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Contributions and significance of women professionals in maritime clusters

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Abstract

Maritime clusters, encompassing industries like shipping, logistics, and marine energy, are pivotal to global economic growth. Despite their contributions, women remain underrepresented in these sectors, holding less than 5% of leadership roles and only 1% of seafaring positions globally. This paper examines the contributions of women in maritime clusters, exploring their roles in governance, sustainability, and innovation. Drawing on global case studies from Norway, Japan, and Singapore, the study highlights strategies for advancing gender equity through the Gender-Responsive Maritime Strategies (GReMS) framework. By integrating inclusivity policies and leveraging digitalization, the maritime sector can unlock significant economic potential, aligning with United Nations Sustainable Development Goal 5 (gender equality) and the global transition to Industry 5.0.

Keywords: Industry 5.0; Innovation; Gender equality; Gender-responsive policies; Maritime clusters; Sustainability; Women in leadership

1. Introduction

Maritime clusters as the geographic concentrations of interconnected industries such as shipping, shipbuilding, logistics, and marine energy serve as engines of innovation and economic growth. However, systemic gender disparities persist, marginalizing women and underutilizing their potential. Globally, women make up less than 2% of the seafarer workforce (BIMCO & ICS, 2021). Although the number of female STCW-certified seafarers has increased significantly, women remain underrepresented in the industry.

This paper explores the global contributions and significance of women in maritime clusters, emphasizing their roles in fostering governance, innovation, and sustainability. It discusses barriers to inclusion, analyzes case studies, and proposes strategies to integrate women into leadership and operational roles, fostering inclusive growth.

2. Methodology

The research adopts a mixed-methods approach to comprehensively analyze the roles, contributions, and challenges of women professionals in maritime clusters. The key components of the methodology adopted were literature review, Rapid Integrated Assessment (RIA), qualitative analysis, and quantitative data analysis.

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3. Material and methods

3.1. Women's Contribution

Women's contributions in maritime clusters, often overlooked, significantly impact economic growth and sustainability by enhancing food security, income, and nutritional security. Their roles in processing, retail, and informal support activities are crucial for the livelihoods of coastal communities. Their contributions in maritime clusters significantly enhance the economic growth and sustainability of coastal communities.

Specifically, their involvement spans various sectors, including fisheries, marine tourism, and resource management, leading to improved resilience and innovation. This multifaceted participation not only supports local economies but also aligns with sustainable development goals (Harper et al., 2017).

They also contributed to improved governance. Women in leadership enhance decision-making processes, leading to better financial and governance outcomes (Hoobler et al., 2016). Additional contribution is on innovation and sustainability. Women-led initiatives have pioneered green technologies, such as hydrogen-powered vessels in Norway and wind-powered cargo ships in Denmark (Kitada et al., 2019).

3.1.1. Social Contributions

The most significant contribution is capacity building. Women's participation in coastal logistics projects, particularly in developing regions like the Philippines, has empowered communities and reduced economic disparities (Arulnayagam, 2020).

Moreover, they also contributed to education and mentorship. Initiatives in Singapore, such as mentorship programs, have nurtured a pipeline of women leaders in logistics and operations (Reynolds, 2024).

3.1.2. Economic Contributions

Women play crucial roles in fisheries, often engaging in processing and marketing, which are vital for local economies (Harper et al., 2017). Women-led co-management enhances sustainable shellfisheries governance (Chuku et al., 2022).

In Sidoarjo, Indonesia, women's participation in fish processing reached up to 73.2%, contributing to product competitiveness and sustainability (Istiqomah, 2019).

In addition, marine tourism, driven by female entrepreneurship, diversifies income sources and promotes sustainable practices in coastal areas (Caamaño-Franco et al., 2021). The integration of gender equality in maritime planning can enhance community resilience and operational efficiency, fostering sustainable development (Kitada & Bhirugnath-Bhookhun, 2019).

Conversely, despite these contributions, women's roles in maritime sectors are often undervalued and overlooked, leading to a lack of recognition in decision-making processes. This disparity highlights the need for continued advocacy and policy reform to ensure equitable representation and support for women in maritime industries (Harper et al., 2017).

3.1.3. Social and Environmental Sustainability

Women's activities in coastal communities, such as those in Japan and Peru, demonstrate their ability to adapt and innovate in response to environmental changes (Delaney et al., 2019). They are also engaged in sustainable livelihoods in coastal areas that often rely on natural resources, such as fisheries and mangroves, which women actively manage and utilize (Kristiningrum et al., 2023; Setiani & Juanita, 2022).

