ECONOMIC RESEARCH-EKONOMSKA ISTRAŽIVANJA
2023, VOL. 36, NO. 2, 2125035
https://doi.org/10.1080/1331677X.2022.2125035

Routledge
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OPEN ACCESS Check for updates

Business sustainability for competitive advantage: identifying the role of green intellectual capital, environmental management accounting and energy efficiency

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ABSTRACT

The manufacturing organizations are threatening the earth and its wildlife because of their growing concern about environmental pollution and industrial waste. Hence, in the present study, the three potential solutions, Green Intellectual Capital, Environmental Management Accounting and Energy Efficiency, are evaluated for excelling the organizational operations towards business sustainability and attaining the Competitive Advantage. With the assistance of 'Partial Least Square-Structural Equation Modelling' on the dataset of 364 respondents from the manufacturing organizations in China, the outcome reported the positive and significant impact of all of the studied potential solutions in excelling and enhancing business sustainability and competitive advantage. Based on the findings, it is proposed that manufacturing organizations need to apportion due attention to developing the green intellectual capital, improve the level of consumption of energy and need to disclose their environmental management through proper Environmental Management Accounting.

ARTICLE HISTORY
Received 10 June 2022
Accepted 19 August 2022

KEYWORDS
Business sustainability; competitive advantage; green intellectual capital; environmental management accounting; energy efficiency

JEL CODES
Q56; M140; M210; Q40

1. Introduction

Historically, the organizations considered the world and its respective natural resources a freely available commodity in unlimited quantities. This aptitude of the organizations headed them toward the 'tragedy of the commons' (Yusliza et al., 2020). This is a kind of tragedy where people assume that the consumption of shared resources will have minimal adverse consequences to the ecology and lead to greater depletion of resources and a larger level of pollution (Shaw et al., 2016). However, with the passage of time, there is a development in the understanding of the people that they

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have to preserve the resources, ecology and environment for the future generations, and they need to affirm the responsibilities pertaining to the destruction and preservation of the ecology, flora and fauna (Yusliza et al., 2020; Tiwari et al., 2021). Hence there is an introduction to the phenomena of sustainability in which there is an integration of the diversified aspects covering the ecology, economy and society (Bombiak & Marciniuk-Kluska, 2018).

While the researchers are exploring different potential cleaner solutions for enhancing the business sustainability in order to sustain the Competitive Advantage, the majority of the researchers have explored it within the dynamics of manufacturing by smoothing the supply and value chain (Yildiz Çankaya & Sezen, 2019), human resources having integration of sustainability (Zaid et al., 2018), and sustainable practices (Abdul-Rashid et al., 2017). Thus the major focus remains on the resources that are tangible in nature. However, the significance of intangible resources in nature and equally important has not gained the due attention (Yusliza et al., 2020). Despite that, a group of researchers ascertained the importance of intangible capital, referred to as intellectual capital (Yusoff et al., 2019). Moreover, intellectual capital has also emerged as one of the potential solutions for promoting sustainability within the operations of the organizations (Cavicchi & Vagnoni, 2017; Yusoff et al., 2019).

In addition to this, the transition of the organizations towards sustainability is mainly because of the customer demand for the environment and societal friendly goods and services (Rehman et al., 2021a; Tiwari et al., 2022). Moreover, organizational inefficiencies have also been reported to lead to financial and environmental losses during manufacturing the goods because of the wastage of resources, energy, and capital (Sari et al., 2021). The elimination of such wastage is possible by assisting an efficient system in which environmental management is regularly accounted and updated (Tashakor et al., 2019). Thus the system and procedure of Environmental Management Accounting emerged as a tool through which the wastages are identified, monitored and eventually eliminated from the value stream of the products leading to improving the business sustainability of the organizations (Bresciani et al., 2022; Sari et al., 2021).

It is undeniable that Manufacturing organizations are the largest contributor to carbon emissions and environmental pollution (Yusliza et al., 2020). In fact, according to Zailani et al. (2012), the earth and its wildlife is being threatened by the manufacturing organizations because of their growing concern about environmental pollution and industrial waste. This leads to the need to increase the efficiency and productivity of the consumption of resources, especially energy, as improving energy efficiency leads to various positive benefits for the organizations (Sidik et al., 2019). This is because when there is an improvement in terms of energy efficiency, there will be a lesser generation of non-value added activities leading to saving of the energy resources as well as decreasing the costs associated with the consumption of that un-wanted and excessive consumption of energy (Ahmed et al., 2020). Furthermore, through such kind of mitigation of the pollution, there is also an improvement in the ecology which will also assist in improving the societal well-being (Sidik et al., 2019).

In accordance with the problem highlighted in the discussion mentioned above, it is extremely important to search for the solutions which can eliminate the imbalance among the three different dimensions and aspects of sustainability. Though each of

them is equally important for attaining a competitive advantage, however achieving and then sustaining the competitiveness is extremely crucial. Hence, in the present study, the role of the three potential solutions, Green Intellectual Capital, Environmental Management Accounting, and Energy Efficiency, is evaluated for excelling the organizational operations towards business sustainability and attaining a competitive advantage. Nevertheless, the current study is an attempt to seek the answer to the following research questions:

RQ1: To what extent does Green Intellectual Capital assist the organization in achieving business sustainability and Competitive Advantage?

RQ2: To what extent does Environmental Management Accounting assist the organization in achieving business sustainability and Competitive Advantage?

RQ3: To what extent does Energy Efficiency assist the organization in achieving business sustainability and Competitive Advantage?

RQ4: how does business sustainability provide assistance to the organization in their achievement of Competitive Advantage?

The arrangement of the residual of the study is that the next section comprised of discussion related to the hypothesized relationships among the studied phenomena, followed by methodology, statistical analysis and results whereas in the last the study is concluded and recommendations are proposed.

