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Review Article

Examining the perceptions and attitudes toward Women's employment and leadership in the blue economy: A case study of India

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ABSTRACT

The blue economy (BE) is a bedrock towards sustainable ocean transitions, coastal women's empowerment (WE), and sustainable development. However, in most coastal regions, empowerment challenges for vulnerable people, especially coastal women, have remained prevalent. With the increasing appetite for BE resources, concerns have been raised about whether women's exclusion in BE sectors will not perpetuated, amidst the masculine domination of employment and leadership opportunities in the BE sectors. A case study of India is utilized to explore the literature and understand the perceptions and attitudes towards women's employment and leadership in the BE. This study sourced literature and utilized a bibliometric analysis technique to analyze 1768 articles. The aim was to: (i) explore research trends, (ii) scientifically map literature, key themes, and networks, and (iii) highlight perceptions and attitudes towards women's employment and leadership in the BE of India. Findings revealed that research on the BE and gender issues increased. Research citations and impact are low or have plummeted. Most publications on women-related issues in the BE are in low-impact journals. Publishing gender-specific research in top journals increases the authors'/research's impact and visibility. Multi-country collaborations on WE in the BE are low. Historical gender stereotypes and negative attitudes are critical in determining women's employment and leadership in BE sectors. Themes/concepts that promote sustainable avenues for WE in the BE, such as sustainable development, blue equity and justice, uplifting of women's status, shared gender roles, and gender relations, are just emerging or declining. Socioeconomic empowerment through financial literacy is considered critical to WE in the BE. Promoting coastal WE requires grounded transdisciplinary research approaches/techniques. Positive indicators for women's employment are emerging, mostly in service sectors, some coastal nearshore and onshore activities. Employment opportunities are enormous in long-established sectors, but social sexism on gender roles persists. Institutional mechanisms, targeting WE and gender equity in the BE, are being streamlined. Emphasizing women's studies, community participation, and WE, especially in vulnerable regions like the Bay of Bengal, are recommended strategies. Although policy and research efforts to empower women in decision-making are increasing, women's input/relevance in decision-making is abysmal. Transformative indicators have hardly translated into holistic women's employment and leadership. A simplistic women empowerment pathway (WEP) (comprising five steps) has been developed to aid WE in the BE. Holistic WE could only be achieved in a phased and continuous manner. This should begin by redefining what WE in the BE must

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entail. This can help generate micro-level vulnerabilities, viable WE opportunities, and holistic inclusion mechanisms that could be replicated in other jurisdictions.

1. Introduction

The blue economy (BE) is envisioned as a novel pathway for creating long-lasting avenues for ocean sustainability, women's empowerment (WE) (i.e., in this case, participation and employment), and inclusive equity in the use of the ocean/coastal resources (Techera, 2019; Matovu & Raimy, 2022 Matovu et al., 2023b; 2023a; 2024a; Matovu et al., 2024a). Shreds of evidence related to ocean governance and management resoundingly highlight that the increasing focus on the BE, especially after the 2012 Rio +20 'Earth Summit', is a valid and urgently needed global necessity (IOC-UNESCO, 2020; W. O. A. II. (WOA), 2021). This is due to the continuum of unsustainable practices in the tapping of ocean resources that have increased the loss of marine resources, increased injustices and inequalities meted out to vulnerable coastal communities (especially coastal women) (IOC-UNESCO, 2020; W. O. A. II. (WOA), 2021; Ocean Panel (High-Level Panel for a Sustainable Ocean Economy); IOC-UNESCO, 2022). Unsustainable marine resource user practices have been worsened by the skyrocketing negative impacts of climate change, especially global warming, which has damaged ocean resources and increased coastal livelihood vulnerability (Matovu et al., 2024a; Matovu et al., 2024d). By leveraging the BE paradigm to reverse systemic human-environmental threats in the ocean space, mind-boggling ocean sustainability and sustainable development benefits could be reaped, notably through the inclusion of coastal women and vulnerable communities (Croft et al., 2024; Matovu and Raimy, 2022; Techera, 2019). According to several reports, the empowering women in the BE could increase the global gross domestic product (GDP) obtained from ocean resources, goods, and services from about 2.5 trillion USD in 2020 to over 3 trillion USD as early as 2030 (IOC-UNESCO, 2020; UN, 2023a; World Bank, 2020; OECD; UNEP FI).

The BE is also primed to contribute to the attainment of the five United Nations sustainable Ocean development pillars (social, economic, co-governance, environmental, & scientific) and the Ocean Decade targets (2021–2030) (Matovu et al., 2024d; Matovu et al., 2024e; Matovu et al., 2025). Some of these targets include promoting ocean equity, justice, and fairness in using and accessing ocean goods, services, and resources (IOC-UNESCO, 2022; UNEP FI; Lubchenco and Haugan, 2022). Crucially, there is increasing evidence that most of these benefits are likely to be tapped by historically marginalized coastal communities, including Indigenous people, vulnerable women, and Small Islands Developing States (SIDS), mostly in the tropics (Matovu et al., 2025; Matovu and Raimy, 2022; Partelow and Manlosa, 2023; Techera, 2019). Addressing equity in the BE reifies multiplier benefits related to holistic WE, notably in gainful participation for better social, economic, leadership (institutional), and psychological domains of empowerment (Dana et al., 2023; Gupta et al., 2020; Matovu et al., 2024e; Sathiadhas et al., 2009). In most of the marine socioecological systems literature, it is highlighted that the promotion of women's or gender empowerment will largely depend on a clear understanding of the opportunities that the BE offers for WE and inclusion, in coastal communities or sector(s), especially in vulnerable tropical regions and countries (Government of India, 2021; Croft et al., 2024; Matovu et al., 2024e). This implies that coastal states and regions, especially in the global south, such as India, that quickly streamline their BE pathways and agendas towards WE could profit more from the BE paradigm shift, notably with a focus on sustainability domains such as vulnerable coastal communities' equity (Ocean Panel (High-Level Panel for a Sustainable Ocean Economy); World Bank, 2020; IRP; Ekins et al., 2019; Matovu et al., 2025). As this study utilized the case study of India, where policy directions are targeting the leveraging of BE opportunities as stipulated under India's 2021 draft BE framework and Maritime Vision 2030 (Government of India, 2021), it is imperative to explore the BE opportunities for WE in India. Subsection 1.1 explicitly sets the context of the BE in India and the opportunities it could offer for WE.

1.1. Contextual focus on the BE in India

Recognizing the potential of the BE (in boosting socioeconomic livelihoods and national development), the government of India has increased its focus (including investments) on ocean sectors and its ocean space (Meilana et al., 2023). Since 2015, when the *Sagarmala* program was initiated, a spike in coastal investments and infrastructure developments has proliferated to, among others, tap into the coastal economy (Ministry of Earth Sciences; Government of India, 2020a). To further streamline her BE, India has initiated an ambitious Maritime Vision 2030 through which a working definition of the BE has been charted, and the 2021 draft BE framework has been developed (Matovu and Raimy, 2022; Techera, 2019). According to the working definition of the BE of India, the emphasis is on, among others, the sustainable optimization of ocean resources for socioeconomic development and future sustainability (FICCI; Matovu et al., 2025). These key tenets in the working definition have been further embedded in the 2021 draft BE framework to identify seven priority ocean sectors to drive India's maritime agenda (Government of India, 2021; Matovu et al., 2023a; Matovu et al., 2024a). These include fishing, tourism, marine transport and logistics, offshore oil and gas, marine biotech, deep sea and coastal mining, and renewable energy (Government of India, 2021). Through the promotion of sustainable and inclusive livelihood opportunities, harnessing and tapping of BE resources, India could generate approximately 1.5 trillion USD by 2030 (under a best-case scenario). India's BE sectors could employ approximately 300–400 million people, especially in coastal communities, with a focus on inclusive gender employment, leadership, and holistic empowerment mechanisms (Government of India, 2021; Matovu et al., 2024d; Matovu et al., 2024e; Matovu et al., 2025).

This reveals that as policy mechanisms are being developed to safeguard ocean resources and create avenues for socioeconomic transformation and coastal communities (e.g., coastal women) inclusion in India; understanding the current coastal activities (BE sectoral) (ex) inclusion indicators could be a critical starting point to: (i) assessing progress toward India's realization of Agenda 2030, and (ii) streamline or localize national-level indicators on gender inclusion or WE in other vulnerable tropical regions, as emphasized under the Ocean Decade and the UN sustainable Ocean development pillars (Matovu et al., 2024d; Matovu et al., 2024e; Matovu et al., 2025).

1.2. BE opportunities for Women's employment and leadership in India

India has one of the largest ocean spaces (i.e., exclusive economic zone-EEZ) in South Asia, which is endowed with a plethora of ocean resources (biotic and abiotic). This provides several goods and services to more than 171 million sedentary coastal communities (Ministry of Earth Sciences; Government of India, 2020a) (see Appendix 1). According to the Ministry of Earth Sciences (2021), India's EEZ extends to 2 million km^2. Additionally, India has a 7517-kilometer-long coastline, which is home to 1382 islands and nine coastal states (V Perumal et al., 2016; Ogden, 2017; Government of India, 2020a). The EEZ is interspaced with valuable resources spread across different maritime zones, including the Bay of Bengal to the east, the Arabian Sea to the west, and the Indian Ocean to the south. These zones are all located along a geographic axis that runs from the western Pacific Ocean to the eastern coast of Africa (Government of India, 2020a; Shyam and Rajamanickam,

2013). India's territorial sea (up to 12 nautical miles) has a surface area of 193,834 km^2, and its continental shelf has a surface area of 372,424 km^2 (Ministry of Earth Sciences; Government of India, 2020a).

Policymakers and researchers in India envision that through the tapping of the BE opportunities, better women's livelihood outcomes would be attained. This is partly due to(1) the increasing evidence of coastal women's stewardship and engagement in dominant coastal activities and sectors, such as fishing (Government of India, 2020a; Juneja et al.; FAO, 2022a, 2022b; UN, 2023b; FAO, 2022a, 2022b; Government of India, 2018) (Also see Appendix 10), trade and manufacturing, and coastal mining (e.g., in 2022, India exported sand to Bangladesh, Mauritius, and the Maldives equivalent to 6,900,000, 207,000, and 835, 000 tons, and this was valued at 66.7, 5.0, and 1.8 million USD, respectively (Sand Mining Framework, 2022; accessed via www.resourcetrade.earth) (IRP; India Rivers Forum, 2020; Observatory of Economic Complexity, 2023; SANDRP; Lavadya et al., 2021; Mahadevan, 2019; Matovu et al., 2023a; Mujabar and Chandrasekar, 2013; Kamalakannan.K. and Balakrishnan, 2017; Matovu et al., 2023b; Mallik et al., 1987), and tourism among others, (2) increased recognition of the benefits of women empowerment in BE sectors, such as marine transport and security, and (3) recognition of the value of an inclusive BE towards India's development targets, (Government of India, 2021; Matovu et al., 2024b; Juneja et al.). For instance, in the fisheries sector, coastal women could be tapped into key value-chain activities, such as fish packaging, and backwater fishing (Government of India, 2020a; Matovu et al., 2024d; Juneja et al.; FAO, 2022a, 2022b; UN, 2023b; FAO, 2022a, 2022b; Government of India, 2018). The increased trade in coastal minerals, such as sand, provides a unique opportunity for women's leadership and participation as researchers, sand miners, and executives in government, and private-led mining companies (International Chamber of Shipping; Kitada and Langåker, 2016) (Also see Appendix 5). Additionally, with the increasing tourism arrivals in India, employment prospects for women have increased (FICCI; Senthilkumar, 2022; Ghosh, 2011; UNWTOa). These prospects are mostly observed in tourism or blue economy-related services, passenger transportation, food and beverage serving activities, travel agencies, and other reservation activities (Ghosh, 2011; UNWTOa; UNWTOb).

More opportunities have emerged in marine transport for women-led navy, cruise officers, captains, stewards, psychologists, and port services, as India's maritime fleet and sea-borne trade have increased (FICCI, 2019; Matovu et al., 2024b; International Chamber of Shipping; Kitada and Langåker, 2016). The increased institutional developments and initiatives, such as the National Skill Development Corporation (NSDC) and the Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS), are new engines for engaging coastal populations (women) and increasing the working age young population (working age population was estimated at 70 million people in 2023) (Angom and Viswanathan, 2022; Matovu et al., 2024d; Matovu et al., 2025). These vulnerable populations and coastal areas could be tapped into emerging BE *manufacturing activities, coastal agri-based and emerging Industries, trade, technology, services, and skills development* (Angom and Viswanathan, 2022; Matovu et al., 2024b; Matovu et al., 2024d; Matovu et al., 2025). Programs, such as *Kudumbashree,* have provided bright lights for WE through self-help groups (SHGs), creating mechanisms for the acquisition of financial support, socioecological capacity training, and skills development (Chapman and Mishra, 2019). These opportunities could reduce the unemployment of 229.2 million women (who are mostly underemployed or largely attending to domestic chores, according to the 2019 India Economic Summit report), reduce acute labor shortages in critical sectors (WEF, 2018) (Also see Appendix 11), aid international or regional security, and diplomacy (Singh, 2022; Heidar, 2020; Ministry of Defense Report, 2022; Bisen), and promote collaborative ocean governance mechanisms (Techera, 2019; Matovu et al., 2024a; Matovu et al., 2023b; Senthilkumar, 2022; UNEP-WCMC and IUCN; CBD). Coastal women's knowledge, employment, and stewardship in ocean and coastal governance can be tapped under India's government plan to protect 34,000 square kilometers of ecologically sensitive areas, mapping 12 critically vulnerable coastal areas (CVCA), and the 10 blue flag beaches (see Appendix 6 that visualizes India's proposed ICZM plan and Appendix 7 of the draft MSP).

1.3. Complex women's employment and leadership ecosystem in the BE of India and globally

Unfortunately, although enormous BE opportunities abound in India, women's exclusion/disempowerment concerns have persisted. In marine fisheries, fisherwomen's employment is mainly seasonal, part-time (66 percent), and restricted, such as in the high sea (0.03 percent), and highly vulnerable (Sathiadhas et al., 2009; Shyam and Rajamanickam, 2013; V Perumal et al., 2016; Ogden, 2017) (Appendix 10). In maritime transport, although there has been a marked increase in women's employment, especially on cruise and passenger vessels (FICCI, 2019; Matovu et al., 2024b), women's employment and leadership in the sector are generally abysmal, especially as seafarers, including on offshore service fleets, overseas vessels (including foreign-flagged but Indian manned vessels), container ships, tankers, and general cargo (International Chamber of Shipping; Kitada and Langåker, 2016) (see Appendix 12). In most sectors, e.g., coastal mining, limited employment data exists (Mahadevan, 2019; Matovu et al., 2024e). Where data exists, it is revealed that women who work in masculine mining jobs (e.g., lifters and sand graders) are less paid, vulnerable, and manipulated by most mining companies as sources of cheap labor (Muthamilselvan et al., 2016; Mahadevan, 2019; Matovu et al., 2024e). Artisanal miners (mostly women) are losing employment due to the privatization of coastal mining zones with unique minerals (Muthamilselvan et al., 2016). Similar concerns are reported in the tourism sector, where women in India make up only 12 percent of the tourism workforce, according to the 2023 World Travel and Tourism Council report titled "*Travel and Tourism: Driving Women's Success*" (UNWTOa; UNWTOb). Nevertheless, pockets of better women's employment and leadership indicators are revealed in selected sectors, such as strategic and international engagements, as among the three security services—the Indian Army, Indian Air Force, and Indian Navy (IN), the IN has the highest percentage of women in its employment at 6.5 % (Ministry of Defense Report, 2022).

The unpalatable women exclusion indicators in the BE sectors bring to the fore critical questions on why or how the bleak futures for coastal women's disempowerment in the BE have bubbled, especially in resource-rich and enterprising coastal zones (Techera, 2019; Matovu and Raimy, 2022; Matovu et al., 2024a; CBD; Enayati et al., 2024; Lukambagire et al., 2023). From a policy perspective, it is partly due to the limited focus on defining what WE in the BE entails, limited integration of women in key coastal activities, and the economic focus on tapping ocean resources, especially among vulnerable coastal communities (Matovu and Raimy, 2022; Enayati et al., 2024; Lukambagire et al., 2023). This is a concern for equity and justice as predominant social-cultural norms, (un)written laws, and institutional red tape still discourage women's engagement in BE activities or jobs away from their homes or communities (FICCI; 2019). This raises questions about whether implementing mechanisms to bridge widening, historical gender inequalities, and systemic barriers for the inclusion of vulnerable communities, especially women, would not be missed. In addition, in coastal zones endowed with valuable ocean resources, such as in Kerala and Tamil Nadu, the resulting natural resource contestations disproportionately affect coastal communities, e.g., women (Enayati et al., 2024; Lukambagire et al., 2023; Matovu and Raimy, 2022; Techera, 2019). This is worsened by the perpetual threat of archaic socioeconomic and institutional bottlenecks, including restrictive norms, perceptions, attitudes, and values, in highly diverse coastal communities, such as those in West Bengal (UNCTAD). These threats have limited or wholly pushed out coastal women from engaging in coastal activities, such as primary and lucrative fishing value chains, tourism, marine

transport, and shipping, among others (Immanuel and Sathiadhas; UNCTAD).

