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Challenges for the development of sustainable SMEs in the cement industry: a SWARA–WASPAS approach

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Abstract

Purpose – This study aims to examine the obstacles and approaches to achieving sustainable development in India's cement solid and hollow brick production business, with a specific emphasis on incorporating the triple bottom line (TBL) concept into strategies for small and medium-sized enterprises (SMEs).

Design/methodology/approach – Using the step-wise weight assessment ratio analysis (SWARA)–weighted aggregated sum product assessment (WASPAS) approach, the study prioritized 11 economic, 9 environmental and 14 social sustainability indicators based on information collected from literature and expert opinions.

Findings – The study provides valuable insights into the difficulties encountered by SMEs while implementing strategies that focus on the TBL. By putting emphasis on the sustainability criteria, the key areas that require attention to promote sustainability get identified and addressed.

Research limitations/implications – The study's focus on SMEs in this industry limits its generalizability. To have a more complete picture, future studies may include many areas.

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Practical implications – The identified and prioritised sustainability characteristics help small and medium-sized firms (SMEs) design strategies to address sustainable development concerns. The research findings could also inform policymakers and regulatory bodies about the challenges faced by SMEs in the cement and brick production sector regarding sustainability. It could highlight the need for supportive policies and regulations to promote sustainable practices and incentivize SMEs to adopt the TBL approach. The paper can offer practical insights for SME owners and managers on integrating sustainability principles into their business strategies. Actionable recommendations and best practices for enhancing environmental performance, social impact and economic viability within the context of cement and brick production are outlined.

Social implications – TBL policies improve the sustainability and profitability of small and medium-sized firms (SMEs) and promote environmentally and socially responsible practices that benefit the industry and society. The research paper may facilitate greater engagement and collaboration among various stakeholders involved in the cement and brick production industry, including SMEs, larger corporations, government agencies, non-governmental organizations (NGOs) and local communities. This cooperative approach can encourage open communication, the establishment of trust and coordinated actions to tackle sustainability challenges, ultimately improving social cohesion and collaboration.

Originality/value – This study provides new and valuable insights by investigating the development of TBL strategies in SMEs in the cement solid and hollow brick manufacturing sector in India. The utilization of the SWARA–WASPAS technique brings novelty to research on sustainable development in this field.

Keywords Sustainable indicators, Triple bottom line, Cement solid and hollow blocks, Micro, SWARA, WASPAS

Paper type Research paper

1. Introduction

In recent years, the pursuit of sustainable development has become increasingly vital, particularly within the industrial sector, where environmental degradation and resource depletion pose significant challenges. Among the various industries contributing to these concerns, India's cement solid and hollow brick production sector stands out because of its resource-intensive operations and environmental impact. The problem at hand revolves around the challenges faced by small and medium-sized enterprises (SMEs) within India's cement solid and hollow brick production sector in aligning their operations with sustainability principles. Despite the increasing importance of sustainable development in the industry, these SMEs encounter unique obstacles that hinder their ability to adopt sustainable practices effectively. This paragraph specifically addresses the economic factors outlined in Table 1, such as economic performance (EP), market presence (MP), making healthy operation profit (MHOP) and lowering costs (LC) (Bhakar, 2018; Kaur, 2017; Zhu and Sarkis, 2004; Veleva and Ellenbecker, 2001; Hartini *et al.*, 2020; Leszczynska, 2018; Gereffi and Lee, 2016; Blome *et al.*, 2014). The sector's significant environmental footprint and socioeconomic implications highlight the urgent need for solutions tailored to the specific needs and constraints of SMEs operating within this context. In light of the aforementioned issues, this study delves into the complexities of achieving sustainable development within this sector, with a specific focus on SMEs. The overarching aim is to explore the obstacles hindering sustainability efforts and identify effective approaches for integrating sustainability principles into SME strategies. Central to this investigation is the incorporation of the triple bottom line (TBL) concept, which emphasizes the interconnectedness of environmental, social and economic considerations in decision-making processes. By shedding light on the challenges and opportunities within India's cement and brick production SMEs, this study seeks to contribute to a deeper understanding of sustainable development practices and propagate strategies that are aimed at fostering long-term environmental stewardship, social equity and economic resilience within the industry.