2. Literature review

2.1. Green intellectual capital, sustainability and competitive advantage

In the current hyper-competitive business environment, the major focus and emphasis of the organizations for excellence in performance in these days, is to have assets that are intangible in nature rather keeping tangle assets that keep on depreciating over the period of time (Eisenhardt & Schoonhoven, 1996; Agostini et al., 2017). Researchers have agreed that the organizations' endurance has a strong reliance over the intangible assets (Obeng et al., 2014), which will also ensure their competitive advantage (Roos, 2017). These intangible assets are referred to as Intellectual Capital, whereby organizations possessing larger reserves of intellectual capital have more operational excellence compared with organizations with lower reserves of Intellectual Capital (Alcaniz et al., 2011; Ahmad & Ahmed, 2016). Similarly, when the intellectual capital incorporates awareness and concerns related to environmental pollution and ecological well-being, it is referred to as Green Intellectual Capital (Chen, 2007). However, despite its significance and essentiality, the phenomenon of Green Intellectual Capital has not been given its due attention and consideration by researchers and academicians (Yusoff et al., 2019).

Despite of the ignorance by the researchers and academicians, Green Intellectual Capital has the tendency and capability to enhance the operational excellence of the organizations for achieving and meeting the sustainable development objectives led by the international bodies, transforming their products towards more environmental friendlier as per the requirements of the customers, and attaining the competitive advantage (Yusoff et al., 2019; Huang & Kung, 2011). In addition to this,

organizations are revisiting their objectives and channelizing more investments to attain the three dimensions of sustainability: ecology, social, and finance (Cavicchi & Vagnoni, 2017). Moreover the role of green intellectual capital has been reported to be more supportive for achieving business sustainability (Tonial et al., 2019), which eventually assists the organizations in attaining and maintaining the competitive advantage (Yusliza et al., 2020; Roos, 2017). Hence it is assumed that:

H1: Green Intellectual Capital of the organization will enhance the environmental performance.

H2: Green Intellectual Capital of the organization will enhance the economic performance.

H3: Green Intellectual Capital of the organization will enhance the social performance.

H4: Green Intellectual Capital of the organization will enhance the Competitive Advantage.

2.2. Energy efficiency, sustainability and competitive advantage

The consumption of energy is pivotal for the organization in transforming the raw material into finished goods leading to revenue and profit generation. Hence, it becomes inevitable for the organization to clearly wipe out the usage of energy from their operations as a preventive measure to control the generation of pollution and greenhouse gases. This is because there is an existence of a direct relationship between the consumption of energy and organizational performance (Ahmed et al., 2020). However, the consumption of energy can be improved by improving its productivity and efficiency, whereas transformation towards environmentally friendly, green and renewable energy sources can also be a potential solution to attain a balance between development and pollution (Mikučionienė et al., 2014; Banerjee & Solomon, 2003). Moreover, it should be noted that the energy efficiency is not merely dependent on the increasing the level of productivity and consumption efficiency rather, it requires a serious attention towards transformation towards green sources, government support, prices, timely availability, taxation etc. (Hanley et al., 2009).

Furthermore, the contribution of energy efficiency in achieving the business sustainability is reported by different researchers in different geographical settings. Precisely, through energy efficiency, a firm can decrease excessive energy consumption, which leads to the lesser generation of pollution and improves environmental performance (Hanley et al., 2009; Ahmed et al., 2020). Moreover, when there is lesser energy consumption, the excessive financial resources can be utilized in any other profitable alternatives, thus improving financial performance (Shin et al., 2018; Dangelico & Pontrandolfo, 2015). Furthermore, through this, the residual of the energy will be available for society to be consumed, thus improving social performance. On the other hand, when an organization saves less energy and progresses far better than the competitors, it actually contributes to the competitive advantage of the firm (Sidik et al., 2019). Hence it is assumed that:

H5: Energy Efficiency of the organization will enhance the environmental performance.

H6: Energy Efficiency of the organization will enhance the economic performance.

H7: Energy Efficiency of the organization will enhance the social performance.

H8: Energy Efficiency of the organization will enhance the Competitive Advantage.

2.3. Environmental management accounting, sustainability and competitive advantage

Environmental Management Accounting (ACC) has been explained as integration of financial and cost accounting with the objective of decreasing the level of environmental costs, effects and risks, which is an important element in any of the decision making made by the top management (Bresciani et al., 2022). It is considered as one of the viable solutions for attaining sustainability (Zhou et al., 2017; Burritt & Saka, 2006). Moreover, through this kind of accounting, the firms will be in a better position to fulfil their environmental protection responsibility at the minimum or no compromise on the finance and economics of the organizations (Ferreira et al., 2010). Moreover, ACC is becoming the criteria for assessing the level of sustainability that the organization possesses while comparing with the related competitors (Christ & Burritt, 2015). This attribute of ACC also makes it to be a differentiating factor for achieving a competitive advantage (Sidik et al., 2019).

Despite its importance and significance, organizations have the implementation of ACC at a minimal rate (Doorasamy, 2015). This eventually decreases ACC's effectiveness by reducing waste, energy, and costs (Schaltegger, 2018). One of the recent studies conducted by Qian et al. (2018) confirms the assistance of ACC in eradicating carbon emissions through effective management and disclosure. The researchers reached this conclusion after conducting the analysis on the data collected from 114 organizations belonging to developed countries like Germany, Japan, Australia, and United States. Similar findings were validated by Phan et al. (2018), who reached this conclusion after analyzing the firm-level data of 208 organizations from Australia. Hence it is assumed that:

H9: Environmental Management Accounting of the organization will enhance the environmental performance.

H10: Environmental Management Accounting of the organization will enhance the economic performance.

H11: Environmental Management Accounting of the organization will enhance the social performance.

H12: Environmental Management Accounting of the organization will enhance the Competitive Advantage.