A continuum of restrictions and disempowerment of women would open a plethora of historical wounds that have been largely less addressed in most of the policy and local discourses, including restrictive taboos, role allocation, and sexist stereotypes (Dana et al., 2023; Gupta et al., 2020; Sathiadhas et al., 2009). Worse still, most of the policy recommendations and marine research to understand marine women's (in)equity concerns are still in the infancy stages (Matovu et al., 2024d). Most often, BE research is engulfed with dominant masculinities and has largely focused on exploring scientific innovations in ocean space and ignored the exploration of intricate social research dynamics (notably negative attitudes and perceptions) (Techera, 2019; Matovu and Raimy, 2022; Lubchenco and Haugan, 2022; Partelow and Manlosa, 2023; Partelow et al., 2023a; Partelow et al., 2023b). Most literature on coastal women's employment in the BE is disjointed and lacks a thorough analysis that would effectively consolidate the field's intellectual framework or policy direction(s). This is very evident in the abysmal understanding of the underlying impediments to women's employment, such as in coastal fisheries value chains. Moreover, previous studies to understand the causes and perpetuation of attitudes and perceptions toward WE have focused mainly on land-based sectors, such as agriculture, and only a few coastal activities, like coastal fishing (Vossenberg, 2020). Although some recent studies have tried to unearth the socioeconomic disempowerment landscape in coastal fisheries in India, research specifically focusing on the comprehensive analysis of impeding perceptions, attitudes (social, economic, and institutional barriers), and their impact on the localization of SDGs, and policy decisions; notably using novel approaches/huge research data analysis methods, such as bibliometric analysis is very limited and at worst non-existent (Matovu et al., 2023a; Matovu et al., 2024a; Matovu and Raimy, 2022; Techera, 2019).

To the best of our knowledge, this study is the first attempt to utilize a huge volume of literature and comprehensive bibliometric analyses to holistically explore and examine the perceptions and attitudes (positive and negative) that either promote or demote women's employment and leadership in the BE in India. Unlike previous bibliometric analyses (which focused on land-based quantitative development indicators and descriptive community empowerment parameters), this study goes beyond providing statistical data by presenting the entire knowledge structure and development in all BE sectors of India using performance analysis, science mapping, co-occurrence network analyses, and thematic maps. The in-depth exploration and synthesis of literature provides a critical starting point that could help identify the dominant perceptions and attitudes towards WE and situate it into the different BE sectors and sustainability pillars/WE dimensions. An additional contribution to research is the amalgamation of the diverse women's disempowerment or empowerment indicators to develop a novel women's empowerment pathway.

To systematically contribute to scholarship and policy directions on WE in the BE, an overall objective of this paper is to fill the knowledge gap and provide insightful information by answering several significant research questions that clarify current patterns (perceptions and attitudes) of women's employment and leadership in the BE of India and give guidance for future investigations, in other jurisdictions. To achieve this objective, four research questions (RQs) have been identified that will be addressed in this study, including the following:

RQ 1: What are the emerging trends in literature, research, and authorship on BE with a focus on women's employment and leadership dynamics in India?
RQ 2: What do the current and emerging research trends, themes, and networks in the literature on the BE and women's employment and leadership inform us about the nature of perceptions and attitudes toward women's employment and leadership in the BE sectors?
RQ 3: What comprehensive insights/lessons can be identified from the literature that specify and uncover insights on the nature of perceptions and attitudes towards women's employment and leadership in the BE?
RQ 4: How can we design a framework of WE depicting the principal dimensions and indicators of women's inclusion to help develop novel pathways that could help energize holistic WE in the BE to prepare for a sustainable and equitable BE future?

By answering the above questions,this research provides a comprehensive analysis of literature that can be utilized to understand: (i) trend analyses and mapping of WE indicators, and (ii) identify key bottlenecks to WE in coastal regions of India and other coastal regions. The generated insights could be scaled up as policy discussions and action plans in the BE frameworks that are in the pipeline, including redefining the working definition of the BE (Matovu and Raimy, 2022; Techera, 2019).

2. Method and material utilized

This paper utilized a systematic literature review (SLR) to obtain literature for bibliometric analysis (Matovu et al., 2024a). SLR is a secondary data collection method that has gained popularity in research as it is rigorous and replicable. A rigorous and phased technique was utilized to source and obtain literature on the BE explicitly and WE in India (SLR) (Neumann, 2014; Pranajaya et al., 2024). A step-by-step technique embedded in a research flow framework for conducting bibliometric analyses was performed, as recommended in recent studies (Koseoglu, 2016; Neumann, 2014; Payumo et al., 2020; Pranajaya et al., 2024). The research framework involved four steps, including (i) sourcing of literature in Scopus, (ii) performance analysis of the literature (such as publication and citation trends and indicators), (iii) scientific mapping and network analysis, including thematic analysis, and (iv) interpretation, and reporting of the results to align with overall research aim.

2.1. Database and search protocol

SLR was strategically conducted in a phased manner and designed according to the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) (Bhyan et al., 2023; Pranajaya et al., 2024; Raparelli and Bajocco, 2019; Sarfo et al., 2024). On March 28, 2024, and February 12, 2025, the Scopus digital database was utilized to conduct four customized literature search queries. The search queries and terms utilized were: (i) TITLE-ABS-KEY (coastal AND women AND in AND India) AND PUBYEAR >2011 AND PUBYEAR <2025) and 138 results were obtained (ii) TITLE-ABS-KEY (blue AND economy AND in AND India) AND PUBYEAR >2011 AND PUBYEAR <2025) and 148 results generated, (iii) TITLE-ABS-KEY (women AND employment AND in AND coastal AND India) AND PUBYEAR >2011 AND PUBYEAR <2025) and 9 results were obtained and (iv) TITLE-ABS-KEY (women AND empowerment AND in AND India) AND PUBYEAR >2011 AND PUBYEAR <2025) and 1490 results were obtained. At this stage, 1785 documents were obtained. The four searches were made to ensure that all the key issues in the study topic and objectives were captured. All the documents were downloaded as Microsoft Excel CSV files (including article(s) bibliometric data/information).

2.2. Bibliometric analysis (procedure, main analyses made, and reporting)

The bibliometric analysis technique was utilized to synthesize literature and understand quantitative/qualitative publication patterns and themes over time (Koseoglu, 2016; Mejia et al., 2021; Payumo et al., 2020). Before conducting the analysis, the four separate Microsoft Excel CSV files were combined into one file (https://acesse.one/MVbqf). This

was followed by the installation of the bibliometric analysis tool (Biblioshiny) in R software to import, screen, and analyze the 1785 documents, as guided by recent studies (Mejia et al., 2021; Mongeon and Paul-Hus, 2016; Sarfo et al., 2024). The installation of the Biblioshiny tool was done in a phased process. Initially, Initially, the R Studio program/software was downloaded and installed. This was followed by RStudio's installation. The following steps were taken to install the Biblioshiny tool in RStudio: (i) installing Bibliometrix by clicking on packages; (ii) typing "library(bibliometrix)" and pressing run; and (iii) typing "Biblioshiny ()" and pressing enter. This led to the automatic opening of a dashboard where the analysis was to be conducted. When the dashboard was launched, the combined Microsoft Excel CSV file was imported to kickstart the analysis.

The filtering of the 1785 documents automatically removed 17 duplicate articles, thus, 1768 documents were analyzed. The analysis was broadly structured based on three streams: (i) performance analysis (involving the evaluation of key research components, such as authorship, documents, words, and source analysis) (ii) science mapping (focusing on the connections of the various components such as networks and themes) and (iii) comprehensive research trend constructs (on perceptions and attitudes). Several studies have revealed that amalgamating all these components, including co-citation analysis for the past, bibliographic coupling for the present, co-word, and thematic analysis, helps unravel relevant terms for potential future studies, such as on WE (Koseoglu, 2016; Mejia et al., 2021; Payumo et al., 2020; Rejeb et al., 2022). Results obtained from streams (i) and (ii) were visualized. Additionally, to capture the findings of the stream (iii), manual reading and extraction of diverse perceptions towards WE in the BE sectors were conducted. The key narratives/themes were tabulated.

3. Results

3.1. Overview/summary of the bibliometric information of sourced literature

The summary bibliometric characteristics of the 1768 documents utilized are shown in Table 1. Accordingly, positive insights in the domain of research on the BE and coastal women's issues are reported. For instance, in only 12 years (2012–2024), the annual growth rate of research in this field stands at a respectable 13.07 percent. The total number of references for the 1768 documents is 68653.

Table 1
A summary of the bibliometric data of the sourced and analyzed 1768 documents on the BE, women's employment, and leadership in India from 2012 to 2024 (Source: Scopus/Biblioshiny).

Description	Results	Description	Results
Timespan	2012:2024	Authors' collaboration: International co-authorships (percentage-%)	17.7
Sources (Journals, Books, etc)	1028	Articles	1272
Documents	1768	Books	48
Annual Growth Rate %	13.07	Book chapters	273
Document Average Age	5.26	Conference papers	88
Average citations per doc	8.445	Conference reviews	4
References	68653	Data paper	1
Keywords Plus (ID) (document contents)	3933	Document Type	1
Author's Keywords (DE) (document contents)	4347	Editorials	6
Authors	4058	Letter	1
Authors of single-authored documents	428	Notes	7
Authors collaboration: Single-authored documents	481	Reviews	67
Authors collaboration: Co-Authors per document	2.93		

3.2. Performance bibliometric analysis

Here, the focus is centered on examining the performance of the literature published in the field. The main analyses involved (i) research and citation analysis, (ii) author analysis, (iii) sources, (iv) documents, (v) institutions, and (vii) country-level analyses in the domain of women's employment/leadership in the BE, to identify their essentiality (*RQ1*).

3.2.1. Research publication and citation analysis

An analysis of the annual scientific publication and average citation of research is shown in Fig. 1. The publication of research has increased, from 68 papers in 2012 to 297 papers in 2024. However, the mean total citation (TC) per article has regressed from 20.74 in 2012 to 0.65 in 2024 (Mean TC per article represents the average total number of citations for an article over a period). A similar regression is revealed in the average citations per year (i.e., Mean TC per year shows the mean total number of citations per year for all articles) (See Appendix 9).

Insights to unravel the causation of the increasing number of publications could be understood by exploring and plotting the nature of research and the key focus areas. This is shown in the Three-field plot (Fig. 2). Accordingly, the analysis of the 12 keywords utilized by authors and institutions in India comprehensively reveals an emphasis on critical issues, such as WE, BE, SHGs, education, microfinance, and gender equality.

3.2.2. Source analysis

This captures the main journals publishing research in each field, their ranking, and the journal's impact. Over the years, several journals have increasingly published work on the BE and women's issues in India. The Journal of International Women's Studies is the most dominant and published 25 articles in 2024 (Fig. 3). However, based on the Scimago Journal and Country Ranking (www.scimagojr.com), the most relevant journals have a low quartile ranking (e.g., The Journal of International Women's Studies is ranked in Quartile 3 (Q3) and the Journal of Rural Development is Q4). This might lead to limited impact and visibility of the published works or capturing of the insights for WE at the policy or scholarly level.

In terms of source impact, World Development Journal is the most impactful journal publishing research on women's issues in coastal regions and the BE in India (Table 2 and Appendix 13). Although publications in World Development are comparatively fewer (21) than those in the Journal of International Women's Studies (25), they have garnered a high impact. In the academic domain, this implies that targeting high-impact journals, irrespective of the quantity of publications, leads to high-impact research that could help uncover complex WE issues in the BE. This perspective is true based on the critical analysis of the citation impact of authors in the field. Accordingly, top-cited authors, such as Kumar N (2019), who published their work in the World Development Journal (https://doi.org/10.1016/j.worlddev.2018.09.023), have the highest number of local citations (22).

3.2.3. Document analysis

Document analysis reveals the dominant/prominent articles in the field, and their impact at a global or local level. The dominant articles by the different authors based on the Local citations (LC), global citations (GC), normalized GC (NGC), and normalized LC (NLC) are indicated in Table 3. Findings in Table 3 reveal that the publication of articles in high-impact journals on the BE and WE leads to high global citations. For instance, although the work of Kumar et al., 2019 (https://doi.org/10.1016/j.worlddev.2018.09.023) has a low GC as compared to that of Banerjee A. (2015), its LC impact (22:16) and LC/GC ratio (26.83:2.28 percent) are higher. This is partly because this work explicitly highlights and uncovers critical empowerment needs of rural

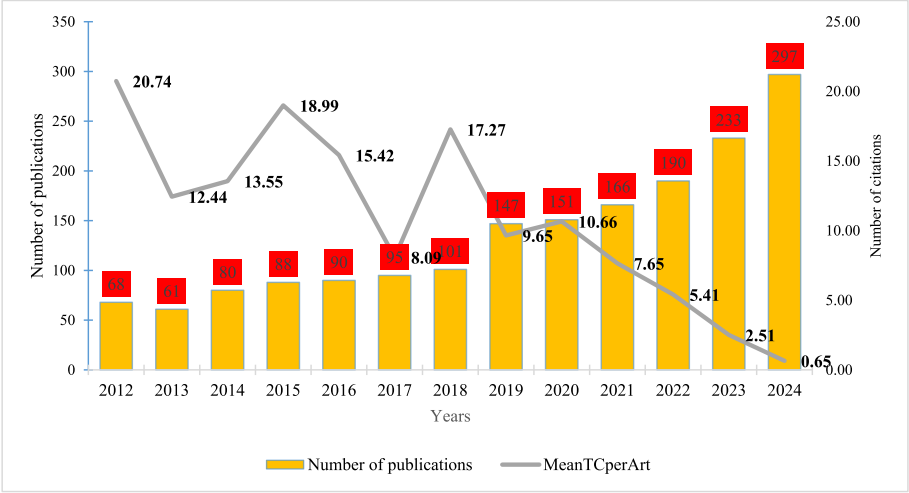

Fig. 1. Annual scientific publication and mean TC per article on the BE, women's employment, and leadership in India from 2012 to 2024 (Authors' modification of data sourced from Scopus/Biblioshiny).

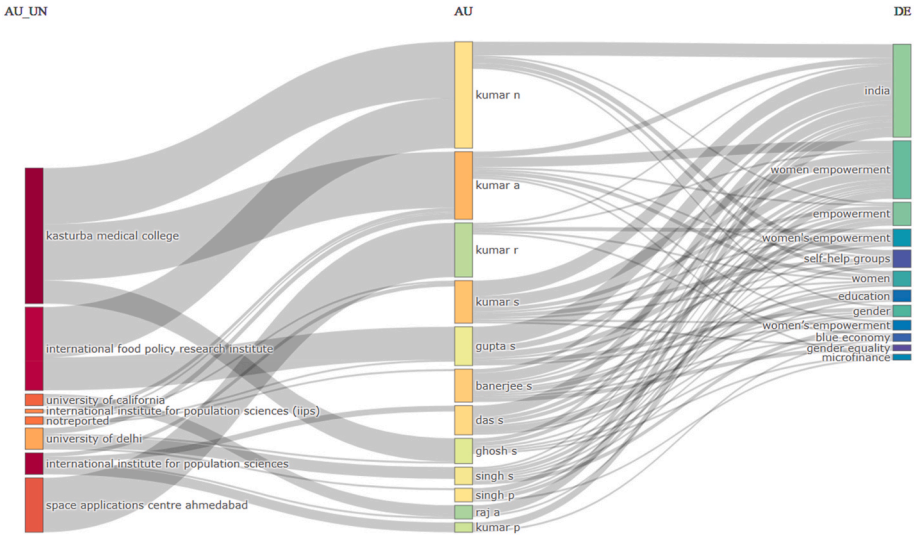

Fig. 2. Three-field plotting of the 12 authors, institutions, and keywords emphasized in research on the BE and women's employment and leadership (Source: Scopus/Biblioshiny).

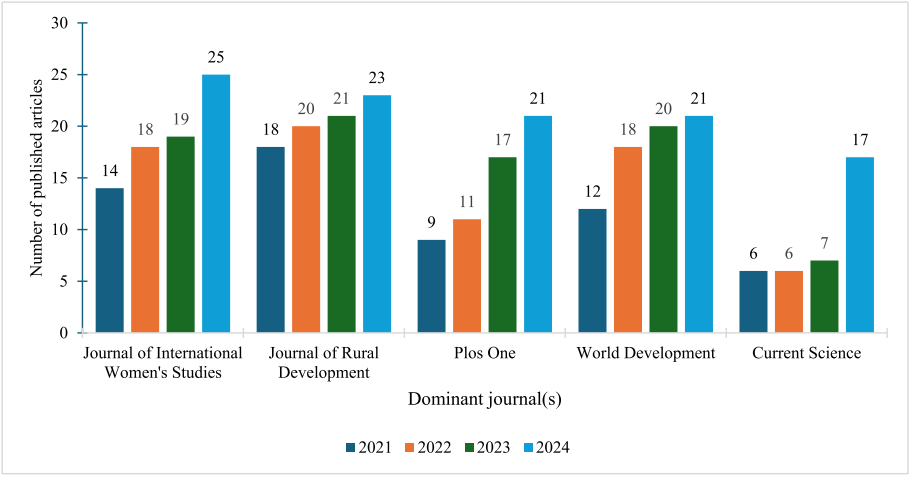

Fig. 3. Analysis of the top five relevant sources/journals publishing research on the BE and WE since 2021 (Authors' modification of data sourced from Scopus/Biblioshiny).

Table 2
List of the top 42 journals/sources publishing research on women's employment and leadership in the BE from 2012 to 2024 (Source: Scopus/Biblioshiny) (*Each year shows a paper(s) published by a given journal(s) and its impact. TC: shows total citations received by a given journal in a given year; PY_start represents publication year start (when the article/document was/is first published); NP: number of publications.

