Production*, 225, 1183–1193. doi: [10.1016/j.jclepro.2019.03.290](https://doi.org/10.1016/j.jclepro.2019.03.290).
- Mansoor, A., Jahan, S., & Riaz, M. (2021). Does green intellectual capital spur corporate environmental performance through green workforce? *Journal of Intellectual Capital*, 22(5), 823–839. doi: [10.1108/JIC-06-2020-0181](https://doi.org/10.1108/JIC-06-2020-0181).
- Rauschmayer, F., Omann, I., Frühmann, J., & Loibl, W. (2018). The role of learning in governance for sustainable development: A systematic review. *Journal of Cleaner Production*, 198, 1438–1450. doi: [10.1016/j.jclepro.2018.07.254](https://doi.org/10.1016/j.jclepro.2018.07.254).
- Yong, J. Y., Yusliza, M. Y., Ramayah, T., Farooq, K., & Tanveer, M. I. (2022). Accentuating the interconnection between green intellectual capital, green human resource management and sustainability. *Benchmarking: An International Journal*. ahead-of-print(ahead-of-print). doi: [10.1108/BIJ-11-2021-0641](https://doi.org/10.1108/BIJ-11-2021-0641).

Corresponding author

Kassim Alinda can be contacted at: kalinda@mubs.ac.ug

For instructions on how to order reprints of this article, please visit our website:

www.emeraldgroupublishing.com/licensing/reprints.htm

Or contact us for further details: permissions@emeraldinsight.com