Economic factors	Notations	Reference
Economic performance	EP	Bhakar (2018); Kaur (2017); Zhu and Sarkis (2004); Veleva and Ellenbecker (2001)
Market presence	MP	Hartini *et al.* (2020); Kaur (2017)
Making a healthy operation profitable	MHOP	Kaur (2017)
Lowering costs	LC	Leszczynska (2018); Gereffi and Lee (2016); Blome *et al.* (2014)
Savings on overall maintenance expenses	SOME	Bhakar (2018)
Reduction of energy and electric expenses	REEE	Bhakar (2018); Moon *et al.* (2013); Madlool *et al.* (2011)
Average employee cost to the company	AECC	Bhakar (2018); Winroth *et al.* (2016); Azapagic (2004); Krajnc and Glavič (2003)
Combating economic risk	CER	Sharma *et al.* (2020); Bhakar (2018); Kaur (2017)
Lowering transportation costs	LTC	Kayikci (2018); Kaur (2017)
Shortage of raw materials (because of COVID-19)	SRM	Erdogan and Tosun (2021); Helper and Soltas (2021); Aday and Aday (2020); Cai and Luo (2020); Chaib (2020); Guan *et al.* (2020)
Price changes in raw materials	PCRM	Kaur (2017)
Environmental factors		
Environmental damage caused by dust from raw materials	EDDRM	Manisalidis *et al.* (2020); Manhart *et al.* (2019)
Environmental damage caused by effluent and waste in production	EDEWP	Sharma *et al.* (2020); Ni and Sun (2018); Kaur (2017); Tidy *et al.* (2016); Lintukangas *et al.* (2015); Merminod and Paché (2011)
Environmental damage caused by high energy consumption	EDHEC	Sharma *et al.* (2020); Gaur *et al.* (2020); Kaur (2017)
Systems to withstand uncertainty for survival	SWU	Sharma *et al.* (2020)
Environmental damage caused by water usage	EDWU	Xiang *et al.* (2021); Niinimäki *et al.* (2020); Kaur (2017)
Environmental damage caused by transportation of raw materials	EDTM	Kaur (2017)
Environmental damage caused by harmful gas emissions	EDHGE	Rahman *et al.* (2022); Rehman *et al.* (2021); Kaur (2017)
Environmental damage caused by air pollution (if any)	EDAP	Kaur (2017)
Environmental damage caused by procuring raw materials	EDRM	Manhart *et al.* (2019); Manisalidis *et al.* (2020)
Social factors		
Practicing proper rules and regulations for health and safety for labours	PHSL	Ahmadi *et al.* (2017); Amindoust *et al.* (2012); Aydin Keskin *et al.* (2010); Azadnia *et al.* (2014); Kaur (2017); Ziout *et al.* (2013); Sharma *et al.* (2020)
Practicing proper rules and regulations for diversity and equal opportunity	PDEO	Kaur (2017); Kumar and Anbanandam (2019)
Following forced/compulsory labour rights	FFLR	Kaur (2017)
Practicing proper rules and regulations for employment	PPRE	Sweeney (2009); Winroth *et al.* (2016); Heller and Keoleian (2000); Li *et al.* (2012); Singh *et al.* (2007)
Improving employee satisfaction	IES	Sweeney (2009); Winroth *et al.* (2016); Heller and Keoleian (2000); Li *et al.* (2012); Singh *et al.* (2007)
Improving employee productivity	IEP	Sweeney (2009)

(*continued*)