Source	h_index	g_index	m_index	TC	NP	PY_start	Source	h_index	g_index	m_index	TC	NP	PY_start
World Development	13	21	1	547	21	2013	Gender in Management	4	6	0.308	91	6	2013
Journal of Development Studies	9	11	0.643	213	11	2012	Gender, Technology, and Development	4	9	0.286	142	9	2012
PLOS One	8	15	0.8	241	21	2016	Indian Journal of Gender Studies	4	8	0.286	72	11	2012
BMC Public Health	7	10	0.5	120	11	2012	International Journal of Rural Management	4	5	0.308	78	5	2013
Journal of Clinical and Diagnostic Research	6	10	0.5	101	10	2014	Journal of International Development	4	4	0.333	63	4	2014
Journal of International Women's Studies	6	7	0.462	68	25	2013	Journal of Rural Development	4	6	0.286	57	23	2012
Social Science and Medicine	6	8	0.429	163	8	2012	Oxford Development Studies	4	6	0.308	118	6	2013
BMC Women's Health	5	10	0.625	126	10	2018	Space and Culture, India	4	6	0.308	52	6	2013
BMJ Open	5	7	0.556	63	8	2017	Women's Studies International Forum	4	8	0.286	83	8	2012
Clinical Epidemiology and Global Health	5	8	0.833	77	8	2020	Asian Pacific Journal of Cancer Prevention	3	3	0.273	22	3	2015
Feminist Economics	5	7	0.385	110	7	2013	Benchmarking	3	4	0.375	68	4	2018
Gender, Place, and Culture	5	8	0.5	98	8	2016	Bulletin of the Atomic Scientists	3	3	0.25	15	4	2014
International Journal of Social Economics	5	6	0.455	147	6	2015	Community Development Journal	3	3	0.25	22	3	2014
Journal of Interpersonal Violence	5	7	0.5	140	7	2016	Current Science	3	4	0.25	27	17	2014
Sustainability (Switzerland)	5	10	0.455	115	10	2015	Enterprise Development and Microfinance	3	4	0.231	24	4	2013
Asian Journal of Women's Studies	4	6	0.364	36	7	2015	Equality, Diversity, and Inclusion	3	4	0.333	71	4	2017
Contemporary South Asia	4	4	0.308	68	4	2013	European Journal of Development Research	3	5	0.231	27	6	2013
Development and Change	4	4	0.286	92	4	2012	Gender and Development	3	3	0.273	61	3	2015
Development in Practice	4	6	0.308	43	9	2013	Gender and Society	3	3	0.231	75	3	2013
Economic and Political Weekly	4	7	0.286	59	10	2012	Global Public Health	3	3	0.231	85	3	2013
Energy Research and Social Science	4	4	0.667	78	4	2020	Indian Journal of Community Medicine	3	4	0.214	45	4	2012

Table 3
Analysis of the top 25 impactful articles on the BE and WE in India by the different authors based on the global and local impact scores/indicators (Source: Scopus/Biblioshiny).

Document	DOI	Year	LC	GC	LC/GC Ratio (%)	NLC	NGC
Kumar N, 2019	https://doi.org/10.1016/J.Worlddev.2018.09.023	2019	22	82	26.83	29.14	8.49
Banerjee A, 2015	https://doi.org/10.1257/App.20130533	2015	16	702	2.28	16.56	36.97
Datta U, 2015	https://doi.org/10.1016/J.Worlddev.2014.11.013	2015	15	57	26.32	15.53	3.00
Datta PB, 2012	https://doi.org/10.1111/J.1540-6520.2012.00505.X	2012	11	385	2.86	11.69	18.57
Garikipati S, 2012	https://doi.org/10.1111/J.1467-7660.2012.01780.X	2012	10	62	16.13	10.63	2.99
Raj A, 2018	https://doi.org/10.1016/J.Socscimed.2017.11.042	2018	9	52	17.31	19.76	3.01
Roy S, 2015	https://doi.org/10.1016/J.Jdeveco.2014.12.010	2015	9	91	9.89	9.32	4.79
Imai KS, 2014	https://doi.org/10.1016/J.Worlddev.2014.05.001	2014	9	100	9.00	12.41	7.38
Raghunathan K, 2019	https://doi.org/10.1111/Agec.12510	2019	8	29	27.59	10.59	3.00
Ghosh R, 2015	https://doi.org/10.1177/1478210315571214	2015	8	25	32.00	8.28	1.32
Chakrabarti S, 2012	https://doi.org/10.1080/00220388.2011.615920	2012	8	34	23.53	8.50	1.64
Anand P, 2020	https://doi.org/10.1080/19452829.2020.1742100	2020	7	18	38.89	13.55	1.69
Banerjee S, 2020	https://doi.org/10.1108/S1571-038620200000027001	2020	7	22	31.82	13.55	2.06
Haugh HM, 2016	https://doi.org/10.1007/S10551-014-2449-4	2016	7	256	2.73	12.12	16.60
De Hoop T, 2014	https://doi.org/10.1080/13545701.2014.893388	2014	7	33	21.21	9.66	2.44
Singh A, 2014	https://doi.org/10.1108/IJSSP-10-2013-0110	2014	7	10	70.00	9.66	0.74
Laha A, 2014	https://doi.org/10.1080/01900692.2013.858354	2014	7	19	36.84	9.66	1.40
Sinha B, 2012	https://doi.org/10.1080/09589236.2012.639551	2012	7	24	29.17	7.44	1.16
Roy S, 2019	https://doi.org/10.1177/0069966719861758	2019	6	19	31.58	7.95	1.97
Gupta S, 2017	https://doi.org/10.1007/S12571-017-0737-4	2017	6	30	20.00	14.25	3.71
Pattnaik I, 2018	https://doi.org/10.1080/13547860.2017.1394569	2018	6	144	4.17	13.17	8.34
Bali Swain R, 2017	https://doi.org/10.1080/00220388.2016.1205732	2017	6	25	24.00	14.25	3.09
Standal K, 2016	https://doi.org/10.1080/08039410.2015.1134642	2016	6	68	8.82	10.38	4.41
Amaral S, 2015,	https://doi.org/10.1177/0260107915582295	2015	6	31	19.35	6.21	1.63
Allendorf K, 2012	https://doi.org/10.1007/S11113-012-9228-7	2012	6	51	11.76	6.38	2.46

women in India, and the dynamic social networks, mobility, and decision-making spaces that could be harnessed to promote gender equity and equality, especially through SHGs and public entitlement schemes in India. Thus, documents that are grounded on exploring micro-level empowerment narratives could be critical in identifying and providing policy and academic directions in the domain of WE in the BE (Matovu et al., 2024a; Matovu et al., 2024d; Matovu et al., 2024e).

3.2.4. Authors' analysis

Here, an analysis of the dominant authors, corresponding authors' works, the key WE perspectives in their works, and the impact of their works based on research performance indicators is given.

Based on the analysis of authors based on the number of articles published and the articles' fractionalized impact, Kumar A is the most prominent author and has published 23 articles in the field (Fig. 4). Among the prominent articles published by Kumar A, was in 2016 in the Indian Journal of Management (https://doi.org/10.17010/pijom/2016/v9i6/94959). This work highlights the management issues and approaches needed to advance WE, employment, and leadership.

In terms of the overall author impact based on the comprehensive analysis of author bibliometrix, such as h_index, g_index, m_index, TC, and the number of impactful publications (NP), the scholarly works of Kumar S are the most relevant (Table 4). One of the prominent works of Kumar and Gupta was published in 2015 (i.e., Changing Patterns of Women's Turnout in Indian Elections, https://doi.org/10.1177/2321023015575210). In this article, the authors reveal that orthodox social norms had historically impeded women's engagement in leadership and electoral politics. It is argued that overcoming barriers to women's engagement in leadership positions increases democratic spaces for WE, equity, and equality.

In terms of author collaborations, although authors from different countries have demonstrated interest in engaging in multi-country publications, the number of single-authored publications or single-country publications (SCPs) in India is higher. There are a few multi-country publications (MCPs) (Fig. 5). The lack of or limited MCPs, especially in tropical coastal regions neighboring India, such as Bangladesh, might limit the development of comprehensive WE and gender equality mechanisms.

3.3. Scientific mapping and network analysis

In this section, the target is answering *RQ2*. This is done through the exploration/analysis of words, networks, themes, and countries' collaborations to inform policy, and scholarship concerning women's employment, leadership, and empowerment in coastal activities/BE. Subsequent subsections give the key results.

3.3.1. Word analysis

Three main analyses were conducted based on the keywords utilized by authors publishing works on WE, employment, and leadership in coastal activities, and regions of India.

First, a word cloud analysis of the 120 critical issues and keywords that emphasized WE, employment, and leadership was explored (Fig. 6). Here, it is revealed that emphasis on avenues and issues that promote WE and gender equality in the BE are prominent. Most authors and their works reveal the perpetual bottlenecks to socioeconomic empowerment, such as domestic and intimate partner violence in regions, such as West Bengal. Additionally, avenues/mechanisms that could promote holistic WE are highlighted, such as financial inclusion mechanisms, leveraging SHGs, and women's entrepreneurship.

Second, to quantitatively explore the impact and frequency of relevance of the keywords utilized/emphasized in research, tree mapping was conducted (Fig. 7). The Treemap analysis revealed that 12 percent of the literature emphasizes holistic empowerment, and 11 percent of authors' works commend the focus on WE. However, only 2 percent of the literature and authors focus on sustainability or comprehensively explore the BE. 1 percent of research has explored the gender intersectionality components in employment and leadership, especially in critical and long-established BE sectors.

Third, the complex dynamics, such as in understanding the gender intersectionality and WE perspectives led to the trending topics in research and policy (Fig. 8). In most research, topical focus is on economic empowerment aspects, such as financial literacy. In other words, research and policy perceptions argue that economic empowerment through financial literacy is the benchmark for promoting women's employment and leadership in BE activities.

3.3.2. Social structure analysis

In bibliometrics, social structure analysis uncovers key networks among countries and authors in different research domains. In this paper, as a part of social structuring, countries collaboration network analysis was conducted. As indicated in Fig. 9, India mainly collaborates with developed or rich countries in the global north in research on the BE, WE pathways, and benchmarking. For instance, there are 100 and 46 collaborations between the USA and the United Kingdom in this field. Few collaborations exist between India and several developing coastal countries in the tropics or the Global South (Appendix 14).

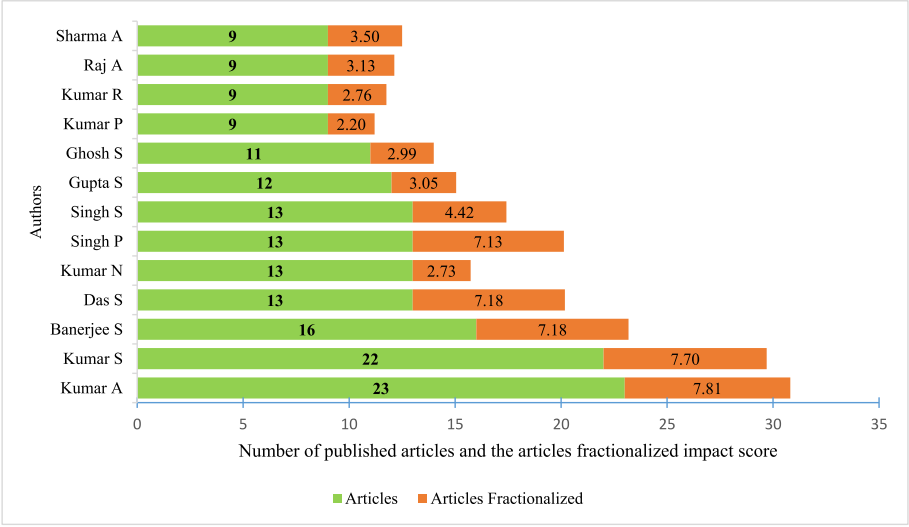

Fig. 4. Analysis of the 13 most relevant authors based on the number of articles published and article fractionalized impact (Source: Scopus/Biblioshiny).

Table 4
Analysis of the 20 dominant authors publishing research on women's issues in the coastal regions of India based on the h_index, g_index, m_index, TC, and NP from 2012 to 2024 (Source: Scopus/Biblioshiny) (i.e., the TC refers to the total citations of the works of a given author), NP is the number of publications by a given author, h_index is the analysis of productivity and citation impact of a given publication(s) by the author(s), g_index is the cumulative citation performance of a given article, *PY_start: represents publication year start (when the article/document was/is first published)*, and m_index is the author's impact, relative to other authors' impact factor).

Author	h_index	g_index	m_index	TC	NP	PY_start	Author	h_index	g_index	m_index	TC	NP	PY_start
Kumar S	9	14	0.643	205	22	2012	Raghunathan K	5	6	0.714	202	6	2019
Kumar N	8	13	0.727	277	13	2015	Saggurti N	5	5	0.455	117	5	2015
Gupta S	7	12	0.778	147	12	2017	Shetty Rs	5	6	0.714	48	7	2019
Kumar A	7	9	0.5	119	23	2012	Singh A	5	8	0.385	65	9	2013
Raj A	7	9	0.7	212	9	2016	Singh S	5	8	0.625	65	13	2018
Ghosh S	6	9	0.545	88	11	2015	Banerjee S	4	6	0.333	49	16	2014
Singh P	6	8	0.462	80	13	2013	Donta B	4	4	0.4	137	4	2016
Unnikrishnan B	6	7	0.545	61	9	2015	Farnworth Cr	4	6	0.667	77	6	2020
Das S	5	9	0.455	82	13	2015	Garikipati S	4	5	0.286	136	5	2012
Nair S	5	6	0.5	95	6	2016	Holla R	4	5	0.364	32	8	2015

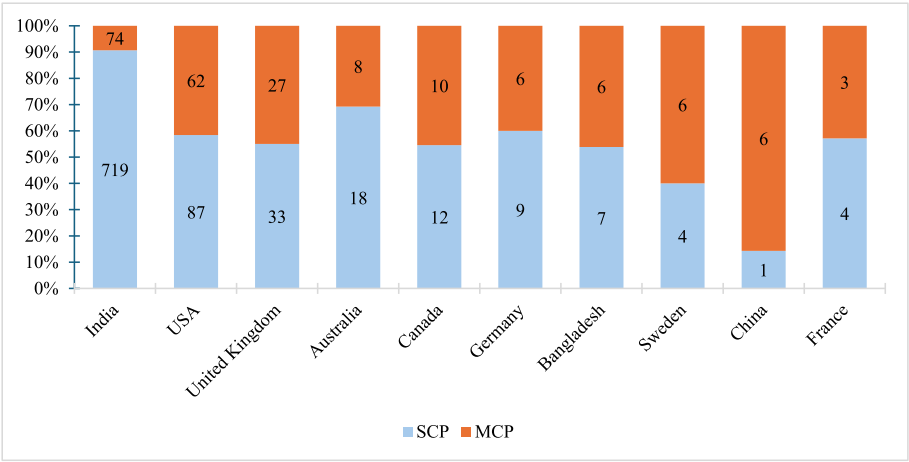

Fig. 5. Analysis of the different authors' country collaboration in research on women's employment, leadership, and empowerment in coastal activities/BE (Source: Scopus/Biblioshiny).

3.3.3. Network analysis/approach (keyword co-occurrence network)

The main themes/words based on their co-occurrence patterns are indicated in Fig. 10. Terms such as " women empowerment," "gender equality," "financial inclusion," "economic empowerment," "women entrepreneurs," "women's entrepreneurship," "rural development," "maternal health," "microfinance," and "SHGs" are grouped in the first cluster (red). In the bibliometric analysis of cluster 1, comparative studies in economic empowerment had a high betweenness of 0.492 and a closeness of 0.015. Socioeconomic factors for women's disempowerment, such as poverty and caste, have a relatively low closeness and are less explored (second cluster in blue). This reveals that these terms are closely associated and may represent key themes or areas of focus in research related to coastal women's challenges in India. Similarly, emerging terms such as 'BE', 'sustainable development', 'Kerala', and 'economic development' form the third cluster (green). This cluster reveals emerging interconnected themes that could drive the BE. States, such as Kerala, could provide critical insights for understanding WE perspectives and stories for holistic empowerment and sustainable development (Matovu et al., 2024d). The topic/term/keyword 'public health' highlighted in purple falls under the fourth cluster (with a weak betweenness and closeness). The betweenness, closeness, and PageRank metrics provide insights into the importance or centrality of each term within the network. This is further highlighted in the conceptual mapping of key themes and concepts on WE, employment, and leadership in the BE, based on the factorial approach (Appendix 15).

Terms with high betweenness centrality, such as 'WE', and 'women's entrepreneurship' serve as important bridges connecting different thematic networks. The terms with high closeness centrality, such as "empowerment" and "employment," are closely linked to other terms in the network. These represent high PageRank values and are considered important or influential within the WE discourse in the BE. The co-occurrence network analysis helped identify key concepts and their relationships, which can guide further research and intervention strategies related to coastal women's challenges in India. For example, understanding the interconnections between terms can inform the development of holistic approaches to address multifaceted challenges that coastal women face, such as in vulnerable coastal states [42-92]. Identifying central or influential terms helps prioritize research areas or intervention strategies to maximize impact, as in dominant sectors such as fishing (Lukambagire et al., 2023). Exploring clusters of terms further helps reveal thematic areas that require more focused attention or interdisciplinary collaboration (Sarfo et al., 2024). This is key in analyzing changes in the network structure over time and can highlight emerging trends or shifting priorities in research related to coastal women's challenges (Dana et al., 2023; Gupta et al., 2020; Sathiadhas et al., 2009).

3.3.4. Thematic mapping, evolution, and analysis

Two analyses are conducted: thematic evolution and mapping. Thematic evolution focused on the analysis of the conceptual trends on key issues/concepts/themes concerning women's issues in coastal areas/BE activities. As indicated in Fig. 11, since 2012, critical issues and perceptions that impede WE are highlighted, such as patriarchy and maternal issues, in regions such as Assam. Additionally, strategies to promote women's employment, leadership, and holistic empowerment, such as emphasizing women's studies, community participation, and

Fig. 6. Word cloud analysis of the dominant keywords and issues emphasized in the context of (dis)empowering women in coastal regions/BE activities of India (Source: Scopus/Biblioshiny).

