Environment and Social Psychology (2025) Volume 10 Issue 2 ISSN: 2424-8975 (O)
doi: 10.59429/esp.v10i2.3285 2424-7979 (P)

RESEARCH ARTICLE

Personal belief system and engineering skills for sustainable development goals among engineering and maritime professionals

Dione A. Baring

College of Maritime Sciences, Cebu Technological University, Carmen, Cebu 6005, Philippines

*** Corresponding author:** Dione A. Baring, dione.baring@ctu.edu.ph

ABSTRACT

This study investigates the place of personal belief systems and engineering skills for advancing sustainable development goals in the profession of engineers and maritime professionals. Qualitative exploratory research design with purposive sampling features the investigation of whether practices and/or decision-making of engineers and maritime professionals are influenced by their beliefs toward sustainability. Semi-structured interviews with 25 experienced engineers and maritime professionals from Cebu City show that personal beliefs do have a strong influence over the prioritization of such key SDGs as SDG 6: Clean Water and Sanitation, SDG 13: Climate Action, and SDG 11: Sustainable Cities and Communities. The important engineering skills to support sustainability will include project management, innovative problem-solving, water resource management, and sustainable materials science. Findings highlight engineers and maritime professionals with a strong sustainability-oriented belief are likely to champion greener technologies and practices within the organization. The research provides an important need to grow a culture of sustainability based on ethical decision-making, education, and advocacy. In conclusion, the study ends by recommending further research into how personal beliefs and engineering skills are impacting the sustainability outcomes of the activity, how it has evolved over time, and the role of interdisciplinary collaboration and policy in the creation of sustainable practices in the engineering and maritime profession.

Keywords: Engineering skills; SDG; personal belief system

1. Introduction

In our rapidly changing environment, the significance of incorporating sustainability into engineering and maritime education and professional practice has grown. The development of a personal belief system that prioritizes the Sustainable Development Goals (SDGs) is crucial, as engineers and maritime professionals are key to addressing complex sustainability challenges[1]. Engineers and maritime professionals uniquely position themselves to drive solutions that support global sustainability goals by combining technological expertise with ethical considerations. By focusing on solutions in energy, infrastructure, and sustainable cities—areas where their expertise is crucial for addressing issues like resource management and climate change—engineers contribute to achieving these aims[2]. The UN Secretary-General highlighted the importance of sustainable engineering, emphasizing that engineering and

ARTICLE INFO
Received: 30 November 2024 | Accepted: 18 February 2025 | Available online: 27 February 2025

CITATION
Baring DA. Personal belief system and engineering skills for sustainable development goals among engineering and maritime professionals. *Environment and Social Psychology* 2025; 10(2): 3285. doi:10.59429/esp.v10i2.3285

technological innovation—particularly in infrastructure—are essential for attaining the SDGs[3]. Therefore, fostering a culture of sustainability within the engineering and maritime professions requires understanding how personal beliefs influence their approach to sustainable development.

Research shows that engineering and maritime professionals' personal belief systems significantly influence their decision-making. These beliefs affect how maritime engineers prioritize sustainability in their projects and processes, in addition to influencing personal motivations[4]. A strong commitment to sustainability can lead to increased creativity and a willingness to develop solutions that address social and environmental issues. The evolution of engineering culture involves integrating environmental and ethical considerations into routine decision-making[5]. Professional associations' codes of ethics, such as those of the American Society of Civil Engineers, encourage maritime engineers to balance the economic, social, and environmental impacts of their projects and prioritize sustainable solutions. However, the effectiveness of this approach may depend on individual engineers' personal convictions and commitment to sustainability, as these factors heavily influence decision-making[6]. Aligning individual beliefs with organizational sustainability values is now more critical than ever. This alignment can foster a collaborative approach that facilitates the adoption of sustainable engineering practices across various sectors.

Furthermore, preparing the next generation of maritime engineers requires understanding the relationship between personal belief systems and engineering skills. Published research indicates that engineering curricula must integrate sustainability competencies to enhance students' understanding of the SDGs early in their education[7]. By promoting interdisciplinary knowledge and emphasizing both technical and soft skills—such as resilience and teamwork—educational institutions and employers can better prepare engineers for this responsibility. According to Torabi et al.[8] and other organizations, educational reform is urgently needed to promote sustainability and lifelong learning, particularly as engineering fields constantly evolve due to technological advancements and digital technologies. Engineering and maritime education can cultivate individuals who are not only technically proficient but also committed to making ethical decisions that benefit society by providing students with both technical skills and a strong ethical foundation[9]. Programs that prioritize collaborative, interdisciplinary approaches will be vital for addressing the interconnected challenges of sustainability.

Engineers and maritime professionals' responsibilities extend beyond technical execution; they also involve advocating for sustainable practices within their communities and organizations[10]. Maritime engineers with strong personal convictions about sustainability are more likely to champion SDG-aligned projects and persuade stakeholders to prioritize long-term impacts over immediate profits. Advocating for sustainable development can drive innovation and influence policy changes to achieve social and environmental goals[11]. Because research shows that advocacy efforts lead to more lasting results, it's crucial for engineers and maritime professionals to integrate their personal values into their professional identities[12].

As the field of engineering evolves, fostering a culture that values sustainability through ethical decision-making, improved education, and proactive advocacy will be essential for addressing global challenges[13]. The successful integration of sustainable principles into engineering practice relies on both institutional support and the personal commitment of professionals. To cultivate value-driven engineers and maritime professionals dedicated to sustainable outcomes, educational strategies and professional development initiatives must be informed by ongoing research into how belief systems impact engineering practices[14]. This synergy enables engineers and maritime professionals to develop effective, ethical solutions that support global sustainability goals, addressing challenges such as waste management, energy conservation, and sustainable urban development[15].