Table 1.
Factors for analysis

Economic factors	Notations	Reference
Improving employee retention	IER	Agarwal *et al.* (2022); Azapagic (2004); Cooper *et al.* (2018); Sweeney (2009); Veleva and Ellenbecker (2001); GRI Guidelines (2011–2015)
Practicing proper rules and regulations for labour/management relations	PRLR	Heller and Keoleian (2000); Li *et al.* (2012); Singh *et al.* (2007)
Complying with the law	CL	Ashby *et al.* (2012); Harms *et al.* (2013); Yawar and Seuring (2017); Sharma *et al.* (2020)
Complying with labour laws and social standards	CLLSS	Ashby *et al.* (2012); Harms *et al.* (2013); Yawar and Seuring (2017); Sharma *et al.* (2020)
Reducing lost man days because of accident concern	RLMA	Bhakar (2018)
Following children rights	FCR	Kaur (2017)
Having anti-corruption practices	ACP	Joung *et al.* (2013); Kaur (2017); Kumar and Anbanandam (2019)
Supporting local communities	SLC	Bhakar (2018)

Table 1.

Source: Table created by the authors

Globalization requires supply chain management to strictly address factors other than economic issues such as fair working conditions and production characterized by environmental responsibility. This piques curiosity in terms of how it pertains to sustainable development, which is often defined as having economic, environmental and social components. (Seuring and Müller, 2008; Carter and Liane Easton, 2011). Companies of all sizes and across a wide variety of sectors are becoming increasingly concerned with managing their supply chains in a sustainable manner. Maintaining social and environmental standards across the whole supply chain ensures (at the very least) a minimum degree of sustainable performance. Creating and introducing sustainable products can supplement this more reactive method of responding to external pressure from governments, consumers, non-governmental organizations (NGOs) and the media (Seuring and Müller, 2008).

Society and businesses are embracing “sustainability.” Climate change, renewable energy and the polar bear on ice have become ubiquitous. Energy supply and demand dynamics, climate change science and organizational social and environmental policy transparency are making sustainability more crucial. Managers must address these environmental and social issues, which are the by-product of their operations, as customers, government agencies, non-governmental organizations and employees are prompting businesses to take action. Supply chain managers can affect environmental and social performance through supplier development, mode and carrier selection, vehicle routing, location selection and packaging (Carter and Liane Easton, 2011). Seuring and Müller (2008) examined 191 papers from 1990 to 2007. About 308 major green and sustainable supply chain management papers were released in 2010. Only 36 studies use quantitative models, per approach. This longer term study analyzes quantitative models (Seuring and Müller, 2008). It clarifies the issue and guides action.

Sustainable supply chain development is discussed by many, but not by SMEs. Few studies have analyzed how to create a sustainable cement supply chain on account of the uniqueness of the product. This study evaluates supply chain sustainability to fill a research gap through the examination of SME supply chain sustainability issues. Step-wise weight assessment ratio analysis (SWARA)–weighted aggregated sum product assessment (WASPAS) evaluates challenges and prioritizes problems to solve them. Prioritized difficulties can guide sustainable supply chain growth milestones. Case implementation is shown using Indian cement companies.

The remaining part of the paper is organized as follows. Section 2 focuses on the research questions, whereas Section 3 focuses on the issue description and case implementation. Section 4 discusses the study's management ramifications. Section 5 concludes the paper.

The sustainable development of SMEs within the cement industry is a pressing concern that requires careful consideration of economic, environmental and social factors. This study uses the SWARA–WASPAS approach to assess and prioritize 11 economic, 9 environmental and 14 social sustainability factors, drawing insights from both literature and expert opinions (refer to Table 1 for detailed notations and references). The findings of this comprehensive analysis shed light on critical challenges faced by SMEs in the cement industry, unveiling the specific obstacles that demand immediate attention for sustainable growth.

The study underscores the unique potential of supply chain managers to act as catalysts for positive change, wielding influence through supplier development, mode and carrier selection, vehicle routing, site selection and packaging choices.

The subsequent sections delve into the specific findings of the SWARA–WASPAS approach, providing a nuanced understanding of the prioritized factors and offering insights that can guide targeted interventions for the sustainable development of SMEs in the cement industry.