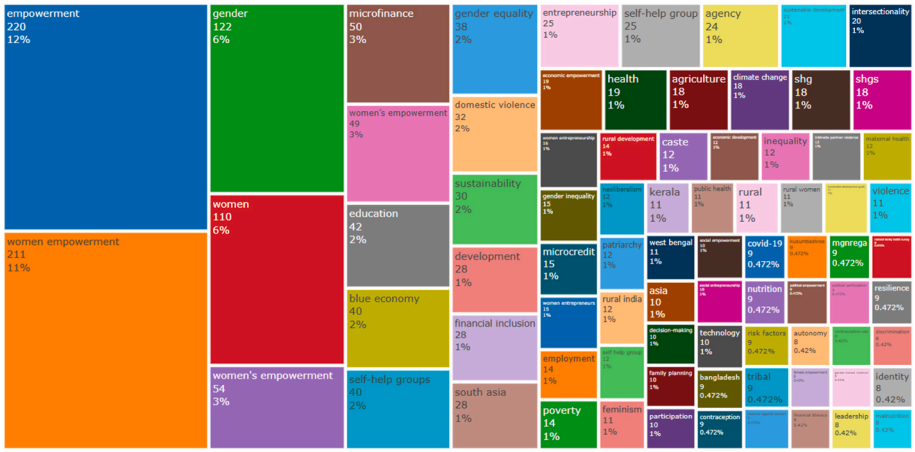

Fig. 7. Treemap analysis of the 80 dominant keywords and issues emphasized in the WE, employment, and leadership discourse in the BE sectors of India from 2012 to 2024 (Source: Scopus/Biblioshiny).

WE, especially in vulnerable regions like the Bay of Bengal, are recommended. These are critical insights that could offer novel policy and research directions on gender inclusion, equity, and empowerment in the BE.

However, the thematic mapping of key concepts and themes reveals an opaque and bleak future regarding women's employment and leadership in the coastal activities or BE sectors (Fig. 12). Accordingly, introspection of the grounded realities on WE, employment, and leadership issues, based on the development degree and centrality (relevance) reveals that women's level of decision-making is still low. Although development efforts to empower women in decision-making are increasing, women's input/relevance in decision-making is abysmal. Themes/concepts that promote sustainable avenues for WE, such as sustainable development, uplifting of women's status, shared gender roles, and gender relations, are just emerging or declining.

3.4. Research trends and insights on the perceptions and attitudes toward women's employment and leadership

The specific perceptions and attitudes (enabling/inhibiting) towards women's employment and leadership in the BE (RQ3) (Table 5). Critical highlights and the nature of complexity in promoting WE in the BE are revealed in Table 5. Generally, women's employment and leadership are still low, and most of the inhibiting perceptions and attitudes are situated in traditional BE activities that have been dominated by men. Shreds of literature on enabling or positive attitudes are reported mainly in service sectors and some coastal nearshore or onshore activities. This creates a varied landscape regarding women's employment and leadership, with critical ramifications related to advances toward ocean sustainability pillars, targets, and indicators as advanced under the UN sustainable Ocean development discourse (Hoegh-Guldberg and

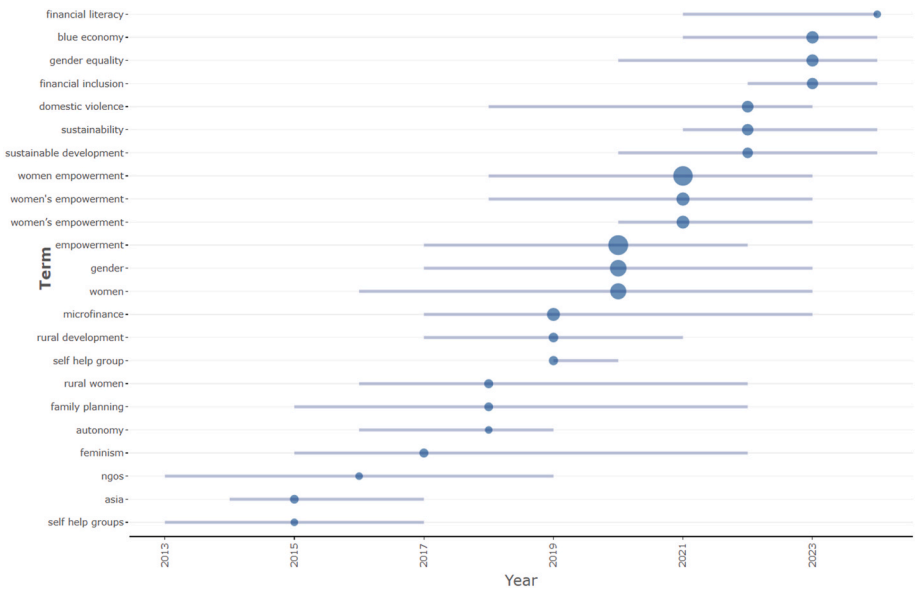

Fig. 8. Analysis of the trending topics on WE, women's employment, and leadership in the BE (Source: Scopus/Biblioshiny).

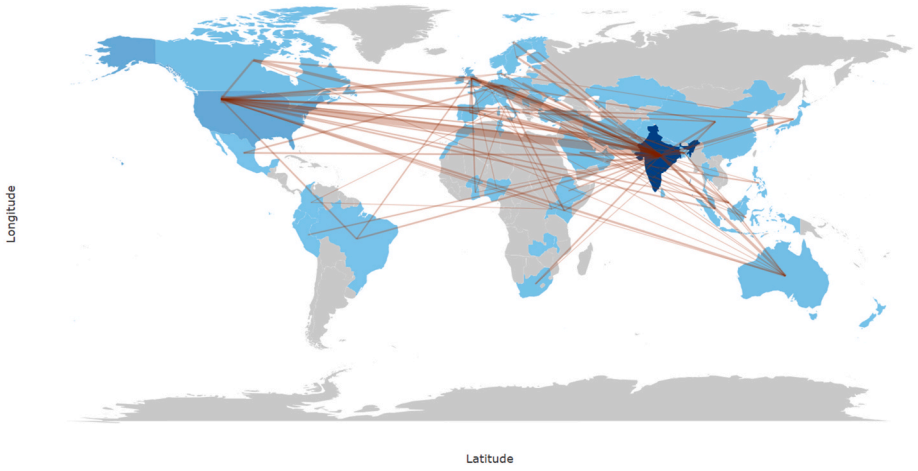

Fig. 9. Collaboration map between India and other countries in the fields of BE, WE, employment, and leadership from 2012 to 2024 (Source: Scopus/Biblioshiny) **The high density/connections of the flow line are indicative of the increased/high collaborations between India and a given country.

Northrop, 2023; IOC-UNESCO, 2022; UNEP FI; Lubchenco and Haugan, 2022).

4. . Discussion and reflections from the literature

Insightful revelations concerning women's employment, leadership, and holistic WE in the BE sectors/coastal regions are revealed in this study. The findings exposed a mixed, double-edged landscape in perceptions and attitudes that either stymie or enable women's participation and engagement in different activities or coastal sectors.

First, positive and promising indicators for women's employment and leadership are reported in some bibliometric analyses. For instance, in terms of research publications, citations, and research focus areas, a positive and increasing trend is reported. Since 2014, increased research publications on BE and WE issues are evident. The increase in publications, especially in 2015–2017, could partly be attributed to the development of the '*Blue Chakra*' and '*Sagarmala*' program (Matovu et al., 2024a). Such programs aim at promoting inclusiveness in the BE sector. These programs are tailored to increase labor force participation of coastal communities, including women. Thus, robust institutional policies that strategically target vulnerable genders in coastal communities could be a cornerstone for a sustainable BE and inclusive WE (Government of India, 2020a; Matovu et al., 2024d; Matovu et al., 2024e; Matovu et al., 2025). A concern, however, is that the average citation of published works has either plummeted or is low, especially since 2000 (See AppendixAppendix 9). This is a concern regarding the identification of the best strategies for women's employment/leadership in the BE (Hans, 2001; Ogden, 2017). A thorough synthesis of the nature of publications over this period could help understand the causation. Most often, authors have published in low-impact and quartile journals or disregarded critical marine social science research, grounded in exploring the historical negativity, perceptions, and attitudes towards women's inclusion, participation, and engagement in coastal activities, such as fishing. Declining citations could further hinder the comprehensive exploration and understanding of the systemic barriers that have stymied women's inclusion in several coastal activities, partly due to patriarchal norms and values (Gupta et al., 2020; Hans, 2001; Matovu et al., 2024b; Ogden, 2017). A decline in the mean total citations per article adds an intriguing dimension to the overall trend in research on women's employment and leadership in the BE could be explored, understood, or prioritized, especially in policy. The findings highlight potential challenges in knowledge transfer and dissemination within the

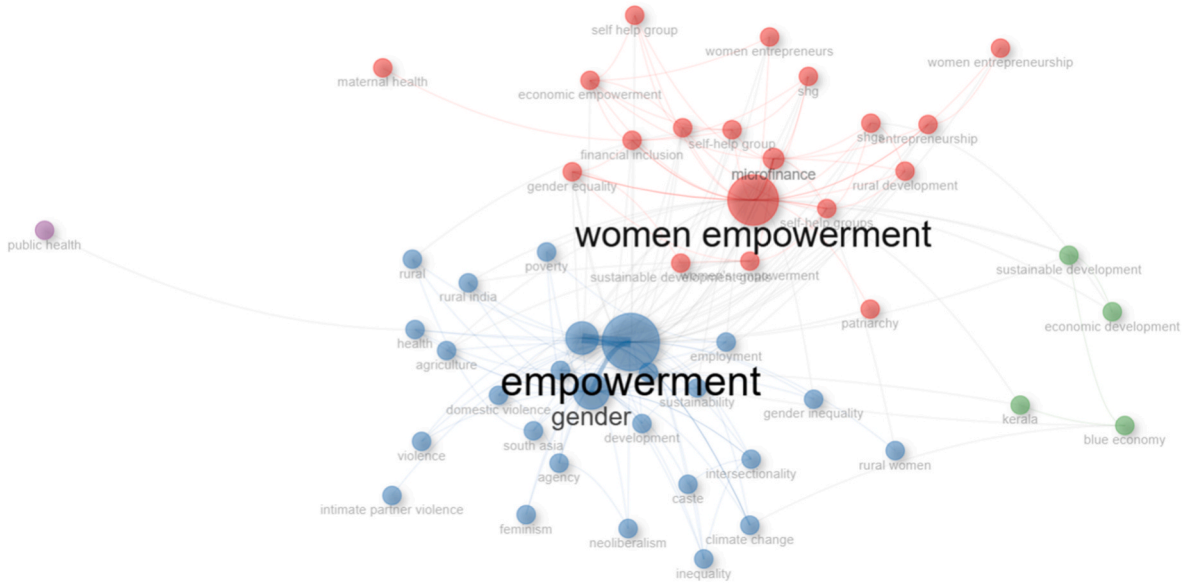

Fig. 10. Clustering using the network approach or co-occurrence networks of the key themes and keywords in the field on WE and BE (Source: Scopus/Biblioshiny).

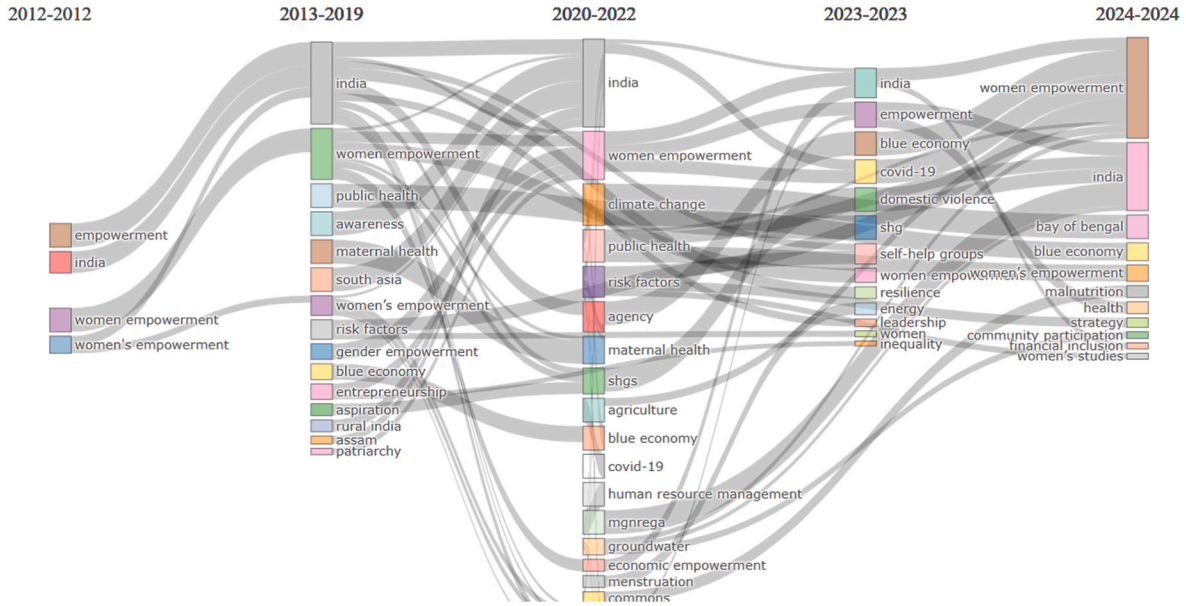

Fig. 11. Thematic evolution from 2012 to 2024 on key themes/concepts on women's (dis)empowerment landscape in coastal regions/BE activities in India, based on five different periods/clusters (Source: Scopus/Biblioshiny).

Indian academic landscape, as revealed in social ocean sustainability studies (Lubchenco and Haugan, 2022; Partelow et al., 2023b). Most often, there seems to be a disconnect between the research conducted on coastal women's employment and leadership challenges in India and the awareness or utilization of this research within the context of holistic WE (Gupta et al., 2020; Lubchenco and Haugan, 2022; Partelow et al., 2023b). This could limit the identification of critical insights from WE, e.g., in promoting micro-level research through targeted dissemination strategies, collaboration with international partners, and fostering dialogue within the BE.

Nevertheless, prominent authors and sources, such as *World Development,* are trying to explore and publish research on the intricate socioeconomic and institutional women's disempowerment landscape in vulnerable coastal settings, such as India. Journals with greater article count indicate a greater volume of research output, and thus, are more likely to cover a wide range of topics on women's issues, including gender intersectionality. This can create a new platform for emerging researchers to uncover or share new findings that are relevant in the discourse of holistic WE, especially in India. The increased visibility of research works in journals that specifically target gender perspectives, such as '*Feminist Economics*', '*Gender, Place, and Culture*', '*Equality, Diversity, and Inclusion*', '*Gender and Development*' among others underscores mushrooming interest to uncover complex gender perspectives, the interdisciplinary nature of WE, and social dynamics in understanding and addressing the challenges faced by coastal women, in sectors, such as fishing, health concerns, and financial inclusion. This could be leveraged at the institutional research and policy level to foster holistic approaches to understanding policy, research, and research implications of women's (ex)inclusion in BE sectors (Dana et al., 2023; Matovu et al., 2025; Enayati et al., 2024; Lukambagire et al., 2023). The predominant issues highlighted in the sources and keyword analyses, including the social, maternal health, environmental (climate change),

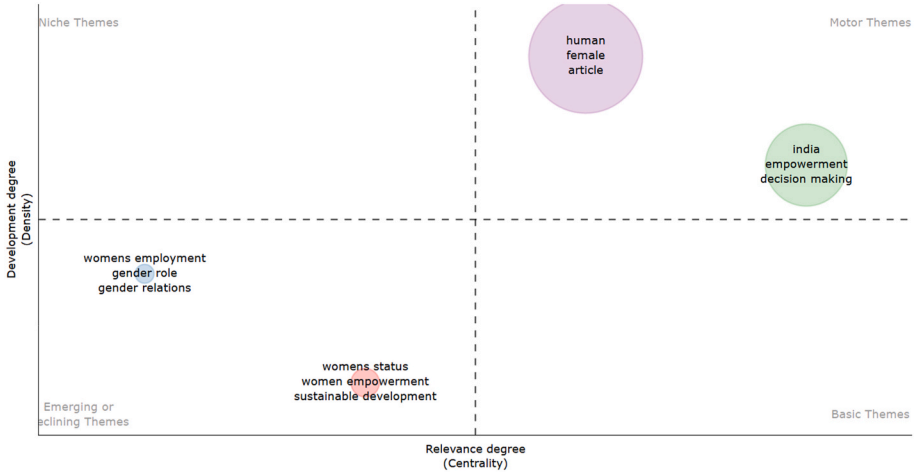

Fig. 12. Thematic mapping of the key themes and concepts on WE, employment, and leadership in the BE, based on the development and relevance degree (Source: Scopus/Biblioshiny).

and economic concerns among coastal women, are well documented in studies in West Bengal and vulnerable coastal regions. Recent studies have comparatively revealed that most coastal women experience acute socioecological vulnerabilities, including maternal health issues and economic/financial fragilities, that limit their ability to engage in several coastal activities (Dana et al., 2023; Gupta et al., 2020; V Perumal et al., 2016; Matovu et al., 2023b; Matovu et al., 2024e). These social health issues could be indicative of the socio-psychological violence that has gradually been experienced by coastal women in their pursuit of livelihood survival (Gupta et al., 2020; Hans, 2001; Ogden, 2017). Policymakers, practitioners, and researchers can draw upon the evidence and recommendations presented in these publications to develop more targeted and effective initiatives, such as financial literacy, and utilize the SHG model (Ghosh, 2011; Lubchenco and Haugan, 2022; FICCI; Matovu et al., 2024d; Matovu et al., 2025; Senthilkumar, 2022).