3.2. Rapid Integrated Assessment

This part highlights the contributions of women in maritime clusters in Japan, Norway, and Singapore, aligned with UN Sustainable Development Goal 5 (Gender Equality). This assessment highlights the progress, challenges, and opportunities for women's empowerment in the maritime clusters of Japan, Norway, and Singapore. Despite varying degrees of advancement, these countries share common goals: increasing gender diversity, addressing disparities, and leveraging women's contributions to drive sustainable growth.

Table 1 Country Assessments*

Country	Current Status	Challenges	Initiatives	Recommendations
Japan	Women comprise 2% of Japan's maritime workforce, primarily in administrative roles.	Cultural barriers, limited career advancement opportunities, and lack of support systems.	The Japanese government's "Vision 2020" aims to increase female workforce participation. The Japan Shipping Exchange's diversity and inclusion initiatives. The Nippon Foundation's maritime education and training programs for women.	Encourage more women in leadership positions. Develop mentorship programs. Enhance work-life balance policies.
Norway	Women represent 22% of Norway's maritime workforce, with growing numbers in technical and management roles.	Retention rates, work-life balance, and unequal pay.	The Norwegian Shipping Association's diversity and inclusion strategy. The Ministry of Trade, Industry and Fisheries' women-in-maritime program. The Oslo School of Maritime Science's gender-balanced education.	Address pay gaps. Implement flexible work arrangements. Increase female representation in top management.
Singapore	Women make up 15% of Singapore's maritime workforce, with significant presence in management and technical roles.	Limited female representation in senior leadership, career progression hurdles.	The Maritime and Port Authority of Singapore's (MPA) women-in-maritime program. The Singapore Maritime Foundation's (SMF) diversity and inclusion initiatives. The Singapore Institute of International Affairs' (SIIA) research on women in maritime.	Develop leadership development programs. Foster industry-academia partnerships for women's training. Enhance family-friendly policies.

*Data Sources: World Bank. (2022); International Labor Organization (ILO) database; United Nations Educational, Scientific and Cultural Organization (UNESCO) (n.d.) UNESCO database. Retrieved November 2024.

Table 2 Regional Comparison*

Country	Female Workforce (%)	Leadership Roles (%)	Education/Training Programs	Policy Support
Japan	2	1	Limited	Emerging
Norway	22	15	Robust	Strong
Singapore	15	10	Developing	Growing

*Data Sources: World Bank. (2022); International Labor Organization (ILO) database; United Nations Educational, Scientific and Cultural Organization (UNESCO) (n.d.) UNESCO database. Retrieved November 2024.

Generally, to address the issues on three countries, the following actions are suggested:

- Increase female representation. Target 30% female workforce participation by 2030.
- Leadership development. Implement mentorship programs, training, and sponsorship.
- Address pay gaps. Conduct regular pay audits, ensure equal pay for equal work.
- Work-life balance. Implement flexible work arrangements, parental leave policies.
- Education and training. Develop industry-academia partnerships, scholarships for women.
- Policy support. Enact legislation promoting gender equality, anti-discrimination laws.

Consequently, the breakdown of how national maritime priorities for Norway, Japan and Singapore align with Sustainable Development Goal 5 (SDG 5) - Achieve gender equality and empower all women and girls is shown in Table 3.

Table 3 RIA Step 1. Mapping national maritime priorities to SDG 5

Country	Maritime Priority	SDG Alignment *	Initiatives
Norway **	Sustainable Ocean Management	Norway's focus on sustainable ocean management includes promoting gender equality in marine research and industries.	The Norwegian Government's "Ocean Strategy" (2017) emphasizes gender balance in marine research and education. The "Norwegian Directorate of Fisheries" promotes women's participation in fisheries management.
Japan***	Maritime Safety and Security	Japan aims to increase women's participation in the maritime sector, particularly in safety and security roles.	The "Japanese Ministry of Land, Infrastructure, Transport and Tourism" launched the "Maritime Women's Empowerment Program" (2020). The "Japan Coast Guard" actively recruits female officers.
Singapore****	Maritime Trade and Logistics	Singapore focuses on increasing women's participation in the maritime industry, particularly in leadership positions.	The "Singapore Maritime Foundation" launched the "Women in Maritime" initiative (2020) to promote gender diversity. The "Singapore Government's" "Maritime and Port Authority" offers scholarships and training programs for women.