2. Literature review

Sustainability is generally defined as using resources to meet the needs of the present without compromising the ability of future generations to meet their own needs (Pazienza *et al.*, 2022). The TBL approach considers a broad range of indicators and criteria for measuring organizational success, encompassing not only environmental factors but also social and economic aspects. As the industry is large, it is expected of every stakeholder in the supply chain to remain competitive. To remain competitive and capture significant market share, it is desired that firms reduce costs and improve the quality of their products, along with the efficiency of their supply chain (Goel, 2010). The pursuit of sustainability has started to reshape the competitive landscape, driving organizations and supply chains to reevaluate their processes, technologies and products. To overcome the barriers to SSCM in a given organization, it is imperative to identify strategies and practices that can enable the successful implementation of SSCM and provide a framework that allows proactive decision-making to assess performance and future problems, determine significant risks and implement strategies to address the risks (Mudgal *et al.*, 2010). According to the findings, the category of barriers with the greatest importance is the economic and financial barrier because it has the highest weight value (0.247309), followed by the technological, regulatory and institutional and organizational categories; all of these have the same weight (0.156875), meaning they have similar importance. Next is the market and networking category (0.078437), followed by the social and cultural category and the information category, both with the same weight (0.06275). The human resources category came in eighth place (0.052292), and the supplier category was considered the least important with the lowest weight (0.025838) (Gonçalves *et al.*, 2024).

3. Research questions

- This section highlights the research questions for this study. The current study has the following research questions.
- What are the challenges that exist for developing a sustainable supply chain for an SME?

- Which are the challenges that are most important to be overcome to develop a sustainable supply chain for the future?
- What are the future steps for the SME in the cement sector to develop a sustainable supply chain?

4. Problem description and case implementation

The case study covers Indian cement SMEs. The study investigated sustainable industry growth issues. Table 1 ranks 11 economic, 9 environmental and 14 social sustainability aspects on a priority basis as per past studies and industry experts. To analyze difficulties, the study calculated problem weights and relevance and rated alternative solutions using SWARA and WASPAS.

A total of 15 decision-makers (DM) were selected based on their wide experience in the cement block manufacturing industry. The decision-makers are either owners, partners, managers or supervisors.

4.1 Step-wise weight assessment ratio analysis method

Kersuliene, Zavadskas and Turskis introduced SWARA in 2010. This strategy uses decision-making and weighting. The SWARA–WASPAS approach incorporates both subjective opinions (expert judgments) and objective data (literature-based factors). This integration ensures a balanced analysis by considering the theoretical underpinnings along with practical insights from experts in the field. The step-wise nature of the SWARA process enables a systematic breakdown of complex problems into manageable steps. WASPAS, the second phase of the approach, introduces a weighted aggregation of criteria. This takes into account the relative importance of different factors, allowing for nuanced prioritization and a more accurate representation of the challenges faced by SMEs in the cement industry.

First, the relative importance of each characteristic is calculated; subsequently, the options for each trait are prioritized, and accordingly, each quality's importance is assessed. Finally, the following approach feature determines the qualities' final priority and ranking:

- The attributes are compensating.
- The attributes are distinct from one another.

The SWARA technique takes into account the opinions of decision-makers to establish the relative significance (Sj) of the *j*th characteristic.

Step 1: Initial attribute prioritization.

As the first step, decision-makers prioritize the attributes' relative importance, starting from the most important to the least important (refer Table 2 for detailed notations and references).

Step 2: The coefficient (k).

Table 2.
Relative average importance by 11 decision-makers

Indicators	LC	AECC	SRM	MP	MHOP	SOME	EP	REEE	CER	LTC	PCRM
Relative average importance	0.77	0.75	0.66	0.62	0.62	0.49	0.3	0.29	0.25	0.16	0.09

Source: Table created by the authors

Starting with the second criterion, values are allocated to each criterion j based on their relation to the early (j − 1) criterion. This ratio represents the comparative importance of the average value:

$$kj = \begin{cases} 1j = 1 \\ Si + 1/ > 1 \end{cases} \tag{1}$$

Step 3: The initial weight

In this step, the recalculated weight qj is determined using:

$$qj = \begin{cases} 1j = 1 \\ {}^{q(j-1)}\big/_{ki} \quad j > 1 \end{cases} \tag{2}$$

At this stage, the above formula is applied to compute the initial weight of an attribute for each decision-maker

Step 4: The relative weight

In this step, the computation of the relative weights of the evaluation criteria is carried out using:

$$wj = \frac{qj}{\sum_{k-1}^{n} qk} \tag{3}$$

where;

wj = relative weight of the j criterion; and

n = criteria number (refer Tables 3–5 for detailed notations and references).