Most importantly, the documents and publications of prominent authors, such as Kumar S, emphasize the sourcing of evidence-based data to inform coastal women's empowerment avenues. Their collective efforts contribute to the diversity of perspectives and research methodologies that could be applied to understanding coastal women's challenges, including sociocultural attitudes and perceptions, and collaborative efforts toward WE in India (Lukambagire et al., 2023; Mahadevan, 2019; Matovu et al., 2023a; Matovu et al., 2024a). Crucially, most of their research advances the need to highlight structural and non-structural impediments to women's labor force participation, as recommended in several studies (Gupta et al., 2020; Hans, 2001; Ogden, 2017). Authors and national institutions, such as the University of Delhi, that have made significant contributions or have consistently published on gender-related topics could collaborate to strengthen research efforts and address coastal women's challenges more comprehensively. Collaborative study findings and evidence-based data can help identify emerging opportunities or threats to WE and how the disempowerment risks have gained traction or can be ameliorated (FICCI; Senthilkumar, 2022; Matovu et al., 2024a; Ghosh, 2011). As India advances strategies for BE inclusion, these scholarly insights are key to unlocking critical needs for women's empowerment in coastal activities, such as fishing (FICCI; Senthilkumar, 2022; Ghosh, 2011).

India's contribution and collaborations to/in the WE scholarship have increased. This suggests a growing interest and focus on coastal women's challenges within India, possibly driven by local research initiatives and funding. The increased scholarship and contribution of India can be attributed to the increased collaboration with other countries, such as the United States, Canada, Australia, the United Kingdom, and Japan. Critically, although still meager, collaborations are being developed among emerging economies grappling with challenges regarding increasing women's empowerment and engagement arenas in the blue economy, such as Bangladesh, South Africa, and the Philippines, among others. This commendable collaborative shift has been reported in sectors such as marine transport and shipping, as well as in regional security operations in the Indian Ocean Rim (FICCI; Senthilkumar, 2022; Ghosh, 2011). However, when a comparative synthesis is focused on the citation indicators and collaborative impact, MCPs are still few (by authors and at the cross-country level). To build a multi-country impact, there is a need for greater international collaboration and engagement in researching and addressing the coastal challenges women encounter. The urgent need for multi-country collaborative research (mostly led by the global south) is emphasized in recent studies on ocean sustainability, equity, and inclusion as a key conduit for sailing toward women's inclusion in crucial ocean sectors (Croft et al., 2024; Spalding et al., 2023).

Network analysis of key trends, themes, and concepts in the literature revealed promising indicators. Most literature underscores the need for understanding gender dimensions concerning WE and empowerment needs in vulnerable coastal states, such as West Bengal and Kerala. It is further emphasized that uncovering complex gender dimensions and emphasizing holistic empowerment are drivers for just transitions, sustainability, and sustainable development in the BE (Dana et al., 2023; Gupta et al., 2020; Partelow and Manlosa, 2023; Sathiadhas et al., 2009). The sustainable emphasis on gender issues in coastal areas is paramount to the understanding and addressing of challenges that have historically faced coastal women, using a gender-sensitive and human-centric perspective. In addition, social issues that impede women's inclusion (employment) in coastal sectors, such as maternal health and risks, are increasingly being researched (Dana et al., 2023; Gupta et al., 2020; Sathiadhas et al., 2009). This presents a novel research and policy arena to explore the social-psychological and structural issues that could have limited women's agency in engaging in challenging coastal activities, such as transport or fishing (Chhabra et al., 2022; Hamdani et al., 2023; Matovu et al., 2024b; Picciaia et al., 2023). Women's issues in coastal India encompass diverse interdisciplinary topics and socio-demographic dynamics (Matovu et al., 2024b; Matovu et al., 2024e). Analyzing the diverse keywords and themes could be harnessed as building blocks for understanding coastal community vulnerabilities and complex dynamics related to WE and other genders in marginalized coastal communities (Enayati et al., 2024; Lukambagire et al., 2023; Matovu et al., 2024a). This suggests that interventions should consider the specific socioeconomic factors that influence coastal women's (dis)empowerment, such as environmental livelihoods safeguard and socio-economic empowerment in vulnerable coastal zones,

Table 5
Summarized themes/narratives that highlight the diverse perceptions and attitudes reported in literature that inhibit or enable women's employment, leadership, and holistic WE in coastal activities/BE sectors of India (Source: Authors' development based on the synthesis of literature).

Description of a Perception/Attitude	Perception/Attitude indicator/effect (++ represents a positive or enabling WE avenue, and – shows a negative or inhibiting WE avenue)	Impacted BE Sector(s)	Women Empowerment Domain	Reference(s)
Women are fit for onshore coastal jobs	–	Fishing, Transport, Offshore Research	Social, Economic	(Dana et al., 2023; V Perumal et al., 2016; Ogden, 2017; Hans, 2001; Roy et al., 2022)
Social customs, values, and taboos are safeguarded when women are at home.	–	Fishing, tourism, and transport	Social, Psychological, Economic	(Matovu et al., 2024a; Dana et al., 2023; V Perumal et al., 2016; Ogden, 2017; Lukambagire et al., 2023; Hans, 2001; Roy et al., 2022)
Coastal unwritten laws are safeguarded through traditional role/ responsibility allocation	–	Fishing, Tourism, Mining, transport, and ocean governance	Social, Economic, Institutional, Environmental, Psychological	(Croft et al., 2024; Matovu et al., 2024b; Matovu et al., 2024d; Matovu et al., 2024e; Matovu et al., 2025; Mussi, 2019)
Women have less experience than men in BE activities	—	Transport, Mining, Ocean governance, Fishing	Social, Economic, Institutional, Psychological	(Matovu et al., 2024b; Matovu et al., 2024e; UNCTAD)
Women are more successful as housewives or in domestic work	–	Fishing, Transport, Tourism, Skills development	Social, Economic, Psychological	(Sathiadhas et al., 2009; Shyam and Rajamanickam, 2013; V Perumal et al., 2016; Ogden, 2017)
Women fear offshore jobs and cannot withstand psychosocial challenges	–	Deep-Sea Mining, Transport, Fishing, Ocean research,	Environmental, Social, Economic, Psychological	(Matovu et al., 2024b; Roy et al., 2022)
BE jobs are low-status for women's participation and leadership	–	Fishing, Mining. Beach Tourism, Small-Scale Manufacturing, Coastal farming	Economic, Social, Psychological, and Institutional leadership	(Kamberidou, 2013; Mahadevan, 2019)
Risky environmental conditions don't favor women such as monsoons and high sea waves	–	Tourism, Mining, Transport, governance,	Environmental, Economic, Social, Psychological	(Dana et al., 2023; V Perumal et al., 2016; Ogden, 2017; Hans, 2001; Roy et al., 2022)
Women lack the capital to run and manage complex BE value chains/ systems	–	Tourism, Fishing, Mining, Manufacturing, Research, Emerging technologies and energy	Economic, Social, Psychological, Institutional	(Matovu et al., 2024a; Dana et al., 2023; V Perumal et al., 2016; Ogden, 2017; Matovu et al., 2024c; Hans, 2001; Roy et al., 2022)
Women are invisible drivers of secondary value chains and environmental governance	++	Fishing, Manufacturing, Knowledge protection, Skills development, Coastal Protection, Tourism, Ports and Harbors	Economic, Social, Psychological, Institutional and Environmental Governance	(Sathiadhas et al., 2009; Shyam and Rajamanickam, 2013; V Perumal et al., 2016; Ogden, 2017)
Women have low levels of education, lower expectations, and training that fit the needed maritime leadership and skills/hi-tech BE jobs	–	Fishing, Transport, Mining, Research, Manufacturing, Coastal Governance, Maritime Security	Economic, Social, Psychological, Institutional and Environmental Governance	(Arulnayagam, 2020; Asian Development Bank and India, 2013)
Most BE jobs favor men and require masculinity and personality adjustments or traits e.g. simulated emotions	–	Transport, Mining, Fishing, Maritime security, Coastal Governance, Manufacturing	Economic, Social, Psychological, Institutional and Environmental Governance	Koshal et al. (2010).
Women's employment and leadership in offshore BE jobs build social bonds/reduce psychosocial stress	++	Ocean governance, Maritime Security, Transport, Shipping, Tourism, Ocean Research	Social, Psychological, Institutional, and Environmental Governance	(Koshal et al., 2010; Matovu et al., 2024b; Matovu et al., 2025).
Scaling up women in maritime leadership threatens cohesion, increases conflicts, competition (professional discriminations), economic systems, and established laws	–	Marine shipping and seafaring, Mining, Cruise ships	Social, Economic, Psychological, Institutional	(Matovu et al., 2024b; Naoum et al., 2019)
Women's employment increases socioeconomic costs e.g. maternity leaves, girl-child trafficking, and breaking of salary ceilings	–	Marine shipping and seafaring, Mining, Cruise ships, Manufacturing, Offshore research, Maritime Security, Commercial fishing	Social, Economic, Psychological, Institutional	(Lirola-Delgado, 2019; Matovu et al., 2024b; Matovu et al., 2024e)
Inflexible work schedules require masculinity, male leadership, and employment	–	Marine shipping and seafaring, Mining, Commercial tourism cruises, Manufacturing, Offshore research, Maritime Security, Commercial fishing	Social, Economic, Psychological, Institutional, Environmental	(Koshal et al., 2010; Matovu et al., 2024b).

(*continued on next page*)

Table 5 (*continued*)

Description of a Perception/Attitude	Perception/Attitude indicator/effect (++ represents a positive or enabling WE avenue, and – shows a negative or inhibiting WE avenue)	Impacted BE Sector(s)	Women Empowerment Domain	Reference(s)
Women are a good fit for cruise ships, in marketing, in historic and leisure lodgings, and in hotel management and leadership	++	Tourism, Recreation fishing, and Service sectors of the BE	Social, Economic, Institutional, Psychological	(Debnath et al., 2016; Ogden, 2017)
Profiling the diverse needs of women in BE jobs is hard (limited gender-disaggregated data)	–	Marine shipping and seafaring, Mining, Commercial tourism cruises, Manufacturing, Offshore research, Maritime Security, Commercial fishing, Governance	Social, Economic, Institutional, Psychological, Environmental	(Everett and Watson, 1998; Yusof et al., 2022).
Women's skills and Indigenous knowledge safeguard BE resources	++	Fishing, Tourism, Governance, Skills Development, Renewable Energy, Coastal Protection and Management, Social-cultural knowledge safeguards	Social, Economic, Institutional, Psychological, Environmental	Dana et al. (2023)
Women are required for moral and ethical reasons to achieve effective sustainability-focused ocean governance	++	Fishing, Mining, Marine Pollution, Transport, BE Accounting, Ocean Governance, Skills Development and Leadership	Social, Institutional, Psychological, Environmental	(Croft et al., 2024; World Bank)
Women's employment and leadership aid adherence to sustainable regulations and policies	++	Fishing, Mining, Marine Pollution, Transport, BE Accounting, Ocean Governance, Skills Development and Leadership, Maritime security	Economic, Social, Institutional, Psychological, Environmental	(Matovu et al., 2024d; Ogden, 2017)
Women's aid sustainable coastal livelihood welfare and collaborative advocacy	++	Fishing, Mining, Marine Pollution, Transport, BE Accounting, Ocean Governance, Skills Development and Leadership, Maritime Security, Tourism	Economic, Social, Institutional, Psychological, Environmental	(Matovu et al., 2025; Ogden, 2017)

such as Kerala (Matovu et al., 2023a; Matovu et al., 2024a; Matovu and Raimy, 2022). In this context, understanding the shifting socio-ecological dynamics in coastal zones, e.g., using comparative and controlled studies to provide evidence-based insights and solutions to address structural and non-structural impediments to women's inclusion (Chapman and Mishra, 2019; Jahiruddin et al., 2020; Mukhwana et al., 2020).

Most themes unravel WE, and gender empowerment is critical in women's employment and leadership discourse. In India, this could be a perpetual critical concern that requires immediate action and targeted policy interventions to improve outcomes for coastal women and break social-cultural stereotypes that stymie their participation in coastal activities, including marine shipping (Gekara and Sampson, 2021, p. 198; Guo and Liang, 2012; Matovu et al., 2024b). The growing volume of scholarly publications on coastal women's challenges in India indicates increased attention and interest in WE in the BE within the academic community (Chapman and Mishra, 2019; Matovu et al., 2024b; Matovu et al., 2024d; Matovu et al., 2025). This is indicative of a shift toward more evidence-based approaches to addressing the complex empowerment challenges faced by coastal women (IOC-UNESCO, 2020; FICCI; IRP; Mahadevan, 2019; Pande et al., 2018). This narrative reveals an increasing awareness of the interconnectedness between ocean sustainability, environmental health, and the well-being of coastal communities, including women, a key asset in amalgamating divergent ocean sustainability narratives (Datta and Roy, 2022; Lavadya et al., 2021; Lukambagire et al., 2023; Matovu et al., 2024a). The only concern is that only 2 and 1 percent of the research is targeting coastal areas' sustainability and gender intersectionality, especially in long-established BE sectors. Additionally, key themes on WE and gender issues are either less explored, declining, or less relevant in most research. This might lead to a limited understanding of the conceptual and practical needs of coastal women's employment, leadership, and holistic WE, needed to drive a sustainable BE (Dana et al., 2023; Enayati et al., 2024; Gupta et al., 2020; Matovu et al., 2024a; Sathiadhas et al., 2009). This perspective is highlighted in several studies and could affect gender-inclusive transitions in the BE, highlighting the urgency of understanding gender issues specific to India (Gupta et al., 2020; Hans, 2001; Ogden, 2017). Key themes are still broad, using terms such as 'sustainable development' and 'human', especially after the *Sagarmala* (Chopra). Recognizing the need for key concepts and themes, such as gender equality, women's equity, and WE, could help design targeted interventions for gender equity and inclusion in coastal activities such as fishing (Ocean Panel (High-Level Panel for a Sustainable Ocean Economy); Matovu et al., 2024a; Partelow and Manlosa, 2023; Enayati et al., 2024; Spalding et al., 2023; Fjærli et al., 2017). However, from the analysis, specific insights on the perceptions and attitudes toward women's employment and leadership have remained less clear. This might present a new area for future research, especially on WE in the BE.

The pedestrian inclusion of key WE concepts and themes in literature and policy is overtly visible, like in the perceptions and attitudes towards women's employment and leadership in the BE sectors (Matovu et al., 2024a; Matovu et al., 2024e). Although the perceptions and attitudes highlighted in Table 5 are not exhaustive, especially if we factor in the heterogeneity and diversity of communities and cultures in coastal zones, they are emblematic of key drivers that either negate or promote women's leadership and employment in ocean-based activities, notably in resource-hungry coastal zones, as reported in several studies (Brouwer et al., 2024; Hoegh-Guldberg and Northrop, 2023; IOC-UNESCO, 2022; UNEP FI; Lubchenco and Haugan, 2022; Matovu et al., 2024c). A critical understanding of how these perceptions have cascaded provides a critical contribution to future resource nexus perspectives and fluxes, especially in socio-economic and institutional ecologies of equity. These are key to understanding complexities in driving human-environmental (in)justice and gender (in)equalities in coastal zones and the BE (Brouwer et al., 2024; Matovu et al., 2024a).

Critically, the dominance of negative perceptions and attitudes, especially in traditional BE activities, such as fishing, further reinforces the unsustainable concerns highlighted in many studies that explored the causation of socioeconomic injustices and vulnerabilities among coastal women, especially in tropical regions (Pande et al., 2018;

Partelow et al., 2023a; Partelow et al., 2023b; Partelow and Manlosa, 2023). Although most negative stereotypes are based on myths and unwritten laws (thus subjective), most of them have become institutionalized as determinants of where women can be engaged in BE sectors. This is evident in the value chains of fishing and the marine seafaring profession (Ogden, 2017). This implies that positive perceptions, in recreation activities and services sectors, such as marine tourism and cruise ships, might not be reflective of the masculine interest in involving women in such sectors. Rather, they might be due to social and psychological sexism and stereotypes that women provide the best customer service and care. This is notably true, as even within sectors, such as tourism, key leadership or positions of influence are still dominated by men (UNWTOb). Thus, institutionalized positive attitudes with well-defined regulations are needed.

Nevertheless, realistic, transformational, and positive perceptions/attitudinal change in the historically conservative vulnerable regions is perpetually emerging (including within traditional or dominant BE sectors), albeit with slow progress. For instance, as reported in Mumbai's urban fishing village of Versova, positive perceptions of fisherwomen among the *Koli* household community group have emerged. This is due to the increasing contributions from women in supporting social-cultural and economic units, advocacy, strength, and financial independence (Debnath et al., 2016). These shining lights are further reported among coastal women in South India's coastal states, such as Kerala (Shyam and Rajamanickam, 2013), and in BE sectors, such as marine transport and shipping, tourism, marine research, and skills development (Gekara and Sampson, 2021, p. 198; Guo and Liang, 2012). These are crucial building blocks that need to be sustained or symbiotically tapped by key actors in realizing holistic WE and ocean sustainability (Farmery et al., 2021; Matovu et al., 2024d; Matovu et al., 2024e). As momentum for WE is stratospherically increasing in most coastal regions of India and vulnerable tropical regions are scything, an opportunity to kickstart engagement avenues, pathways, and mechanisms has emerged. As a critical contribution to this, in this paper, a pathway that integrates diverse theoretical and conceptual WE perspectives and frameworks is developed. This is succinctly highlighted in the next section.

5. Navigating through complex perceptions and attitudes in the BE to increase women's employment and leadership

Global and regional sustainability studies conceptualize and theorize that the bedrock towards sustainable livelihood and development futures is coiled around holistic individual, community, regional, and global empowerment. Conceptually, empowerment denotes promoting equity and equality of genders and societies in achieving better and sustainable livelihood and development outcomes. To advance this, several frameworks and approaches have been highlighted and recommended, such as the gender empowerment framework and sustainable livelihood framework, among others. In most of the empowerment frameworks, it is emphasized that WE is the cornerstone to kickstart sustainable transformations. This is partly due to the historical injustices that have boxed women from participating in diverse socioeconomic livelihood and development initiatives. Some of the comprehensive frameworks that explain the complexity of WE include the AWESOME and women empowerment frameworks (Gressel et al., 2020; Coley et al., 2022).