2.4. Sustainability and competitive advantage

The concept of sustainability entails three dimensions that need to be considered, which covers the aspects of society, ecology and finance or economics (Eklington, 1998; Asadi et al., 2017). Normally, organizations are only focused and concerned on the financial aspects for which they take decisions ignoring the societal and ecological concerns (Van der Byl & Slawinski, 2015; Neri et al., 2018). However, it should be noted that focusing merely on financial aspects will only benefit the organization in a

shorter period of time. Hence, for long term survival and competitiveness, they have to pay equal importance to all of the three dimensions of sustainability (Neri et al., 2018). Moreover, organizations also prioritize these dimensions based on their comfort, resources and objectives (Fernando et al., 2019). However, all of these dimensions are interrelated. For instance, when organizations strive to eliminate waste, improve the efficiency level of energy consumption to improve their financial excellence, they are actually also taking sufficient steps to improve environmental performance (Khurshid & Darzi, 2016).

Moreover, these initiatives will not be possible without the support of the human resources who actually drives the strategies and policies. Hence, they are also getting awareness regarding the preservation of the environment, which is also a small step toward improving social performance (Mehta & Chugan, 2015). Hence, through these initiatives, organizations are moving towards attaining a competitive advantage (Asadi et al., 2020). Thus it is assumed that:

H13: Environmental Performance of the organization will enhance the Competitive Advantage.

H14: Economic Performance of the organization will enhance the Competitive Advantage.

H15: Social Performance of the organization will enhance the Competitive Advantage.

3. Methodology

Prior to the execution of any research study, the researchers have multiple options in terms of research approach and design. In terms of research approach, a study can be quantitative, qualitative or both, which is referred to as a mixed research approach. With every research approach, there are different pre-requisites, benefits, and challenges that a researcher needs to ascertain before the commencement of any study. In the present study, the researcher opts for the survey research design within the quantitative research approach. In this kind of research design, there is a collection of quantitative data from the potential respondents through the employment of the questionnaire, often referred to as a survey form. In terms of benefits associated with the survey research within the quantitative research approach, it enables to researchers with the collection of quantitative data, in which the outcome is estimated through the application of statistical analysis, which further assists the researcher in drawing the logical interpretations and conclusions (Hulland et al., 2018). Moreover, in this research design, the data is collected from the sample, which is relatively smaller in terms of size compared to the population; however, the outcome generated can generalize the findings over the maximum proportion of the population. In addition to this, the survey methodology is relatively cost-effective, whereas it also fulfils the requirements of randomness and reliability (Cooper et al., 2006).

3.1. Common method variance

Among the pre-requisites and challenges associated with the survey research within the quantitative research approach is the mitigation of the capturing of unwanted

Table 1. Source of measures.

Constructs	Number of items	Sources
Green Intellectual Capital	6	Chen (2007)
Energy Efficiency	4	Chang and Chen (2012)
Environmental Management Accounting	4	Latan et al. (2018)
Competitive Advantage	4	Chang and Chen (2012)
Environmental Performance	6	Iranmanesh et al. (2019)
Social Performance	5	Iranmanesh et al. (2019)
Economic Performance	6	Iranmanesh et al. (2019)

operational variance, which is often referred to as 'Common Method Variance' (CMV) (Podsakoff et al., 2003). This type of variance are un-willingly integrated during the execution of the research, hence requiring careful attention and consideration by the researcher executing the research. Several operational methods suggested by Podsakoff et al. (2012) enable the researcher to mitigate the CMV. Among these, the most crucial is developing and designing the survey questionnaire. It is said that if the survey form is designed in a way that it provides a hassle-free experience to the respondents while they are responding to that survey form, then this easiness will be reflected in the collected outcome, whereas it significantly mitigates the CMV at the operational stage. The level of easiness can be enhanced through different steps. This includes making the statements of questions easy so that it is easily be answered by the respondents. The other way is to improve the navigation of the survey form. When the questionnaire is designed to provide ease to the respondents while they are moving from one question to another, it will eventually improve the respondents' engagement with the research. Hence, these guidelines will be followed, which will assist in eliminating the CMV at the operational stage.

3.2. Development of questionnaire

As mentioned earlier, the questionnaire is the crucial element in any survey-based quantitative research; therefore, the questions that the survey form comprises must be reliable, robust, and valid. Therefore, in the current study, the researchers rely on the previously established scales that have reported a higher level of internal consistency in other related and similar research. Moreover, these adapted scales were measured on the Likert Scale, having 5 points where '1 represents Strongly Disagree,' '2 represents Disagree,' '3 represents neither Disagree nor Agree,' '4 represents Agree,' and '5 represents Strongly Agree.' The details of the adapted scales are listed in Table 1.

3.3. Data collection and data screening

In addition to this, as the current research is intended to assess the Business Sustainability for attaining the Competitive Advantage through understanding the role of Green Intellectual Capital, Environmental Management Accounting, and Energy Efficiency, the required sample for the research is the firms or organizations. Hence for the current study, the data is collected from the organizations that are operating in China. Moreover, the inclusion criteria comprised of green certifications attained by the firms like ISO 14001 etc. The reason for making this criterion as the

requirement is that when the firms are certified with any of the green and sustainability, their operations are more inclined towards sustainability. In contrast, the collected data from these firm and the outcome drawn will assist the other firms in pursuing the green and sustainable initiatives.

Initially, there was a distribution of 1000 questionnaires, of which 437 were responded back, leading to the response rate of 43.7%, which is unexpectedly great as similar studies have reported far less response rates. Nevertheless, among the collected 437 responses during the stage of data screening, there was further elimination of 54 survey forms because of containing missing values, leading to 383 responses. Among these 383 responses, 19 were further removed because of their capability to distort the data distribution. They were identified as uni-variate and multi-variate outliers as per the discussion by Hair et al. (2010). Hence the final data used for the current study comprised 364 respondents.