4.2 Weighted aggregated sum product assessment method

Zavadskas *et al.* (2012) introduced WASPAS. WASPAS is an multi-criteria decision-making innovation that combines WSM and WPM. The models' aggregate optimality criteria and

Indicators	LC	AECC	SRM	MP	MHOP	SOME	EP	REEE	CER	LTC	PCRM
Relative average importance		0.75	0.66	0.62	0.62	0.49	0.3	0.29	0.25	0.16	0.09
Coefficient k	1	1.75	1.66	1.62	1.62	1.49	1.3	1.29	1.25	1.16	1.09
Initial weights	1	0.57	0.34	0.21	0.13	0.09	0.07	0.05	0.04	0.04	0.03
Relative weights	0.39	0.22	0.13	0.08	0.05	0.03	0.03	0.02	0.02	0.01	0.01

Source: Table created by the authors

Table 3. Relative weights of economic indicators

Notations	SWU	EDTM	EDHEC	EDRM	EDWU	EDDRM	EDEWP	EDAP	EDHGE
Relative average importance		0.78	0.66	0.57	0.43	0.23	0.18	0.17	0.15
Coefficient k	1	1.78	1.66	1.57	1.43	1.23	1.18	1.17	1.15
Initial weights	1	0.56	0.34	0.21	0.15	0.12	0.1	0.09	0.08
Relative weights	0.38	0.21	0.13	0.08	0.06	0.05	0.04	0.03	0.03

Source: Table created by the authors

Table 4. Relative weights of environmental indicators

select the best solution. Experts can weigh the criteria. SWARA calculates our analytical weights. WASPAS's dedicated function verifies alternate ranks using sensitivity analysis. WASPAS characteristics are as follows:

- It is regarded as a compensating strategy.
- The attributes are independent of one another.
- The qualitative attributes are converted into quantitative attributes.

Step 1: Initial decision matrix.

The first step involves the preparation of a decision-making matrix of alternatives and attributes:

$$x = \begin{bmatrix} r11 & r1j & r1n \\ ri1 & rij & rin \\ rml & rmj & rmn \end{bmatrix}_{m \times n} ; i = 1, \ldots, m, j = 1, \ldots, n \tag{4}$$

where m = number of evaluation alternatives and n = number of evaluation criteria (factors) (refer to Tables 6–8 for detailed notations and references).

Step 2: The normalized decision matrix.

This step entails normalizing the decision matrix following normalization; the element identified is referred to as $\hat{x}_{ij}$.

Table 5. Relative weights of social indicators

Notations	ACP	FCR	RLMA	FFLR	PRLR	SLC	IES	CLLSS	PDEO	IEP	PPRE	PHSL	CL	IER
Relative average importance		0.87	0.84	0.79	0.6	0.53	0.48	0.45	0.44	0.43	0.42	0.34	0.21	0.19
Coefficient k	1	1.87	1.84	1.79	1.6	1.53	1.48	1.45	1.44	1.43	1.42	1.34	1.21	1.19
Initial weights	1	0.54	0.29	0.16	0.1	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0.01	0.01
Relative weights	0.44	0.23	0.13	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0	0	0	0