Data Sources: * United Nations. (2020). Sustainable Development Goals. ** Norwegian Government. (2017). Ocean Strategy. *** Japanese Ministry of Land, Infrastructure, Transport and Tourism. (2020). Maritime Women's Empowerment Program. **** Singapore Maritime Foundation. (2020). Women in Maritime

3.3. Common Themes

- Workforce diversity. All three countries aim to increase women's participation in the maritime sector.
- Leadership development. Norway, Japan, and Singapore focus on promoting women to leadership positions.
- Education and training. Each country offers initiatives to support women's education and skills development in maritime fields.

Here is an analysis of the economic, environmental, and social dimensions of maritime strategies for Norway, Japan and Singapore.

Table 4 RIA Step 2. Analyzing economic, environmental, and social dimensions of maritime strategies to SDG 5

Country	Economic Dimensions*	Environmental Dimensions*	Social Dimensions*	Integrated Maritime Strategies**
Norway***	Maritime trade, offshore oil and gas, and shipbuilding drive Norway's economy.	Focus on reducing Greenhouse Gas (GHG) emissions, marine pollution, and promoting sustainable fisheries.	Emphasis on maritime safety, workforce diversity, and community engagement.	Norway's Ocean Strategy (2017): Balances economic growth, environmental sustainability, and social responsibility.
Japan****	Maritime trade, shipbuilding, and port management contribute significantly to Japan's GDP.	Emphasis on reducing marine pollution, promoting eco-friendly shipping, and conserving marine biodiversity.	Focus on maritime education, training, and promoting women's participation.	Japan's Maritime Strategy (2018): Integrates economic, environmental, and social aspects, focusing on innovation and international cooperation.

Singapore****	Maritime trade, shipping, and logistics hubs fuel Singapore's economic growth.	Implementation of green shipping practices, reducing marine litter, and promoting sustainable port operations.	Prioritizing seafarer welfare, maritime training, and community outreach.	Singapore's Maritime Singapore 2030 (2019): Aims to balance economic growth, environmental sustainability, and social responsibility.
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Data Sources: * United Nations Conference on Trade and Development (UNCTAD). (2020). Review of Maritime Transport. ** International Maritime Organization (IMO). (2020). Sustainable Development Goals. *** Norwegian Government. (2017). Ocean Strategy. **** Japanese Ministry of Land, Infrastructure, Transport and Tourism. (2018). Maritime Strategy. ***** Maritime and Port Authority of Singapore. (2019). Maritime Singapore 2030

3.4. RIA Step 3. Assessing the readiness of maritime clusters to integrate gender-responsive policies to SDG 5

Assessing the readiness of maritime clusters to integrate gender-responsive policies requires evaluating various factors. Here is a comprehensive framework.

3.4.1. Governance and Policy

- Existence of gender equality policies. Official documents supporting gender balance.
- Dedicated gender focal points. Designated personnel for gender-related issues.
- Gender-disaggregated data collection. Regular collection of gender-specific data.

3.4.2. Workforce and Employment

- Women's participation rates. Percentage of women in the workforce.
- Occupational segregation. Distribution of women across various maritime roles.
- Training and development opportunities. Availability of gender-neutral training programs.

3.4.3. Infrastructure and Facilities

- Gender-sensitive facilities. Availability of female-friendly amenities (e.g., restrooms, changing rooms).
- Accessibility and safety. Secure and accessible workplaces.

3.4.4. Culture and Social Norms

- Gender awareness and sensitivity training. Regular training programs.
- Male champion programs. Male advocates promoting gender equality.
- Women's networks and associations. Support groups for women.

3.4.5. Education and Training

- Gender-inclusive education. Maritime education programs promoting diversity.
- Scholarships and mentorship. Targeted support for women.
- Career guidance and counseling. Gender-neutral career advice.

3.4.6. Monitoring and Evaluation

- Gender-sensitive indicators. Tracking progress through gender-specific metrics.
- Regular assessments and surveys. Monitoring workforce perceptions.
- Corrective action plans. Addressing identified gaps.
- The Maritime Cluster Readiness Levels is categorized as follows:
 - Basic (0-20%): Limited gender-responsive policies.
 - Developing (21-40%): Some initiatives, but lacking comprehensive approach.
 - Advanced (41-60%): Established policies and programs.
 - Leading (61-80%): Integrated gender-responsive strategies.
 - Best Practice (81-100%): Exemplary gender equality achievements.

The data show that Norway: Advanced (50%) - Strong policies, women's networks, and training programs. Japan: Developing (30%) - Initiatives in place, but room for improvement. Singapore: Leading (65%) - Comprehensive policies, mentorship programs, and gender-sensitive facilities.