3.4. Demographic profiles

From the collected 364 data, the demographic profiles of the respondents were gauged through different criteria. Regarding gender, 40% of the data means 147 respondents identified themselves as females, whereas 60% of the data means 217 respondents identified themselves as males. In terms of age, 27% of the data, which means 97 respondents were reported to have age less than 30 years, 38% of the data, which means 138 respondents were reported to have an age between 31-40 years, 21% of the data which means 76 respondents were reported to have age between 41-50 years whereas 15% of the data which means 53 respondents were reported to have age greater than 51 years. In terms of the size of the organizations from which these respondents belong and the number of employees being hired by these firms, 20% of the data, which means 74 respondents were, belong to the organizations having less than 100 employees, 37% of the data which means 134 respondents belonged to the organizations having between 101 to 250 employees, 20% of the data which means 74 respondents belonged to the organizations having between 251 to 450 employees, 23% of the data which means 82 respondents belonged to the organizations having greater than 450 employees. In terms of nature of the industry from where the firms belong, 31% of the data, which means 112 respondents belonged to the automobile industry, 37% of the data, which means 135 respondents belonged to the electronics industry, 13% of the data which means 49 respondents belonged to the chemical industry, 16% of the data which means 57 respondents belonged to the Pharmaceutical industry, whereas rest of them which are 3% of the data that means 11 respondents belonged to the industry other than the industries mentioned above. The decomposition of the demographic profiles of the respondents is listed in Table 2.

4. Estimations and results

Based on the objectives, proposed hypotheses and direction of the relationships among the focused variables, the current study has applied the statistical technique

Table 2. Descriptive statistics.

		Frequency	Percent
Gender	Female	147	40%
	Male	217	60%
	Total	364	100%
Age	30 or less years	97	27%
	31–40 years	138	38%
	41–50 years	76	21%
	51 and above	53	15%
	Total	364	100%
Size (Number of Employees)	Less than 100	74	20%
	101–250	134	37%
	251–450	74	20%
	More than 450	82	23%
	Total	364	100%
Industry	Automobile	112	31%
	Electronics	135	37%
	Chemical	49	13%
	Pharmaceutical	57	16%
	Others	11	3%
	Total	364	100%

Source: Authors Estimation.

which belongs to the second generation. The difference between first-generation and second-generation statistical techniques is their capability to handle multiple criterion variables even at different ends. For instance, referring to Figure 1, if a first-generation technique is applied on the same framework, linear regression will be applied four times as there are four criterion variables. On the other hand, the whole analysis can be performed in a one-go in any second-generation technique. Hence, to minimize the complexities, the current study has utilized the second generation technique.

Moreover, within the second generation technique, the current study has applied 'Partial Least Square-Structural Equation Modelling' (PLS-SEM), which is superior to other co-variance based conventional SEM techniques in terms of their predictability, variation explanation, robustness and handling complex research models (Hair et al., 2019) as are the requirements of the present study. Moreover, for the application of PLS-SEM, Hair et al. (2016) have provided guidelines according to which the application should be considered legitimate if it comprised the assessments of the two level of the model. These are the inner model and the outer model. There are further evaluation criteria for assessing the model which is discussed in the subsequent sections. Apart from that, the application of PLS-SEM is made through the help of SmartPLS developed by Ringle et al. (2015). This software is considered as the software with the most user-friendly interface and robust generation of the outcome.

4.1. Assessment of outer model

At this level of the model, the assessment of observed variables, with the focused variables, which includes predictors and criterion as shown in Figure 1 is assessed. The observed variables are actually the survey questions upon which the data is collected from the respondents. Their themes and operationalization must be highly related to

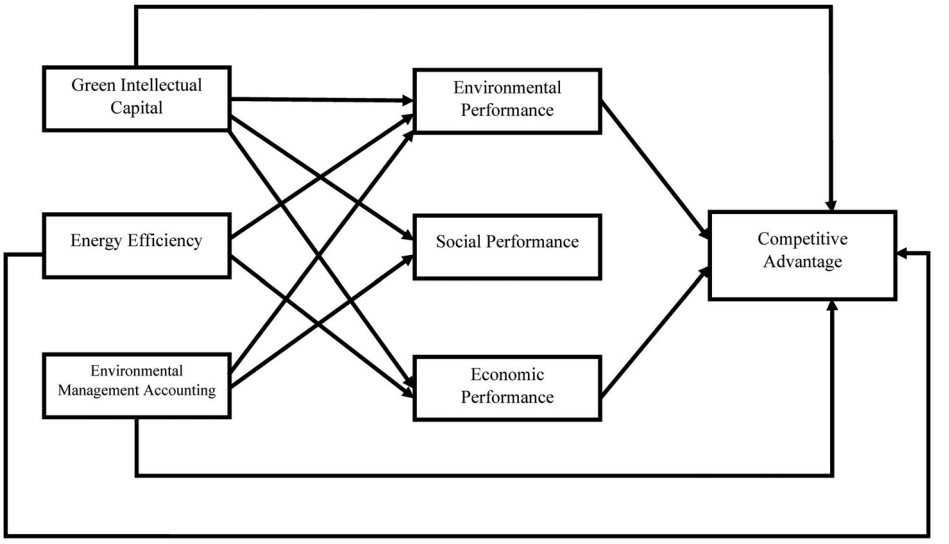


Figure 1. Conceptual framework.
Source: drawn by authors.

their respective latent variables. At the outer model, two types of validation need to be ensured, which are discussed in the following sub-sections.