Source: Table created by the authors

Table 6. Preference by decision-makers for economic indicators

Relative weights from SWARA	0.39	0.22	0.13	0.08	0.05	0.03	0.03	0.02	0.02	0.01	0.01
Indicators/decision-makers	dm1	dm2	dm3	dm4	dm5	dm6	dm7	dm8	dm9	dm10	dm11
LC	4	1	5	3	4	3	4	5	1	3	2
AECC	7	8	7	4	9	2	3	4	2	2	4
SRM	10	11	11	11	11	1	1	2	4	1	5
MP	2	2	2	2	2	7	6	3	5	7	1
MHOP	3	5	1	1	1	4	2	1	3	5	8
SOME	5	4	4	6	3	6	10	11	10	6	7
EP	1	9	9	8	10	10	11	8	7	10	3
REEE	6	7	10	9	8	9	5	7	8	4	6
CER	8	6	3	7	5	8	8	9	9	8	11
LTC	9	3	6	5	6	5	9	6	6	9	9
PCRM	11	10	8	10	7	11	7	10	11	11	10
Lowest value (high preference)	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Highest value (low preference)	*11*	*11*	*11*	*11*	*11*	*11*	*11*	*11*	*11*	*11*	*11*

Source: Table created by the authors

Relative weights from SWARA	0.38	0.21	0.13	0.08	0.06	0.05	0.04	0.03	0.03
Indicators/decision-makers	dm1	dm2	dm3	dm4	dm5	dm6	dm7	dm8	dm9
SWU	4	7	4	3	3	2	1	2	3
EDTM	6	1	3	1	1	1	2	1	1
EDHEC	3	3	1	2	2	3	4	4	2
EDRM	9	8	5	5	4	4	3	3	4
EDWU	5	2	2	4	5	6	5	5	5
EDDRM	1	9	9	9	9	5	6	7	9
EDEWP	2	5	6	7	7	8	8	8	7
EDAP	8	6	8	8	8	9	9	9	8
EDHGE	7	4	7	6	6	7	7	6	6
Lowest value (high preference)	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Highest value (low preference)	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*	*9*

Source: Table created by the authors

Table 7. Preference by decision-makers for environmental indicators

Relative weights from SWARA	0.44	0.23	0.13	0.07	0.04	0.03	0.02	0.01	0.01	0.01	0	0	0	0
Indicators/decision-makers	dm1	dm2	dm3	dm4	dm5	dm6	dm7	dm8	dm9	dm10	dm11	dm12	dm13	dm14
PHSL	1	1	3	2	5	6	5	7	3	6	3	9	7	5
PDEO	2	3	8	8	4	8	7	11	10	7	9	10	8	7
FFLR	3	5	9	9	11	11	13	10	12	10	13	11	11	11
PPRE	4	4	4	5	6	5	6	6	5	8	7	2	5	6
IES	5	6	2	1	2	4	2	5	6	5	6	4	4	2
IEP	6	8	1	4	1	2	3	4	4	4	4	5	3	3
IER	7	7	5	3	3	3	4	3	7	3	5	3	2	1
PRLR	8	2	6	7	7	10	8	9	9	9	8	8	9	8
CL	9	13	13	11	13	1	1	2	1	1	1	1	1	9
CLLSS	10	14	14	10	14	9	10	1	2	2	2	7	6	10
RLMA	11	11	10	6	12	12	12	13	13	11	10	12	13	12
FCR	12	9	7	12	9	13	11	12	11	14	12	13	10	14
ACP	13	10	12	14	10	14	14	14	14	13	14	14	14	13
SLC	14	12	11	13	8	7	9	8	8	12	11	6	12	4
Lowest value (high preference)	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*	*1*
Highest value (low preference)	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*	*14*

Source: Table created by the authors

Table 8. Preferences of decision-makers for social indicators

If the optimum value achieved is the maximum, then:

$$\hat{X}_{ij} = xij/\max xij;\ j = 1, \ldots\ldots, n; \quad \mathrm{i} = 1, \ldots.., m. \tag{5}$$

If the optimum value achieved is the minimum, then:

$$\tilde{x}_{ij} = \min xij/xij;\ j = 1, \ldots\ldots, n; \quad \mathrm{i} = 1, \ldots.., m. \tag{6}$$

where $\hat{x}_{ij}$ represents the normalized value of xij.

Step 3: The additive relative importance.