These studies reveal that WE is only achieved if a comprehensive focus on all empowerment spaces is identified, implemented, and sustained. However, as highlighted in sections 3 and 4, a complex and start-stop WE landscape is prevalent. For instance, most studies are intertwined with socioeconomic empowerment dimensions, such as financial literacy and economic support mechanisms. Critical WE aspects, such as psychological empowerment, are less explored (Coley et al., 2022; Croft et al., 2024; Gressel et al., 2020; Lubchenco and Haugan, 2022; Matovu et al., 2024b). Although progress towards WE in the BE has been pedestrian, better indicators (perceptions and attitudes) for WE are emerging (Croft et al., 2024; Lubchenco and Haugan, 2022). A critical question is, how can these positive perceptions be cemented, especially in long-established BE sectors, or whether in the future, systemic barriers might not re-emerge, as the level of women's engagement is still low, and institutional mechanisms for WE are not yet fully developed (Lubchenco and Haugan, 2022; Partelow and Manlosa, 2023; Partelow et al., 2023a; Partelow et al., 2023b; Pande et al., 2018; Koshal et al., 2010; World Bank; Hoegh-Guldberg and Northrop, 2023; Matovu et al., 2024d; Farmery et al., 2021; Bennett et al., 2019; Bennett, 2018; ILO; UN). To contribute to creating new avenues for untangling negative perceptions and attitudes as well as reinforcing positive ones, we developed the novel women empowerment pathway (WEP) (Fig. 13), contributing to *RQ4*. Designing the WEP, which depicts the principal WE dimension and its indicators, could help boost equity and holistic WE in the BE to prepare for a sustainable future.

In the WEP, we argue that holistic WE could only be achieved in a phased and continuous manner. Thus, five critical steps could be leveraged to increase women's inclusion and empowerment in the BE space. This perspective has been used in related contexts, especially among vulnerable coastal communities in the global south, albeit with less focus on women (Dana et al., 2023; Nuno et al., 2020; Wali et al., 2017). Thus, in this study, we amalgamate diverse insights to develop a holistic pathway based on key equity and ocean sustainability narratives. For each step, we further linked it to a WE component or domain, spatial-temporal scale, and the key indicator components that can be used to assess the level of WE, notably in the context of employment and leadership in the BE. This is because of the causation of historical and largely negative attitudes and perceptions that stymie inequalities denote a plethora of multi-faceted systemic barriers (Gupta et al., 2020). These can only be explored using a combination of evidence-based indicators, especially on the ramifications of the negativity in the BE sectors (Gupta et al., 2020).

5.1. Relevance and applicability of the WEP toward creating avenues for women's employment and leadership in the BE space

The proposed WEP is premised on the view that collaborative and participatory approaches hinged on lowering hierarchical and century-long barriers (negative socio-cultural, political/institutional, and economic stereotypes/attitudes/perceptions) to women's inclusion are key to navigating through the perception and attitudinal challenges women face in the BE (Croft et al., 2024; Ehler and Douvere, 2009; Matovu et al., 2025; Tabara et al., 2017; University and Douvere, 2010). This perspective mirrors participatory governance models, recommended in marine equity and environmental sustainability studies (Croft et al., 2024; Ehler and Douvere, 2009; Matovu et al., 2025; University and Douvere, 2010). This section succinctly delves deeper into this by combining a paucity of viewpoints, theories, and literature, e.g., in social, economic, environmental, and political domains, to promote a clear understanding of system dynamics to highlight leverage points that could be contextualized and embedded into the diverse social contexts to promote local-level, macro, and institutional coherence on WE across different patterns and vulnerable regions in the BE space (Simpson and Beeson, 2018; Tabara et al., 2017; Wali et al., 2017).

In complex human-environmental systems, inequalities stem from the limited consideration of how a given system interacts at both spatial and temporal levels, forming the basis for the exclusion of vulnerable communities (Nuno et al., 2020; World Ocean Review). With this hindsight, the proposed WEP contextualizes that the initial step in reversing systemic barriers to women's inclusion is system scoping and analysis, depending on the BE sector, community, or region. This is key in unearthing systemic barriers (both emerging and continuous), that stifle women's inclusion in some BE activities and the causal-effect relationships that scale up vulnerabilities at the individual, local, household, or community levels (Dana et al., 2023; Muthamilselvan et al.,

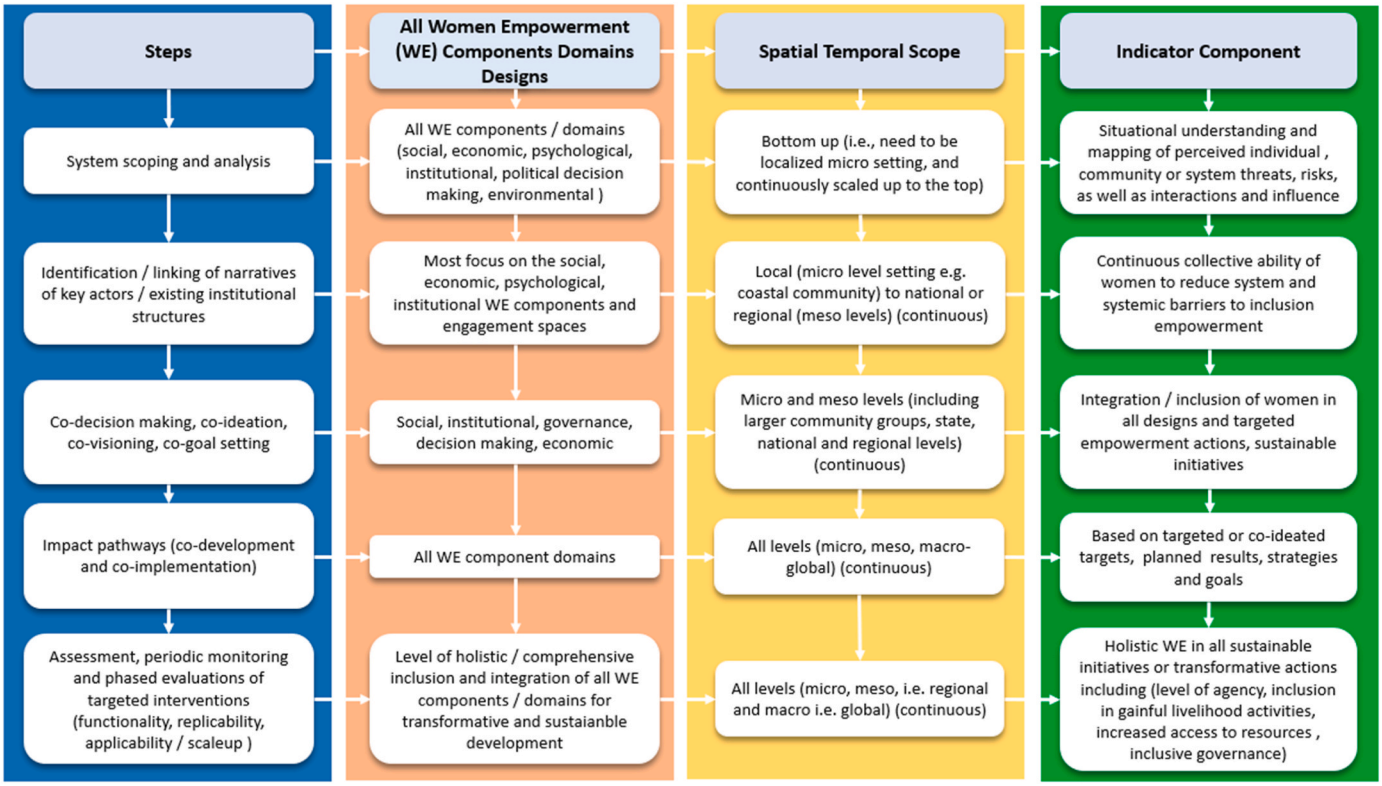

Fig. 13. The developed WEP, showing five key steps that could be undertaken to situate five WE components into complex micro-level settings to create transformative actions for women's empowerment (Authors' creation).

2016). This forms the basis for the identification of baseline indicators on perceptions and attitudes, including resistance factors and constraints, and how they interact (both positively and negatively). This perspective is supported by the socioecological approach to understanding the nexus of environmental-anthropogenic interactions and how social (in)equity mushrooms in ocean-based activities across vulnerable coastal zones (Bennett, 2019; Croft et al., 2024; Koehler, 2016; Matovu et al., 2024e). Since micro-level scoping embeds the component of local-level interactions, it is key to understanding and situating the four WE domains—psychological, political/institutional governance or leadership, economic, and social—in BE sectors in coastal zones (Coley et al., 2022; Nuno et al., 2020). This further creates continuous scaling-up avenues that open mental spaces, for instance, related to belief systems and norms that affect perceptions and attitudes toward women in the BE space (Hans, 2001). System scoping further enables the critical understanding of diverse perspectives and mapping of system interactions and influences, which eases the generation of acceptable pathways and scenario building for inclusion, for example, in fisheries and resource use (Freduah et al., 2019; Wali et al., 2017).

Step 2 envisions that understanding a system is crucial in the identification or linking of narrative networks of different actors in each coastal system/community (Bennett, 2019; Croft et al., 2024; Koehler, 2016; Matovu et al., 2024e). Studies have shown that coexistence and coproduction of values, such as those in participatory science, are bolstered or created via the use of narrative strategies developed by all actors (Simpson and Beeson, 2018; Techera, 2019). This is based on the critical understanding of traditional knowledge, amalgamating global scientific knowledge, and the creation of mutually constituted local input that is acceptable and produced by all actors in each society, community, or sector (Bennett, 2019; Yong, 2022). This approach has been applied (with innumerable successes) in the Pacific region, notably in SIDS, using a community characterization approach that created new alternatives to reverse dominant and exploitative powerful actors (Techera, 2019). This helped generate new policy morals, solutions, and localized governance networks to mitigate increasing environmental and human risks, notably, those related to climate change and its impact on vulnerable women (Nuno et al., 2020; Simpson and Beeson, 2018; Tran and Tortjada, 2022). In the context of applying the proposed WEP in diverse coastal communities, this could be key in increasing political, economic, and social spaces for women's inclusion in decision-making by allowing women to be collaborative agents in identifying systemic barriers and strategizing on the development of transformative constructions. The benefit of women as collaborative agents has been reported in Ghana among small-scale fishing (SSF) communities where the capacity of women for mobilization boosted adaptive actions (Denton, 2017; Stone, 2008). This importantly aligns with the seven livelihood capitals needed to reduce exposure units to climate and non-climatic stressors in vulnerable BE sectors, especially among fisherfolk communities, where most fisherwomen engage in fish activities, such as trading for their livelihood (Kidaha et al., 2017; Matovu et al., 2024a; Matovu et al., 2024c).

In addition, co-designing, ideation, and visioning are key in reducing system barriers (attitudes and perceptions) to inclusion in the BE space (*step 3,* Fig. 13). Most systemic barriers have proliferated due to a lack of collaborative inclusion in co-designing (Nuno et al., 2020; Simpson and Beeson, 2018; Tran and Tortjada, 2022). In the worst-case scenarios, a lack of knowledge on how to create collaborative ideas to scale down inequalities balloons this, as most vulnerable people, e.g., coastal women, are knocked out in narrative constructions and access to environmental resources (Denton, 2017; Wali et al., 2017). This limits women's abilities to co-think and co-act for inclusion, thus creating inherent difficulties for different actors and stakeholders (at the micro, meso, and macro levels) to recognize and tap into the potential of women (Dana et al., 2023). This exfoliates key knowledge needed for understanding system indicators, e.g., those related to SDGs and sustainability (Hossain et al., 2020). These further limit the creation of normative scenarios for even survivability as well as the ability to develop interconnected and multiplicative disruptive actions that open

space for the participatory integration of concrete ideas and interventions based on shared knowledge and understanding (Tabara et al., 2017). The effects of a lack of co-designing in ideation have been well documented in several areas, such as in Spain, where environmental risks are exacerbated at all levels with less collaboration in developing robust communication and inclusive pathways such as the polluter-pays principle (Paschen and Ishon, 2014; Tabara et al., 2017). This partly explains a caveat and recommendation in the WEP that to attain transformative narratives, an indicator pathway for co-design needs to be inclusive focusing on co-designing BE actions. Additionally, the development of women-specific or inclusive actions based on their abilities, capacity, and potential in BE activities, such as clam fishing in the coastal backwaters, kickstarts better WE indicators (Lavadya et al., 2021), (Datta and Roy, 2022).

Mostly, the sustainability of BE activities (irrespective of *step 3,* Fig. 12) is correlated with the development of feasible impact pathways with clear indicators or targets that integrate global, regional, national, and local targets, e.g., those related to the SDGs (IOC-UNESCO, 2020; IRP). To increase women's employment and leadership spaces, we argue that this could be focused on all the WE components. As pointed out by Gressel et al. (Gressel et al., 2020) and supported by Coley et al. (Coley et al., 2022), the critical identification of impact pathways (*step 4,* Fig. 13), is key in identifying constraints to attaining higher levels of empowerment and assessing the effect of external interventions before evaluating the efficacy of a given WE intervention. In the BE space, this is paramount in developing community-centric transformative processes that articulate common visions and help in the determination of the level of progress or needed alternatives to increase WE (Gruby and Campbell, 2013). This further helps identify persistent discriminatory dimensions, such as low-high sustainability and low-high inequality (Tabara et al., 2017). This partly explains why, in the WEP, we highlighted the need for result-oriented indicators with a crisp strategy and goals. This perspective is supported by findings in a study conducted in Indonesia that guides simplistic guidelines for the identification of sustainability targets (Techera, 2019). The creation of simple measurement indicators for creating hybrid forms of transboundary empowerment mechanisms, with a focus on addressing regulatory governance gaps, creates avenues for equitable sharing and distribution of BE resources (Miller et al., 2022). It also ushers in positive waves related to the creation of transboundary environmental publics and nested collaboration and environmental governance for women, as reported in Cambodia and Vietnam (Wyborn and Bixler, 2013; Yong, 2022).

In the WEP, the need for continuous evaluation via the functionality or applicability of the narratives and ideas developed for WE is acknowledged (*step 5,* Fig. 13). This is because the WEP is aimed at addressing complex human-environmental issues in complex zones dotted with cascading challenges at the micro-level coastal zones, a crucial component in understanding complex systems (Hossain et al., 2020; Matovu et al., 2024c; Simpson and Beeson, 2018). As observed by a study in the Mekong region of Vietnam, responding to historical and continuously emerging negative attitudes and perceptions in the BE requires the envisioning of robust tools for assessing sustainability and equity targets (Tran and Tortjada, 2022). This should be on developing hybrid monitoring tools for both human and BE systems (Miller et al., 2022) or on understanding all levels of interactions, especially at local levels, that influence attitudes and perceptions and address the adaptive capacity of women (Freduah et al., 2019). This approach correlates with the 'general empowerment' perspective advocated for leveraging perceived social actor interactions and power dynamics to integrate sustainable and new actions for marine resource use and management (Nuno et al., 2020). The general empowerment approach is further supported by studies by Gressel et al. (Gressel et al., 2020) and Deshmukh-Ranadive (Deshmukh-Ranadive, 2006). These are crucial in boosting psychological (mental) empowerment, which is the catalyst for creating women's opportunities, livelihood diversity, and security, as well as increased participation in governance, collaboration, control, choices, and action concerning activities that boost sustainable livelihoods and environmental governance (Dana et al., 2023; Nuno et al., 2020; Tabara et al., 2017).

The recognition and acknowledgment of WE indicate that a focus on holistic empowerment promotes transdisciplinary sustainability via the facilitation of diverse perspectives that challenge dominant paradigms (Borges et al., 2020). This is supported by the cultural dimensions' theory of Dutch cultural scientist and social psychologist Geert Hofstede (Croft et al., 2024; Hofstede, 1980), as well as ocean conflict theories and ocean conflict drivers (Croft et al., 2024). Most of these paradigms emphasize a focus on a typology of logical reasoning aspects: (i) deduction, (ii) induction, and (iii) abduction in the ocean space (Croft et al., 2024; Hofstede, 1980). Abduction enables the extension of a theory structure toward a new understanding of how to include women in BE activities as well as negotiate traditional and emerging ocean conflicts (Orr and Hauser, 2008). Hofstede argued that women's integration in ocean activities is key to reducing inequalities and recommended six categories of synergies that could be key in navigating through such conflicts in social systems, namely, the power distance index, uncertainty avoidance index, individualism versus collectivism dimension, femininity versus masculinity, long-term versus short-term orientation, and indulgence versus restraint (Hofstede; Hofstede and Minkov, 2010). Since the WEP is focused on redressing gender inequalities in India and the vulnerable coastal zones (with complex cultural dynamics and dimensions), we tried to localize Hofstede's view(s) based on local women's capabilities and capacities. This conforms to the new perspective on ocean sustainability that advocates for the use of system conflicts (historical and emerging) as tools for transformative innovations (IOC-UNESCO, 2020).