4.1.1. Convergent validity

In this type of validity, the level of convergence that the observed variables reflect with the respective latent variables is assessed (Mehmood & Najmi, 2017). This degree of convergence eventually forces the formation of a latent variable and hence needs to be assessed as only those observed variables are converged that are operationally reflecting the same phenomena. In this validity, there are three evaluation criteria were assessed. The factor loadings, internal consistency, and 'Average Variance Extracted' (AVE). For factor loadings, the stated threshold by Hair et al. (2016) is the value greater than 0.7, which is found in the present study as shown in Table 3. For internal consistency, which is further assessed by Cronbach's Alpha and Composite Reliability, the stated threshold by Hair et al. (2016) is the value greater than 0.7, which is also found in the present study, as shown in Table 3. For AVE, the stated threshold by Hair et al. (2016) is the value greater than 0.5, which is found in the present study as shown in Table 3. Hence, through the output summarized in Table 3, the legitimacy of convergent validity is assessed and assured.

4.1.2. Discriminant validity

In this type of validity, the level of divergence that the observed variables reflect with the observed variables of other latent variables is assessed (Mehmood & Najmi, 2017). This degree of divergence eventually forces the formation of the latent variable and hence needs to be assessed as those observed variables that are operationally different must form different variables that are operationally reflecting the different phenomena. There are three different criteria utilized in the current study for evaluating

Table 3. Measurement model results.

Variables	Items	Factor loadings	Cronbach's alpha	Composite reliability	AVE
Green Intellectual Capital	GIC1	0.754	0.770	0.828	0.662
	GIC2	0.833			
	GIC3	0.808			
	GIC4	0.744			
	GIC5	0.752			
	GIC6	0.742			
Energy Efficiency	EFF1	0.770	0.714	0.751	0.556
	EFF2	0.833			
	EFF3	0.758			
	EFF4	0.844			
Environmental Management Accounting	ACC1	0.826	0.748	0.793	0.671
	ACC2	0.767			
	ACC3	0.812			
	ACC4	0.797			
Competitive Advantage	ADV1	0.782	0.724	0.733	0.572
	ADV2	0.774			
	ADV3	0.741			
	ADV4	0.818			
Environmental Performance	ENP1	0.810	0.799	0.787	0.583
	ENP2	0.813			
	ENP3	0.758			
	ENP4	0.793			
	ENP5	0.766			
	ENP6	0.819			
Social Performance	SCP1	0.778	0.766	0.781	0.591
	SCP2	0.777			
	SCP3	0.744			
	SCP4	0.838			
	SCP5	0.749			
Economic Performance	ECO1	0.793	0.767	0.756	0.553
	ECO2	0.794			
	ECO3	0.847			
	ECO4	0.755			
	ECO5	0.764			
	ECO6	0.812			

Source: Authors Estimation.

this validity. This includes cross loadings, Fornell-Larcker criterion and 'Heterotrait-Monotrait ratio of correlations' (HTMT). The outcome of assessments of Discriminant Validity as per the above-mentioned criteria are discussed below.

In the cross-loadings, the difference of the factor loading loaded on the latent variables and the loading within their respective latent variables is assessed. The difference as per Gefen and Straub (2005), must exceed 0.1. The assessment of Discriminant Validity through cross-loadings is shown in Table 4.

In the Fornell-Larcker criterion (1981), the comparison is drawn of the square root of AVE of a construct with the value of the correlations of that particular construct with the other latent variables, whereas the square root of AVE of a construct must be higher. Referring to Table 5, the values positioned at the diagonal and are highlighted show the square root of AVE of a construct, whereas the other remaining variables reflect the value of the correlations. The successful assessment of Discriminant Validity through Fornell-Larcker criterion are shown in Table 5.

The third criterion, which is the most recent among the three mentioned for assessing the discriminant validity, is the HTMT. This criterion is proposed by Henseler et al. (2015) and has established the robustness for assessing the discriminant validity among the available alternatives. Henseler et al. (2015) have proposed the

Table 4. Results of loadings and cross loadings.

Variable	GIC	EFF	ACC	ADV	ENP	SCP	ECO
Green Intellectual Capital	**0.754**	0.302	0.234	0.243	0.293	0.305	0.278
	0.833	0.299	0.298	0.256	0.273	0.232	0.267
	0.808	0.245	0.275	0.275	0.282	0.255	0.272
	0.744	0.232	0.304	0.248	0.304	0.243	0.235
	0.752	0.293	0.237	0.287	0.304	0.242	0.265
	0.742	0.247	0.248	0.266	0.242	0.250	0.241
Energy Efficiency	0.298	**0.770**	0.257	0.265	0.264	0.263	0.288
	0.272	**0.833**	0.293	0.294	0.254	0.260	0.257
	0.302	**0.758**	0.251	0.276	0.301	0.301	0.299
	0.284	**0.844**	0.243	0.278	0.258	0.277	0.240
Environmental Management Accounting	0.303	0.304	**0.826**	0.299	0.241	0.289	0.249
	0.266	0.245	**0.767**	0.233	0.265	0.249	0.260
	0.296	0.282	**0.812**	0.231	0.285	0.258	0.237
	0.281	0.253	**0.797**	0.241	0.288	0.309	0.242
Competitive Advantage	0.245	0.298	0.288	**0.782**	0.288	0.233	0.256
	0.270	0.301	0.266	**0.774**	0.252	0.306	0.286
	0.235	0.279	0.268	**0.741**	0.244	0.272	0.272
	0.248	0.298	0.281	**0.818**	0.253	0.262	0.281
Environmental Performance	0.310	0.253	0.289	0.248	**0.810**	0.249	0.243
	0.269	0.273	0.304	0.300	**0.813**	0.256	0.307
	0.303	0.290	0.253	0.289	**0.758**	0.280	0.282
	0.290	0.298	0.262	0.273	**0.793**	0.255	0.252
	0.276	0.253	0.273	0.280	**0.766**	0.273	0.233
	0.260	0.300	0.271	0.269	**0.819**	0.280	0.291
Social Performance	0.233	0.278	0.256	0.238	0.288	**0.778**	0.253
	0.278	0.246	0.251	0.230	0.261	**0.777**	0.295
	0.291	0.239	0.245	0.250	0.280	**0.744**	0.307
	0.271	0.281	0.268	0.274	0.243	**0.838**	0.282
	0.266	0.256	0.263	0.293	0.257	**0.749**	0.287
Economic Performance	0.302	0.282	0.246	0.260	0.306	0.230	**0.793**
	0.242	0.242	0.259	0.242	0.259	0.274	**0.794**
	0.254	0.277	0.308	0.300	0.254	0.303	**0.847**
	0.293	0.263	0.302	0.279	0.269	0.295	**0.755**
	0.277	0.268	0.240	0.306	0.302	0.265	**0.764**
	0.310	0.288	0.235	0.308	0.247	0.298	**0.812**

Source: Authors Estimation.