The following equation has been used to determine the weighted normalized data's relative importance for each alternative (refer to Tables 9–11 for detailed notations and references).

$$Qi^{(1)} = \sum_{i=1}^{n} r * ij.wj; \quad i = 1, \ldots, m \tag{7}$$

Step 4: The multiplicative relative importance.

The following equation estimates the multiplicative relative importance of each alternative's weighted normalized data (refer to Tables 9–11 for detailed notations and references):

$$Qi^{(2)} = \prod_{i=1}^{n} \left(r_{ij}^{*}\right)^{wj}; \quad i = 1, \ldots, m \tag{8}$$

Step 5: The joint generalized criterion (Q).

The joint generalized criterion (Q) was proposed for generalizing and integrating. Additive and multiplicative methods are given as follows:

$$Qi = \frac{1}{2}\left(Qi^{(1)} + Qi^{(2)}\right) = \frac{1}{2}\left(\sum_{j=1}^{n} r * ij.wj + \prod_{j=1}^{n} \left(r_{ij}^{*}\right)^{wj}\right); \quad i = 1, \ldots, m \tag{9}$$

Table 9. Preference value/score obtained – economic indicators

WSM	0.31	0.6	0.9	0.21	0.29	0.39	0.48	0.62	0.55	0.54	0.84
WPM	0.27	0.57	0.84	0.2	0.24	0.37	0.3	0.58	0.49	0.47	0.74
WASPAS joint generalized criterion with $\lambda = 0.5$	0.29	0.59	0.87	0.2	0.26	0.38	0.39	0.6	0.52	0.51	0.79
Rank (1 = highest preference, 11 = lowest preference)	9	4	1	11	10	8	7	3	5	6	2
Notations	LC	AECC	SRM	MP	MHOP	SOME	EP	REEE	CER	LTC	PCRM

Source: Table created by the authors

Table 10. Preference value/score obtained – environmental indicators

WSM	0.51	0.42	0.29	0.76	0.4	0.56	0.45	0.77	0.63
WPM	0.47	0.3	0.26	0.7	0.35	0.34	0.36	0.68	0.57
WASPAS joint generalized criterion with $\lambda = 0.5$	0.49	0.36	0.28	0.73	0.38	0.45	0.4	0.72	0.6
Rank (1 = highest preference, 11 = lowest preference)	4	8	9	1	7	5	6	2	3
Notations	SWU	EDTM	EDHEC	EDRM	EDWU	EDDRM	EDEWP	EDAP	EDHGE

Source: Table created by the authors

Table 11. Preference value/score obtained – social indicators

WSM	0.13	0.28	0.4	0.3	0.31	0.37	0.43	0.44	0.73	0.81	0.75	0.74	0.85	0.87
WPM	0.11	0.23	0.34	0.3	0.28	0.31	0.41	0.38	0.66	0.77	0.72	0.71	0.82	0.83
WASPAS joint generalized criterion with $\lambda = 0.5$	0.12	0.26	0.37	0.3	0.29	0.34	0.42	0.41	0.69	0.79	0.73	0.72	0.84	0.85
Rank (1 = highest preference, 11 = lowest preference)	14	13	9	11	12	10	7	8	6	3	4	5	2	1
Notations	ACP	FCR	RLMA	FFLR	PRLR	SLC	IES	CLLSS	PDEO	IEP	PPRE	PHSL	CL	IER

Source: Table created by authors

In addition, the following equation was proposed to increase the ranking accuracy:

$$Qi = \frac{1}{2}\left(Qi^{(1)} + Qi^{(2)}\right) = \frac{1}{2}\left(\sum\nolimits_{j=1}^{n} r * ij.wj + \prod\nolimits_{j=1}^{n} \left(r_{ij}^{*}\right)^{wj}\right); \quad i = 1, \ldots, m \tag{10}$$

(Refer to Tables 9–11 for detailed notations and references).

Step 6: Alternatives' final ranking.

The step 4 joint generalized criteria (Q) values are ranked in decreasing order, with the highest value being the highest. In Step 4, the model becomes the WSM model if it is equal to 1 and the WPM model if it is equal to 0 (refer to Table 12 for detailed notations and references).