The benefits of this new paradigm have been reported among coastal communities on Moheshkhali Island in Bangladesh, northern Brazil, and around the Torres Strait among Indigenous communities in Australia and Papua New Guinea under the NO-CRISES projects (Aswani et al., 2017; Borges et al., 2020; Busilacchi et al., 2018). In these projects, participatory approaches and synergies proposed or that could be situated under the WEP are emphasized, and these could be translated into local contexts (Government of India, 2020b; Song et al., 2024). In India, for instance, this can be done by adopting or using tools, such as governance mapping, net mapping, cultural consensus analysis, and creative practices interventions to create experiences for women to express their pain points (inhibitors, and complex issues affecting their inclusion), experiences, and collaborative perspectives on equity in the BE (Atmanand et al., 2019; Borges et al., 2020). This helps cement the possible feasibility or applicability of the WEP, especially in creating a system agency related to resource and knowledge asymmetries that spur social inclusion (Aswani et al., 2017; Busilacchi et al., 2018; Dutra et al., 2019). This creates enabling pathways based on resource conflict themes and system understanding to develop women-led *'blue squares'* that integrate marine resource management with livelihood empowerment (Borges et al., 2020). Women-led coastal governance perspectives can be harnessed in highly vulnerable coastal states of India, such as West Bengal, and among tribal communities. Coastal women's stewardship helps tap the traditional knowledge of women, e.g., in stitching, embroidery, and clam picking (Croft et al., 2024; Hossain et al., 2020; Pranajaya et al., 2024). The inclusion and participation of women in coastal activities could be a conduit for increasing women's revenue, initiating SHGs, mindset change, and reducing over-dependence on government support schemes, such as the Mahatma Gandhi National Rural Employment Guarantee Scheme (MNREGS) (Gupta et al., 2020). System understanding and evaluation further integrate the dynamics of socio-ecological contexts. A focus on transdisciplinary sustainability and the resilience analysis of social systems breaks perceptions and attitudes that block women's engagement in the BE (Croft et al., 2024; Hossain et al., 2020; Pranajaya et al., 2024). The insights in the WEP are increasingly emphasized and embedded into regional policy discourse, especially under the 2023 Zanzibar Consensus, which, among others,

calls for leveraging the benefits of ocean space and opportunities via inclusion and equity, especially in the Indian Ocean region (World Ocean Assessment; Zanzibar Consensus).

6. Conclusion

The study findings sourced from the literature highlight critical insights concerning the plight of women's employment and leadership in the BE sectors in India, and these could signify the cries facing coastal women in other coastal regions or communities. The BE endowments and sizeable coastal population are key starting points that could promote equity, fair labor participation, and leadership in the BE and national development. However, complex policy and scholarly challenges to help understand how women can participate in the BE are prevalent. First, although research on the BE has increased, recently, gender-focused research to explicitly capture women (dis)empowerment issues in the BE has plummeted. Additionally, the average citation of research on WE in the BE is low. The publications focusing on coastal women's issues are published in low-impact journals. Although the dominant authors publishing research on women/equity issues on the BE have gained more total citations, most local authors' impact is low. This is partly due to publication in a few top journals focusing on marine or gender-related studies. MCPs are generally low, and this could affect the generation of regional perspectives for a sustainable BE. Research specifically targeting coastal WE is limited. In most regions, historical gender stereotypes and negative attitudes are critical in determining women's employment and leadership in BE sectors. Although employment opportunities are enormous in long-established sectors, social sexism on gender roles persists. A loop-sided focus on socioeconomic WE dimensions, rather than holistic WE, is reported. Key themes on WE, such as gender intersectionality, women's studies, and community participation, are not central in policy and scholarly literature. This might affect chances for women's employment/leadership in emerging BE sectors.

Nevertheless, positive indicators are emerging. Institutional mechanisms, targeting inclusiveness, WE, and gender empowerment in the BE are being streamlined. Additionally, institutional funding and international collaborations for a sustainable BE are increasing. Dominant authors are documenting the need for an inclusive BE. This has led to increased gender-focused research, capturing socio-demographic vulnerabilities. The recognition of WE as critical for a sustainable BE has increased interest in understanding diverse and complex interdisciplinary issues. Dominant positive indicators for women's employment/leadership are evident in the BE service sectors. But most of these indicators have hardly translated into holistic WE. Creating community engagement initiatives, shared/equal opportunities, and developing simplistic and targeted WE pathways could help understand how better WE chances can be created in the BE. The WEP (comprising five steps) has been developed to act as a guideline for increasing and cementing chances for women's employment and leadership in the BE in India and other regions. Based on the WEP, we argue that holistic WE could only be achieved in a phased and continuous manner. Increased focus on evidence-based comparative and controlled studies across coastal states and regions can help understand the diverse social, economic, environmental, and institutional challenges that either (de)increase chances for women's employment and leadership in the BE. This can increase our understanding of how holistic WE in the BE can be achieved. Since the study solely reviewed and mostly utilized a bibliometric analysis of 1768 articles, we might have missed out on new grounded evidence perspectives and micro-level emerging narratives of change towards women's employment and leadership in coastal communities, especially those reported from vulnerable coastal communities. Future studies can leverage some of the ideas embedded in the WEP, especially in *Step 1*, to conduct participatory evidence-based research among coastal women. In India and other vulnerable coastal regions, this should begin by redefining what WE in the BE must entail. This can help generate micro-level vulnerabilities, viable WE opportunities, and holistic inclusion mechanisms that could be replicable and sustainable.

Data availability statement

The data that supports the findings of this study are available in the supplementary materialof this article.

Ethics statement

Ethical approval is not applicable to this manuscript.

Funding statement

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Declaration of the use of AI assisted technologies

The authors declare that during the preparation of this work, no AI tools or techniques were used.

CRediT authorship contribution statement

Baker Matovu: Writing – review & editing, Writing – original draft, Visualization, Validation, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Raimund Bleischwitz:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Funding acquisition. **Isaac Lukambagire:** Writing – review & editing, Writing – original draft, Visualization, Software, Methodology. **Meltem Alkoyak-Yildiz:** Writing – review & editing, Writing – original draft, Validation, Supervision, Project administration, Investigation. **Rashed Tarek:** Writing – review & editing, Writing – original draft, Validation, Supervision, Resources, Project administration, Funding acquisition. **LindaA. Etta:** Writing – review & editing, Writing – original draft, Validation, Software, Resources, Funding acquisition. **Ming-An Lee:** Writing – review & editing, Writing – original draft, Validation, Resources, Project administration, Funding acquisition. **Mubarak Mammel:** Writing – review & editing, Writing – original draft, Software, Resources, Project administration, Investigation, Funding acquisition. **Yu-Ling Hsieh:** Writing – review & editing, Writing – original draft, Validation, Resources, Funding acquisition.

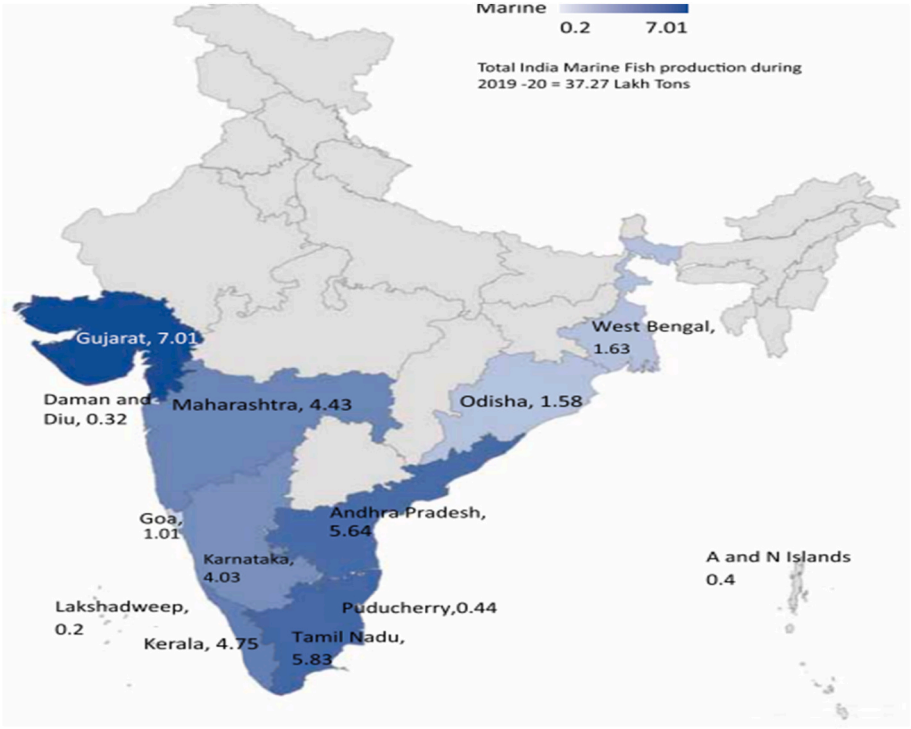
Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

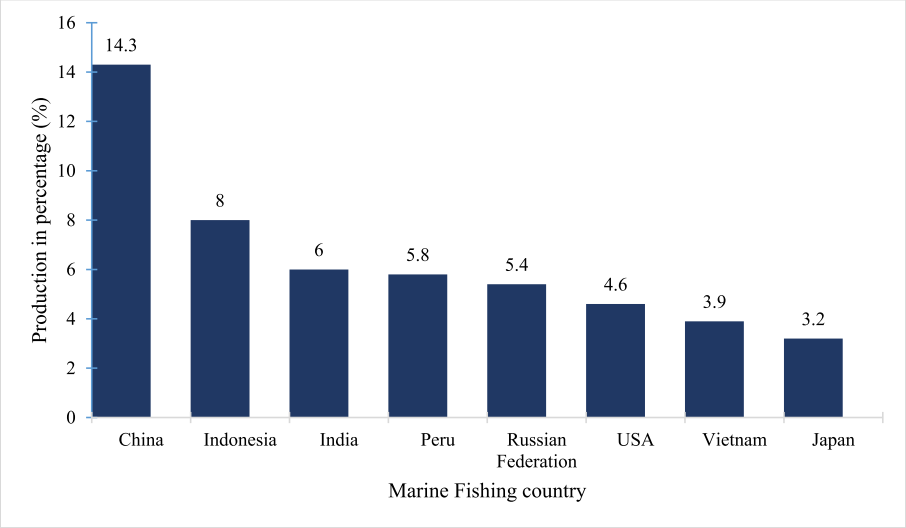
Appendix 1. Extent of India's Ocean Space and the BE resources (Sourced from Government of India, Ministry of Earth Sciences, 2021)

Description	Coverage/statistics	Description	Coverage/statistic
Exclusive Economic Zone (EEZ)	2.31 million km^2.	Major estuaries	97
Coastal length	7,516,6 kms	Mangrove area	6740 km^2
Major ports	12	Marine fishing villages	3288
Non-major ports	187	Fisherfolk population	4 million
Number of Islands	1208	Total number of dams	4862
Coastal population	171 million	Rivers & canals area	195,095
Coastal wetlands	43,230 km^2	Total reservoir area	29.26 lakh hectares.
Major lagoons	34	Total area of tanks & ponds	24.40 lakh hectares
Amount of international trade volumes handled by ports	95 %	Value of trade volumes handled by ports	70 %

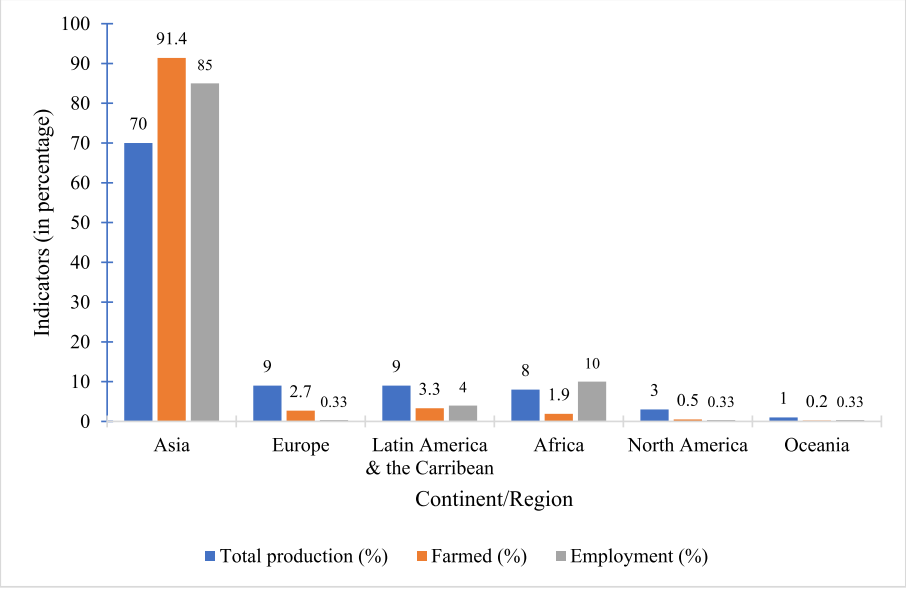
Appendix 2. Fish Production in India's Coastal States and Union Territories between 2019 and 2020 (Source: Government of India, Handbook of Fisheries Statistics, 2020)



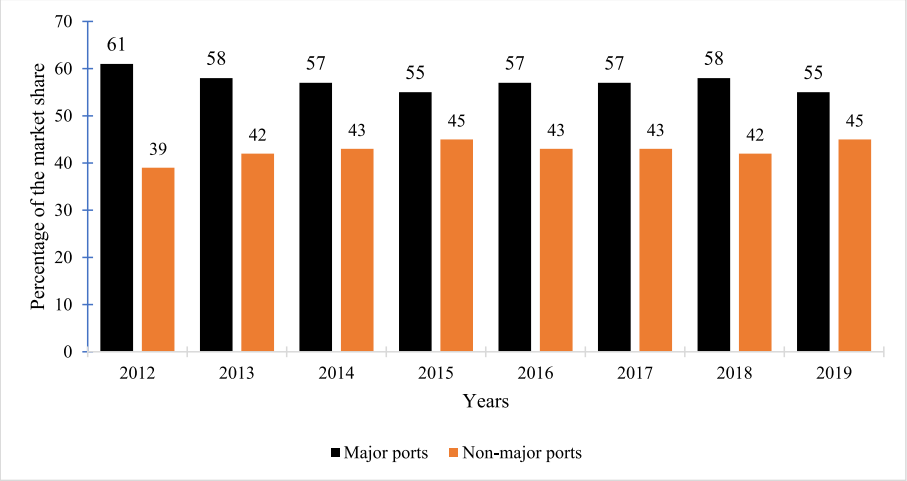
Appendix 3. The major marine capture fish-producing countries (Capture production in 2022 was 92.3 million tonnes) (Data Sourced from FAO, 2024 and modified by Authors)



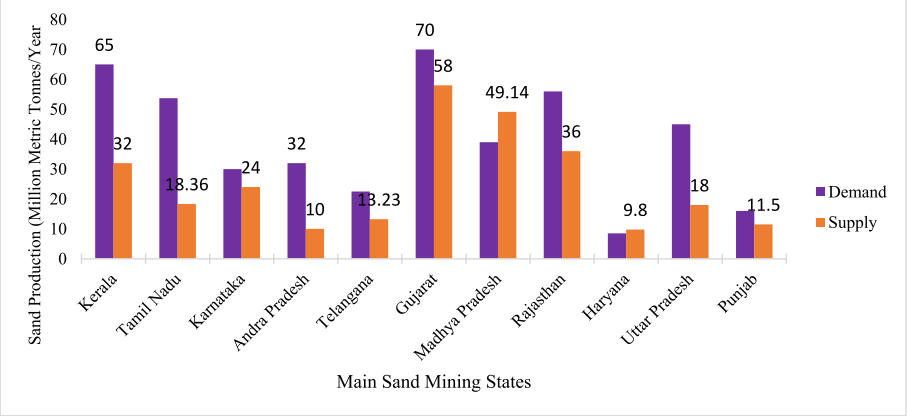
Appendix 3a. Comparative marine fisheries indicators (production and employment) across regions (Source: FAO, 2024)



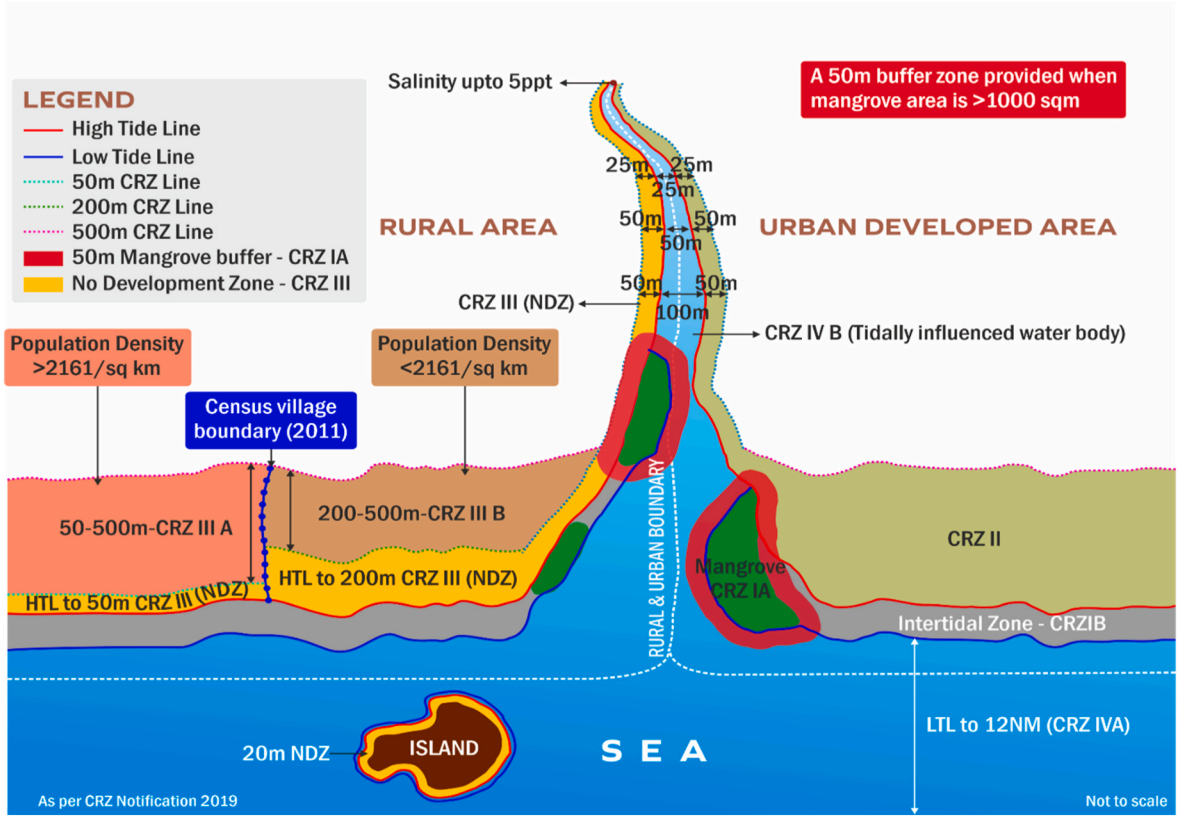
Appendix 4. Market share of India Ports (2012–2019) (Source: Government of India, Ministry of Ports, Shipping, and Waterways Annual report, 2021)