Table 5. Discriminant validity Fornell-Larcker criterion.

	GIC	EFF	ACC	ADV	ENP	SCP	ECO
GIC	**0.813**						
EFF	0.405	**0.746**					
ACC	0.500	0.555	**0.819**				
ADV	0.561	0.371	0.436	**0.757**			
ENP	0.428	0.519	0.590	0.334	**0.763**		
SCP	0.314	0.439	0.405	0.415	0.576	**0.769**	
ECO	0.439	0.508	0.484	0.524	0.396	0.573	**0.744**

Source: Authors Estimation.

cut-off threshold of HTMT, which is 0.85 as found in the present study. The successful assessment of Discriminant Validity through HTMT criterion is shown in Table 6.

4.2. Assessment of the inner model

At this level of the model, the assessment of the model's predictability and explanation capability is made, reflecting the predictor's relationship in explaining the criterion variables. For that purpose, there are two criteria assessed in the present study:

Table 6. Results of HTMT ratio of correlations.

	GIC	EFF	ACC	ADV	ENP	SCP	ECO
GIC							
EFF	0.565						
ACC	0.761	0.714					
ADV	0.563	0.435	0.587				
ENP	0.724	0.765	0.569	0.655			
SCP	0.564	0.609	0.739	0.438	0.519		
ECO	0.660	0.641	0.468	0.438	0.429	0.460	

Source: Authors Estimation.

Table 7. Predictive power of construct.

	R-square	Q-square
ADV	0.354	0.126
ENP	0.283	0.101
ECP	0.225	0.128
SCP	0.288	0.108

Source: Authors Estimation.

'coefficient of determination' and 'Cross-Validated Redundancy.' For the 'coefficient of determination' which is denoted by R-Square the stated threshold by Cohen (1988), is if the value exceeds 0.26 that it should be termed as substantial if the value is below 0.02 then it should be termed as low. In contrast, any value between the two should be considered as the medium. The other criteria used is 'Cross-Validated Redundancy,' denoted by Q-Square and for which Hair et al. (2016) suggested the acceptable value is anything greater than 0. The assessment of the Inner Model is shown in Table 7.

4.3. Hypotheses testing

Another edge of PLS-SEM over conventional SEM is that the significance of the relationship is computed through bootstrapping in this technique. This methodology computes the significance after drawing multiple sub-samples from the data set. The suggested number of sub-samples drawn by Hair et al. (2016) is 5000 sub-samples, followed in the current study.

Firstly, the level of association of Green intellectual Capital is assessed with the other criterion variables. Considering the level of association of Green intellectual Capital with environmental performance, the output of PLS-SEM reported a positive impact ($\beta = 0.327,\ p < 0.05$) which is also significant at a 5% level of significance. It means that 1% improvement in the level of Green intellectual Capital will enhance the environmental performance by 32.7%. In other words, when an organization invests in developing their intellectual capital with updated knowledge about greenness and awareness related to ecological issues, it will further increase the organization's confidence in green initiatives, which will further assist the organization in improving environmental performance. Considering the level of association of Green intellectual Capital with economic performance, the output of PLS-SEM reported a positive impact ($\beta = 0.126,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of Green intellectual Capital

will enhance the economic performance by 12.6%. In other words, when an organization invests in developing their intellectual capital with updated knowledge about greenness and awareness related to ecological issues, it will further increase the organization's confidence in green initiatives, which will further assist the organization in improving economic performance. Considering the level of association of Green intellectual Capital with social performance, the output of PLS-SEM reported a positive impact ($\beta = 0.334,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of Green intellectual Capital will enhance the social performance by 33.4%. In other words, when an organization invests in developing their intellectual capital with updated knowledge about greenness and awareness related to ecological issues, it will further increase the organization's confidence in societal initiatives, which will further assist the organization in improving social performance. Considering the level of association of Green intellectual Capital with a competitive advantage, the output of PLS-SEM reported a positive impact ($\beta = 0.141,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of Green intellectual Capital will enhance the competitive advantage by 14.1%. In other words, when an organization invest in developing its intellectual capital with the updated knowledge and understanding about the greenness and awareness related to ecological issues, it will further increase the confidence of the organization towards green initiatives, and this will further assist the organization in attaining the competitive advantage over the competitors in the market. These findings are in accordance with the conclusions drawn by Sidik et al. (2019); Yusliza et al. (2020) and Yusoff et al. (2019).