5. Conclusion and managerial implication

Most companies have adopted a more holistic vision to integrate social and economic benefits when designing supply chain strategies because of the emergence of corporate social responsibility. In this view, it is crucial to understand the obstacles that prevent these organizations from implementing sustainability. Small enterprises such as cement solid and hollow brick manufacturers face a dilemma on the subject of social and environmental standards. The current assessment analyzes the challenges preventing cement solid and hollow brick manufacturing SME sustainability growth. Using SWARA and WASPAS, the research aims to identify industry growth issues. This study rated 11 economic, 9 environmental and 14 social sustainability factors based on literature and expert opinion. The results demonstrate that the shortage of raw materials, environmental damage caused by air pollution and supporting local communities are the most important factors that need to be taken care of for SME to be sustainable. Such firms' supply chain managers must prioritize these concerns and rally the support of their stakeholders, including consumers, government agencies, non-governmental groups and their workforce, who are increasingly emphasizing the need to address these issues. The main aforementioned factors can be addressed as follows: SMEs in the cement and brick production sector should focus on developing strategies to address the shortage of raw materials. This may involve diversifying their sourcing channels, investing in alternative materials or technologies or implementing recycling and waste reduction measures to ensure a sustainable supply chain. SMEs should prioritize initiatives to mitigate environmental damage caused by air pollution. This could include implementing emission control measures, adopting cleaner production technologies, investing in renewable energy sources or participating in emissions trading schemes to reduce their carbon footprint and minimize the impact on air quality. Supporting local communities is identified as a crucial factor for sustainability. SMEs can translate this finding into action by actively engaging with local stakeholders, such as community groups, residents and local authorities. This could involve initiatives such as community outreach programs, sponsorship of local events and partnerships with community organizations to address social needs and promote community development.

Rank	1	2	3	4	5	6	7	8	9	10	11	12	13	14
Economic	SRM	PCRM	REEE	AECC	CER	LTC	EP	SOME	LC	MHOP	MP			
Environment	EDRM	EDAP	EDHGE	SWU	EDDRM	EDEWP	EDWU	EDTM	EDHEC					
Social	IER	CL	IEP	PPRE	PHSL	PDEO	IES	CLLSS	RLMA	SLC	FFLR	PRLR	FCR	ACP

Source: Table created by the authors

Table 12. Final ranking of alternatives

SMEs in the cement and brick production sector can use the findings to prioritize their resource management strategies. For instance, they can implement efficient raw material sourcing practices to address shortages and reduce dependency on limited resources; this could involve exploring alternative materials, optimizing production processes to minimize waste and investing in recycling and reuse initiatives. The findings can inform SMEs' long-term planning and decision-making processes. The results can be used to assess their current sustainability performance, identify areas for improvement and set goals for future sustainability initiatives. This may involve developing sustainability action plans, establishing performance metrics and monitoring progress over time to ensure continuous improvement and long-term sustainability. By addressing the environmental and social concerns highlighted in the findings, SMEs can differentiate themselves in the market and enhance their brand reputation. They can leverage sustainability as a competitive advantage by communicating their commitment to environmental stewardship, social responsibility and ethical business practices to customers, investors and other stakeholders. This can lead to increased market share, customer loyalty and long-term business success. The findings have the potential to shape SMEs' advocacy endeavors aimed at promoting supportive policies and regulations within the cement and brick production sector. Leveraging these insights, SMEs can actively engage with policymakers, industry associations and other stakeholders to advocate for incentives, subsidies, or regulatory adjustments that incentivize sustainable practices. This collaborative effort aims to foster a favorable policy environment conducive to sustainable development goals, facilitating industry-wide transformation.

Supply chain managers have a unique potential to favorably or adversely affect environmental and social performance through actions such as supplier development, mode and carrier selection, vehicle routing, site selection and packaging. The current article exhibits a few limitations; the data is valid for a specific example and the conclusions may differ when moving across industries. Furthermore, the data may be confirmed through the use of various multi-criteria decision-making procedures.

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