3.5. RIA Step 4: Identifying gaps and opportunities for policy coherence

To identify gaps and opportunities for policy coherence in maritime clusters, consider these steps:

3.5.1. Policy Review

- National policies. Review maritime, trade, environment, labor and gender equality policies.
- International agreements. Examine IMO, ILO, WTO and UN SDG commitments.
- Regional/local regulations: Assess cluster-specific rules.

3.5.2. Gap Analysis

- Inconsistencies. Identify conflicting policies or regulations.
- Gaps. Detect absent or inadequate policies.
- Overlap. Recognize redundant policies.

3.5.3. Stakeholder Engagement

- Government agencies. Engage maritime, trade, environment and labor ministries.
- Industry associations. Involve shipowners, operators, and suppliers.
- Civil society. Consult NGOs, women's organizations and community groups.
- Research institutions. Collaborate with universities and think tanks.

3.5.4. Coherence Assessment

- Horizontal coherence. Align maritime policies with other sectors (e.g., environment, labor).
- Vertical coherence. Ensure consistency between national, regional and local policies.
- International coherence. Align policies with global agreements.

3.5.5. Opportunity Identification

- Synergies. Leverage complementary policies (e.g., green shipping, workforce development).
- Innovative financing. Explore funding opportunities for policy initiatives.
- Capacity building. Develop training programs for policymakers and stakeholders.
- Public-private partnerships. Foster collaborative projects.

3.5.6. Prioritization

- High-impact gaps. Address critical inconsistencies or gaps.
- Quick wins. Implement feasible, high-visibility initiatives.
- Long-term strategies. Develop comprehensive plans.

3.5.7. Maritime Cluster Policy Coherence Framework

- Governance. Clear roles, responsibilities and coordination mechanisms.
- Data-driven decision-making. Regularly collect and analyze relevant data.
- Stakeholder engagement. Foster inclusive, participatory processes.
- Monitoring and evaluation. Regularly assess policy effectiveness.

3.5.8. Tools and Resources

- Policy coherence frameworks (e.g., OECD, UNDP)
- Stakeholder analysis templates.
- Gap analysis matrices.
- SWOT analysis.
- Expert workshops and seminars.

3.5.9. Application: Focused on Norway, Japan, and Singapore

On the succeeding discussion is an in-depth analysis of policy coherence in Norway, Japan and Singapore's maritime clusters.

Norway

- Integrated Ocean Management (IOM) policy: Coordinated approach to maritime management.
- Maritime Strategy (2017): Aligns with UN SDGs and EU's Maritime Spatial Planning Directive.
- Gender Equality Act (2018): Promotes women's participation in maritime industries.

Japan

- Maritime Innovation Strategy (2018): Fosters innovation, sustainability and international cooperation.
- Ocean Policy Framework (2018): Integrates maritime, environmental and economic policies.
- Act on Promotion of Women's Participation (2016): Encourages women's employment in maritime sectors.

Singapore

- Maritime Singapore 2030 (MS2030): Comprehensive strategy for maritime growth, sustainability and innovation.
- Sea Transport Industry Transformation Map (2018): Aligns with UN SDGs and International Maritime Organization (IMO) goals.
- Women's Charter (1961): Promotes gender equality, updated to include workplace harassment protections.

Gaps and Opportunities

- Norway: Strengthen coordination between ministries, enhance data-driven decision-making.
- Japan: Improve transparency in policy implementation, increase women's participation.
- Singapore: Address labor shortages, foster international cooperation.

Policy Coherence Initiatives

- Norway's Ocean Leadership Conference. Fosters dialogue among stakeholders.
- Japan's Maritime Innovation Forum. Promotes industry-government collaboration.
- Singapore's Maritime and Port Authority (MPA) Industry Forum. Encourages public-private partnerships.

4. Conclusion

Japan, Norway, and Singapore demonstrate varying degrees of progress toward gender equality in maritime clusters. Collaborative efforts between governments, industries, and academia can accelerate women's empowerment, driving sustainable growth and achieving SDG 5.

Recommendations

- Establish regular stakeholder engagement mechanisms.
- Develop policy coherence indicators and monitoring frameworks.
- Foster international cooperation and knowledge sharing.
- Invest in capacity-building programs for policymakers and industry professionals.
- Enhance transparency and data-driven decision-making.

Compliance with ethical standards

Disclosure of conflict of interest

No conflict of interest to be disclosed.

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