Secondly, the level of association of Energy Efficiency is assessed with the other criterion variables. Considering the level of association of Energy Efficiency with environmental performance, the output of PLS-SEM reported a positive impact ($\beta = 0.271,\ p < 0.05$) which is also significant at a 5% level of significance. It means that 1% improvement in the level of Energy Efficiency will enhance the environmental performance by 27.1%. In other words, when an organization invests in improving the productivity and consumption of energy that is also environmentally friendly, it will further increase the organization's confidence towards green initiatives, which will further assist the organization in improving environmental performance. Considering the level of association of Energy Efficiency with economic performance, the output of PLS-SEM reported a positive impact ($\beta = 0.309,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of Energy Efficiency will enhance the economic performance by 30.9%. In other words, when an organization invests in improving the productivity and consumption of energy that is also environmentally friendly, it will further increase the organization's confidence towards green initiatives, which will further assist the organization in improving economic performance. Considering the level of association of Energy Efficiency with social performance, the output of PLS-SEM reported a positive impact ($\beta = 0.129,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of Energy Efficiency will enhance the social performance by 12.9%. In other words, when an organization invests in improving the productivity and consumption of the energy that is also

environmentally friendly, it will further increase the organization's confidence in societal initiatives, which will further assist the organization in improving social performance. Considering the level of association of Energy Efficiency with a competitive advantage, the output of PLS-SEM reported a positive impact ($\beta = 0.233,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of Energy Efficiency will enhance the competitive advantage by 23.3%. In other words, when an organization invests in improving the productivity and consumption of the energy which is also environmentally friendly, it will further increase the organization's confidence in green initiatives. This will further assist the organization in attaining competitive advantage over the competitors in the market. These findings are in accordance with the conclusions drawn by Sidik et al. (2019).

Thirdly, the level of association of Environmental Management Accounting is assessed with the other criterion variables. Considering the level of association of Environmental Management Accounting with environmental performance, the output of PLS-SEM reported a positive impact ($\beta = 0.224,\ p < 0.05$) which is also significant at a 5% level of significance. It means that a 1% improvement in the level of Environmental Management Accounting will enhance the environmental performance by 22.4%. In other words, when an organization invest in improving the record-keeping, assessment and maintaining the record related to the environmental initiatives and the subsequent generation of pollution, it will further increase the confidence of the organization towards green initiatives, and this will further assist the organization in their improvement of environmental performance. Considering the level of association of Environmental Management Accounting with economic performance, the output of PLS-SEM reported positive impact ($\beta = 0.214,\ p < 0.05$) which is also significant at 5% level of significance. It means that the 1% improvement in the level of Environmental Management Accounting will enhance the economic performance by 21.4%. In other words, when an organization invest in improving the record-keeping, assessment and maintaining the record related to the environmental initiatives and the subsequent generation of pollution, it will further increase the confidence of the organization towards green initiatives, and this will further assist the organization in their improvement of economic performance. Considering the level of association of Environmental Management Accounting with social performance, the output of PLS-SEM reported a positive impact ($\beta = 0.294,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of Environmental Management Accounting will enhance the social performance by 29.4%. In other words, when an organization invest in improving the record-keeping, assessment and maintaining the record related to the environmental initiatives and the subsequent generation of pollution, it will further increase the confidence of the organization towards societal initiatives, and this will further assist the organization in their improvement of social performance. Considering the level of association of Environmental Management Accounting with a competitive advantage, the output of PLS-SEM reported a positive impact ($\beta = 0.194,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of Environmental Management Accounting will enhance the competitive advantage by 19.4%. In other words, when an organization invest in improving the record-keeping,

assessment and maintaining the record related to the environmental initiatives and the subsequent generation of pollution, it will further increase the confidence of the organization towards green initiatives, and this will further assist the organization in attaining the competitive advantage over the competitors in the market. These findings are in accordance with the conclusions drawn by Sidik et al. (2019).

Lastly, the level of association of dimensions of Business Sustainability is assessed with the Competitive Advantage. Considering the level of association of environmental performance with the Competitive Advantage, the output of PLS-SEM reported a positive impact ($\beta = 0.293,\ p < 0.05$) which is also significant at a 5% level of significance. It means that a 1% improvement in the level of environmental performance will enhance the Competitive Advantage by 29.3%. In other words, when an organization invests in green initiatives to improve environmental performance, it will further increase the organization's confidence in green initiatives. This will further assist the organization in attaining competitive advantage over the competitors in the market. Considering the level of association of economic performance with the Competitive Advantage, the output of PLS-SEM reported a positive impact ($\beta = 0.291,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of economic performance will enhance the Competitive Advantage by 29.1%. In other words, when an organization invest in green initiatives to improve the economic performance through the elimination of the activities that are damaging the environment at the cost of the economics, then it will further increase the confidence of the organization towards green initiatives, and this will further assist the organization in attaining the competitive advantage over the competitors in the market. Considering the level of association of Social Performance with the Competitive Advantage, the output of PLS-SEM reported a positive impact ($\beta = 0.275,\ p < 0.05$) which is also significant at a 5% level of significance. It means that the 1% improvement in the level of social performance will enhance the Competitive Advantage by 27.5%. In other words, when an organization invest in green initiatives with the objective of improving the social performance through the elimination of the activities that are damaging the environment at the cost of the society, then it will further increase the confidence of the organization toward green initiatives, and this will further assist the organization in attaining the competitive advantage over the competitors in the market. These findings are in accordance with the conclusions drawn by Sidik et al. (2019). The outcome generated from the PLS-SEM is summarized in Table 8 and shown in Figure 2.

5. Conclusion and recommendations

Researchers are exploring different potential cleaner solutions for enhancing the business sustainability to sustain the Competitive Advantage; most researchers have explored it within the dynamics of manufacturing operations. Despite that, a group of researchers ascertained the importance of the intangible capital, referred to as intellectual capital that emerged as one of the potential solutions for promoting sustainability within the operations of the organizations.

Table 8. Results of path coefficients.

Hypothesized path	Path coefficient	C.R	*p*-value	Remarks
GIC → ENP	0.327	6.221	0.000	Supported
GIC → ECP	0.126	10.834	0.000	Supported
GIC → SCP	0.334	11.954	0.000	Supported
GIC → ADV	0.141	8.709	0.000	Supported
EFF → ENP	0.271	11.759	0.000	Supported
EFF → ECP	0.309	6.430	0.000	Supported
EFF → SCP	0.129	12.687	0.000	Supported
EFF → ADV	0.233	8.312	0.000	Supported
ACC → ENP	0.224	10.334	0.000	Supported
ACC → ECP	0.214	7.597	0.000	Supported
ACC → SCP	0.294	8.442	0.000	Supported
ACC → ADV	0.194	12.503	0.000	Supported
ENP → ADV	0.293	11.631	0.000	Supported
ECP → ADV	0.291	7.105	0.000	Supported
SCP → ADV	0.275	11.215	0.000	Supported

Source: Authors' Estimation.
Note: Level of Significance (5% i.e., 0.050).