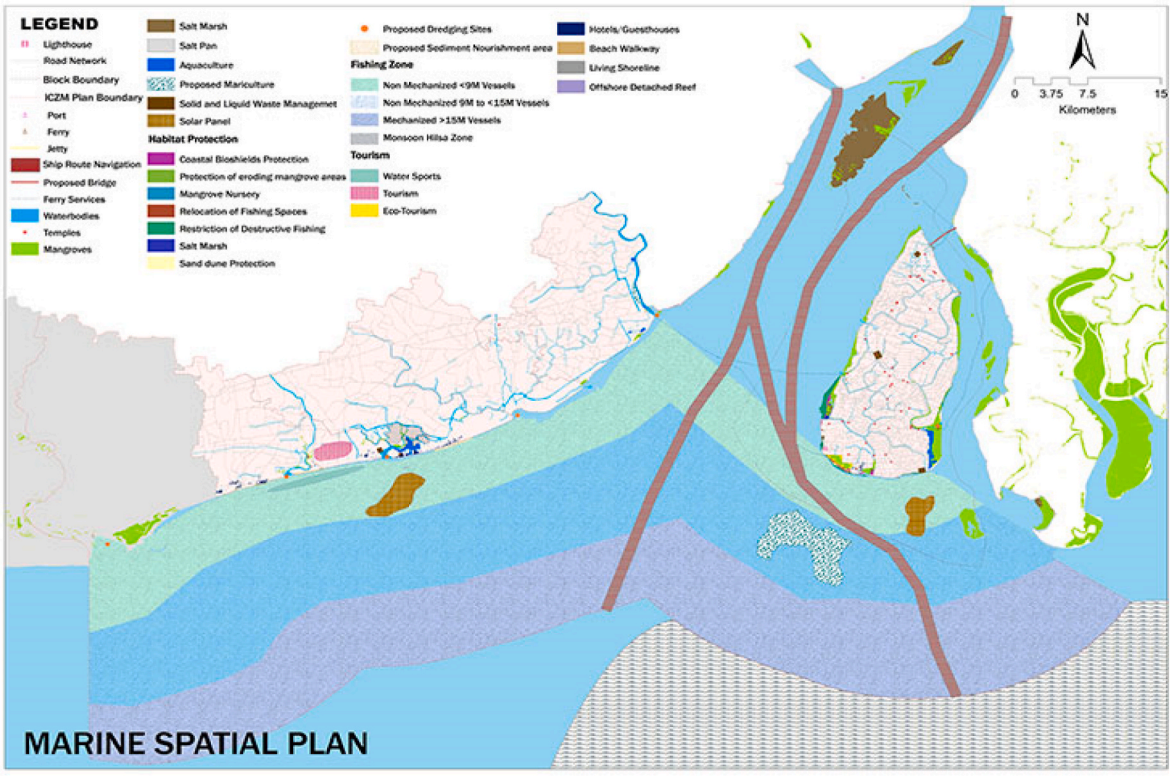
Appendix 5. Sand Trade Demand and Supply in Selected States of India (Sourced from Mahadevan, 2019 and modified by the Authors)



Appendix 6. Coastal Zone Management Plan for India (www.czmp.ncscm.res.in)



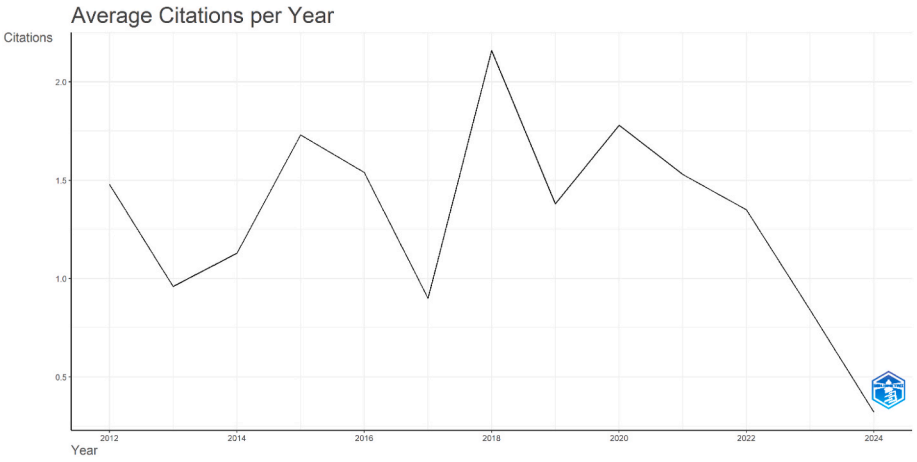
Appendix 7. Draft India's National Marine Spatial Plan



Appendix 8. Total Employees in Tourism Industries by 2019 (Source: UNWTO, 2023)

Country	Employees (in 000s)	Latest data	Country	Employees (in 000s)	Latest data
India	29,683	2020	Brazil	2192	2019
Japan	5889	2019	Mexico	2006	2020
The Philippines	4895	2021	Egypt	1993	2015
Thailand	4258	2016	Turkey	1437	2021
United States	3887	2020	Fance	1340	2020
Malaysia	3520	2021	Russia	1338	2015
United Kingdom	2743	2016	Argentina	1260	2019
Indonesia	2565	2020	Uganda	1173	2015
Spain	2368	2021	Saudi Arabia	820	2021

Appendix 9. Average citations per year for the sourced documents (2012–2024) (Source: Authors' analysis of sourced data using the bibliometric technique)

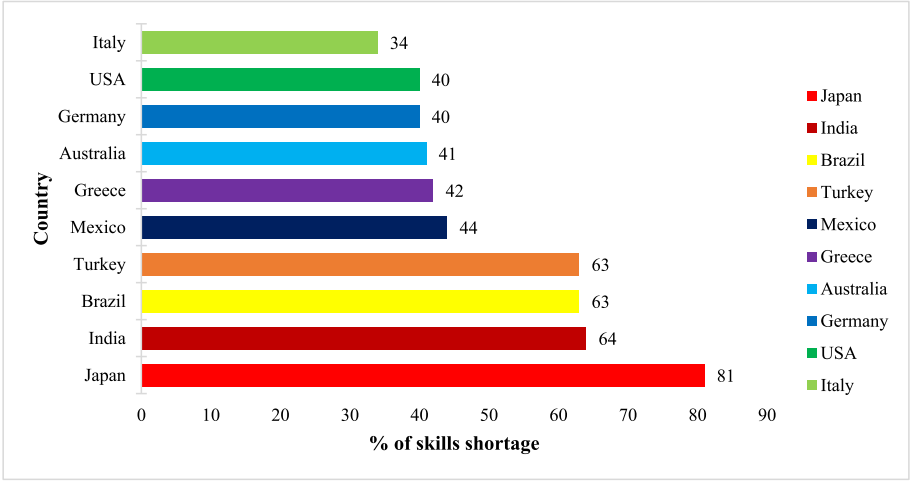


Appendix 10. Gender disaggregation data on labor force participation in the marine fishing sector in India (Source: Government of India, Handbook of Fisheries Statistics, 2020)

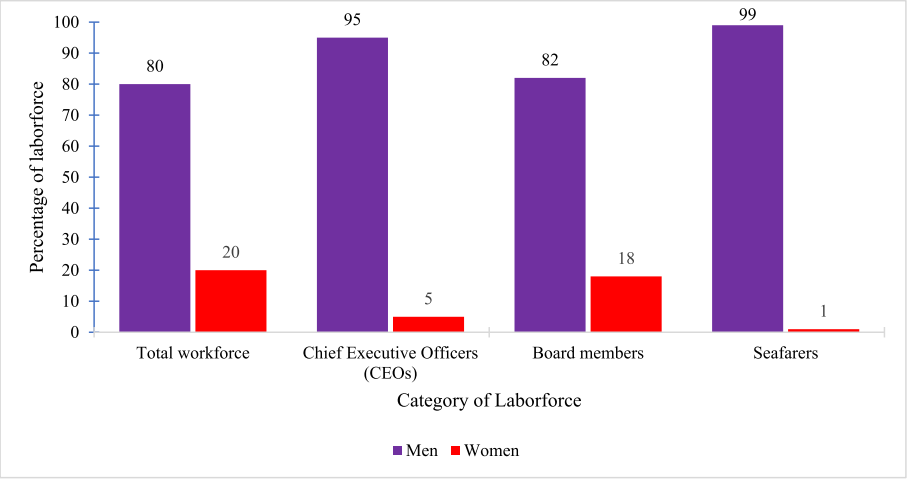
State/Union Territory	Labor force participation category									
	Deep Sea		Full time		Part-time		Occasional		Unspecified	
	Male	Female	Male	Female	Male	Female	Male	Female	Male	Female
Andaman &Nicobar Islands	NA	NA	13,369	112	1058	300	NA	NA	NA	NA
Gujarat	NA	NA	71,777	36,840	19,348	12,362	NA	NA	NA	NA
Karnataka	21,388	NA	56,871	43,030	55,599	39,662	5973	3684	57,139	44,655
Kerala	NA	NA	295,787	255,502	27,178	23,477	NA	NA	NA	NA
Maharashtra	10,913	NA	91,766	34,948	29,262	38,761	20,539	20,343	3318	9954
Tamil Nadu	25,000	NA	208,201	NA	24,253	201,286	12,815	17,645	65,170	248,663
Daman and Diu	NA	NA	6553	NA	82	NA	60	NA	NA	NA
Lakshadweep	NA	NA	2348	NA	2134	562	1380	NA	NA	NA
Puducherry	15,084	25	24,534	11,915	6234	4310	1000	800	2814	10,056
All India	**72,410**		**1,153,553**		**485,306**		**84,801**		**441,769**	

*NA denotes data not available.

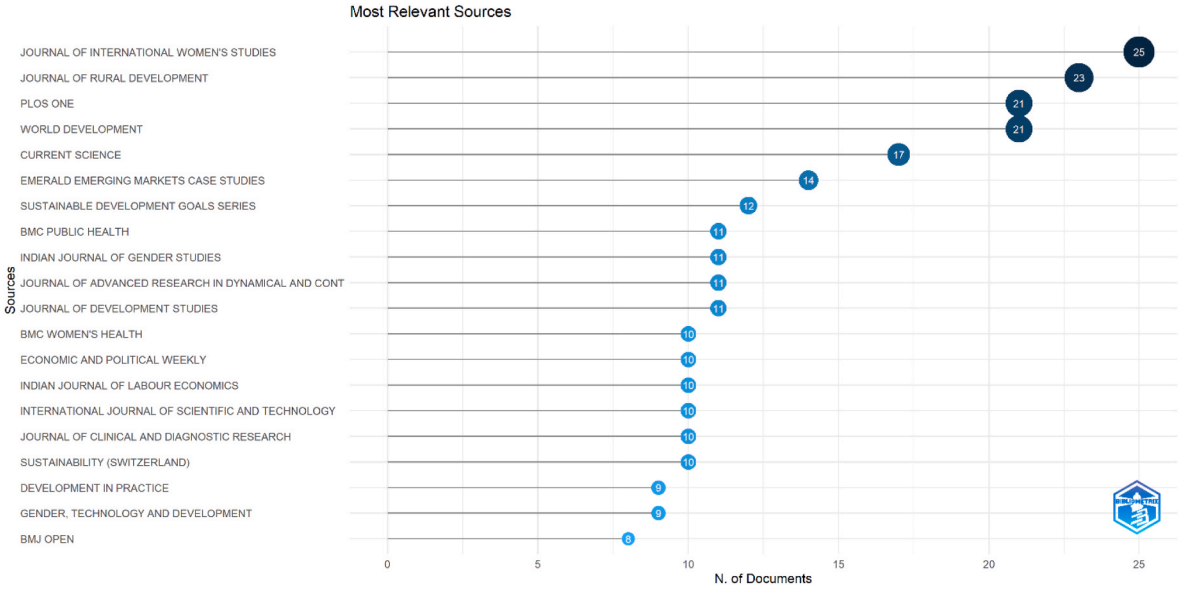
Appendix 11. Ranking of countries with skills shortage as a percentage of firms with 10 or more employees (https://doi.org/10.1787/9789264252073-en)



Appendix 12. Gender labor force participation in the maritime transport and shipping sector of India (Source: Matovu et al., 2024- https://doi.org/10.1007/s10668-024-05786-w)



Appendix 13. Most relevant journals publishing works on women's employment and leadership in the BE of India in 2024 (Source: Authors' analysis of sourced data using the bibliometric technique)



Appendix 14. Collaboration networks between India and other countries, including the number of collaborations (Source: Authors' analysis of sourced data using the bibliometric technique)

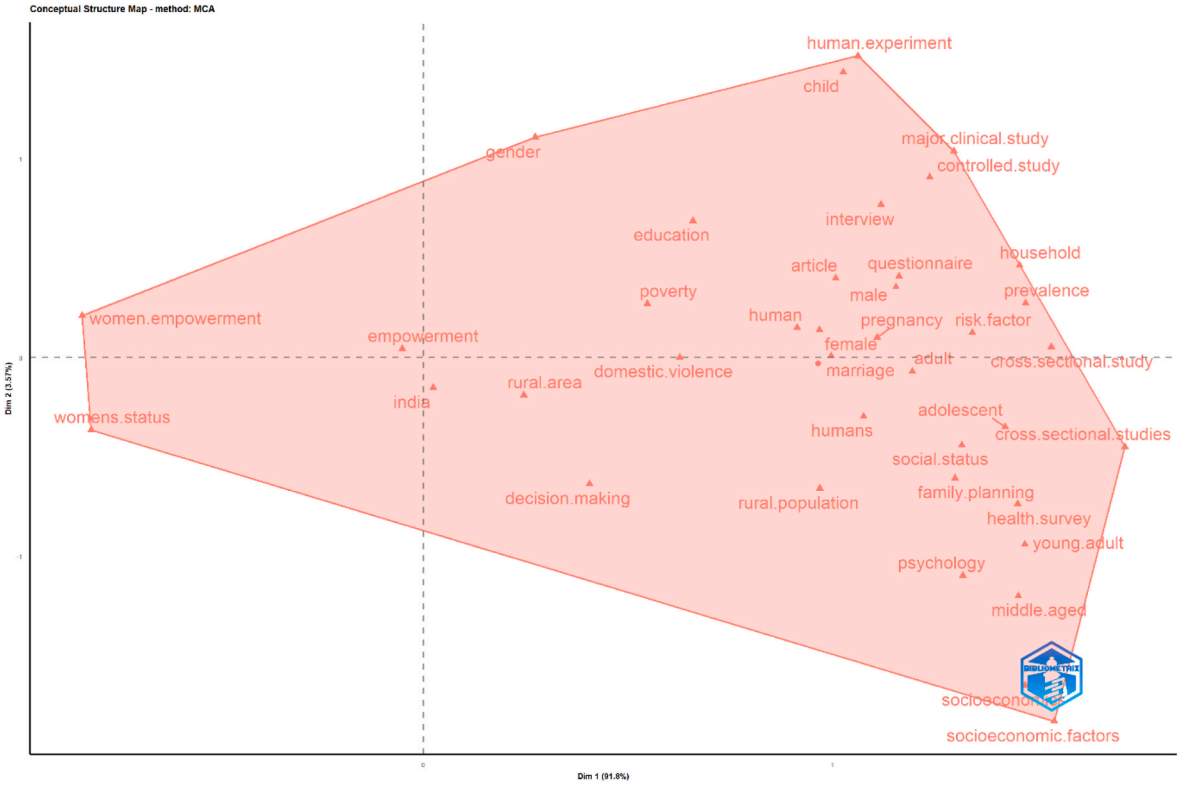
Main country	Collaborating country	Number of collaborations	Main country	Collaborating country	Number of collaborations
India	United Kingdom	46	India	Hong Kong	1
India	USA	100	India	Iran	2
India	Sweden	6	India	Ireland	2
India	Malaysia	9	India	Italy	4
India	Mexico	4	India	Japan	6
India	Netherlands	5	India	Kazakhstan	1
India	Nigeria	1	India	Kenya	4
India	Norway	7	India	Korea	2
India	Oman	5	India	Lebanon	2

(*continued on next page*)

(*continued*)

Main country	Collaborating country	Number of collaborations	Main country	Collaborating country	Number of collaborations
India	Pakistan	1	India	Malawi	1
India	Peru	3	India	Turkey	1
India	Philippines	2	India	Uganda	2
India	Poland	5	India	United Arab Emirates	2
India	France	6	India	Ghana	2
India	Germany	11			

Appendix 15. Conceptual mapping of the closeness and betweenness of key concepts on WE, employment, and leadership in the BE using the factorial approach (Source: Authors' analysis of sourced data using the bibliometric technique)



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