Moreover, the majority of the time, organizational inefficiencies lead to financial and environmental losses. In contrast, elimination of non-value-added activities and wastage is possible by the assistance of an efficient system in which the environmental management is regularly accounted for and updated. Thus Environmental Management Accounting emerged as a tool through which the wastages are identified, monitored and eventually eliminated from the value stream. In addition to this, increasing the efficiency and productivity of the consumption of resources, especially energy, is essential, as improving energy efficiency leads to various positive benefits for the organizations.

Hence, in the present study, the role of the three potential solutions, Green Intellectual Capital, Environmental Management Accounting, and Energy Efficiency, is evaluated for excelling the organizational operations towards business sustainability and attaining a competitive advantage. With the assistance of PLS-SEM, the outcome reported the positive and significant impact of all of the studied potential solutions in excelling and enhancing business sustainability and competitive advantage.

Based on the findings, it is proposed that manufacturing organizations need to apportion due attention to developing the green intellectual capital. This is because, through this, the process of any advancement, innovation and change can be implemented for attaining and sustaining the business sustainability and competitive advantage. Moreover, there is a need to improve the level of consumption of energy. This can be done through the value stream mapping in which the segregation can be made among the value-added and non-value added activities, leading to improved productivity and efficiency. Furthermore, organization need to disclose their environment management through proper ACC as it will assist in promoting the green image of the organization among the customers, society and all other stakeholders.

5.1. Contribution of the study

From theoretical and practical perspectives, the current study contributes in various ways. For instance, the current study explores the potential solution to control carbon

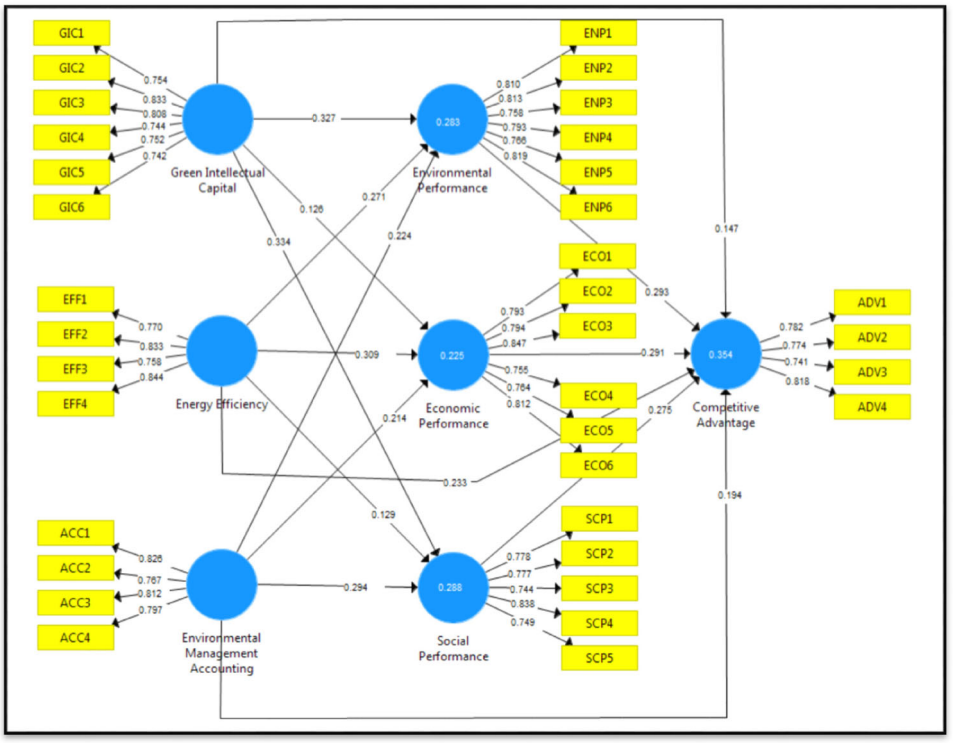


Figure 2. PLS output.
Source: drawn by authors.

emissions by manufacturing companies. The majority of the literature from environmental economics explores the relationships at the country, panel, and/or global level, whereas the current study had explored the literature from the manufacturing industry's level. In addition to this, the current study explores the three potential solutions identified through literature based on their theoretical and practical significance and relevance. Furthermore, the current study explores the context of China, which is gradually expanding its operations from the manufacturing perspective. Statistically, the application of variance-based SEM in explaining the relationships among the studied variables can also be considered as a potential contribution. Lastly, the current study also potentially contributes in terms of attaining business sustainability and sustaining the competitive advantage.

5.2. Limitations and directions for future research

Similar to other research, the present study also has certain limitations. Firstly, in the current study, only three potential solutions for excelling the organizational operations towards business sustainability and attaining a competitive advantage are Green Intellectual Capital, Environmental Management Accounting, and Energy Efficiency. The literature is filled with other solutions which also require in-depth exploration. Secondly, a group of researchers have argued that there are three dimensions of Green Intellectual Capital which are human, structural and relational capital. Hence,

exploring each of them precisely could better understand the nature of the relationships with business sustainability and competitive advantage. Thirdly, in terms of statistics, the current study is based on the exploration of linear relationships among the variables. This deficiency could be covered by exploring the phenomena through artificial intelligence-based estimation and prediction techniques. Lastly, the current study is based on the geographical context of China, which is developing very rapidly and speedily. Based on this limitation, there is a need to explore the contexts of the developing countries, which can be an essential contribution to the literature.

Disclosure statement

No potential conflict of interest was reported by the authors.

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