This research will focus on identifying the engineering skills needed to advance sustainable development concepts. Engineering and maritime professionals possess a range of technical and soft skills that can be pivotal in addressing the complex challenges associated with sustainability. This research will highlight specific skills—such as systems thinking, innovation, and collaboration—that can be enhanced to better address the SDGs. Furthermore, it aims to demonstrate how both personal belief systems and technical expertise can work together to promote sustainable development.

2. Literature

A growingly significant topic of research is the investigation of the connection between individual belief systems and the engineering competencies required to accomplish the Sustainable Development Goals (SDGs)[16]. Because engineers and maritime professionals are in a unique position to influence a sustainable future, there has been a growing interest in the connection between their personal sustainability views and technical practice. This connection emphasizes the value of engineers and maritime professionals who are dedicated to environmental and ethical responsibility in addition to having technological expertise[17]. As professionals in engineering and maritime fields encounter complex global challenges, understanding how individual values and beliefs impact their approach to sustainability becomes crucial. Recent studies emphasize that internal belief systems can significantly shape the motivations and priorities of engineering and maritime professionals as they engage with sustainability issues in their work[18]. By aligning personal values with professional responsibilities, engineers and maritime professionals can contribute more effectively to sustainable practices and innovations.

The integration of sustainability into engineering and maritime education is fundamental for fostering these personal belief systems among future professionals. Abdurrahman et al.[19] highlight that educational programs must not only focus on technical competencies but also instill a robust ethical framework surrounding sustainability practices. The development of personal beliefs that prioritize sustainability can facilitate a more profound commitment to ethical engineering practices. This dual focus on technical skills and personal values prepares engineering students to navigate the complexities of sustainability in their future careers, ensuring that they are equipped to address the multifaceted challenges posed by the SDGs[20]. Furthermore, engineering education for sustainability requires precise competencies, diverse teaching methods, and aligning learning outcomes with industry norms and regulations[21]. Integrating sustainability into engineering curricula can enhance education, but future research is needed to explore knowledge and value frameworks, stakeholder influence, and competency evaluation[22]. A shift in engineering education towards sustainability is necessary, requiring the integration of humanities and engineering sciences[23], and the inclusion of education for sustainable development (ESD) in environmental engineering undergraduate programs can promote environmental sustainability and address global challenges[24]. Engineering education can also integrate sustainability, enhancing students' sense of personal responsibility for sustainability issues like energy and waste management[25].

In addition to education, the role of personal belief systems in shaping professional behaviors and decision-making processes is well-documented. Engineering and maritime professionals who possess strong sustainability-oriented beliefs tend to advocate for greener technologies and practices within their organizations[26]. In order to prepare engineers and maritime professionals who can address the SDGs, UNESCO states that interdisciplinary approaches and the integration of sustainability into STEM education are crucial. Soft skills, teamwork, and resilience are now regarded as essential competencies, highlighting the fact that sustainable engineering encompasses communication and cross-disciplinary collaboration in addition to technical proficiency[27]. This advocacy is essential in promoting a culture of sustainability in

engineering firms, where individual values can influence organizational norms and practices[28]. Engineers and maritime professionals who view sustainability as a core part of their identity are more likely to engage in initiatives that seek to achieve environmental goals and foster social responsibility, highlighting the need for deeper engagement with personal belief systems in professional contexts.

Moreover, the intersection of personal beliefs and engineering skills has implications for collaborative work across disciplines. Engineers and maritime professionals often work alongside professionals from other fields, and a shared commitment to sustainability can enhance teamwork and innovation[29]. The literature suggests that interdisciplinary collaborations are more effective when all parties share common values centered around sustainability[30]. By understanding and nurturing personal beliefs that align with the principles of the SDGs, engineering and maritime professionals can contribute to holistic solutions that transcend disciplinary boundaries, ultimately leading to more impactful sustainability outcomes[31]. An engineering ethic framework can help engineering managers influence team members to adopt moral characteristics for sustainable projects, but future empirical work is needed for operationalization[32].

The interplay between personal belief systems and engineering skills is vital for driving progress toward achieving Sustainable Development Goals. Achieving sustainable development is largely dependent on engineers and maritime professionals' ethical standards and belief systems[33]. Engineering and maritime professionals may make a substantial contribution to a more sustainable and just world by maintaining ethical standards, advancing sustainability education, and developing frameworks[34]. Effective maritime policies should be targeted, comprehensive, contingency-based, and proactive to promote early achievement of emission reduction targets and industry sustainability[35]. MARPOL regulations and environmental guidelines positively impact the efficiency of European ports, promoting sustainable development goals after the pandemic[36]. MARPOL 73/78 has effectively prevented pollution from ships for over fifty years, but requires constant adaptation to new developments and CO2 emissions reduction in shipping[37]. The International Convention for the Prevention of Pollution from Ships (MARPOL) is the primary international framework for preventing marine pollution, ensuring safe operations and environmental protection for shipping companies[38]. Future investigations should focus on practical ways to embed sustainability-oriented beliefs into engineering and maritime education and practice. By fostering a culture where personal ethics and professional skills align, the engineering and maritime community can better equip professionals to lead initiatives that promote sustainable development[39].

3. Methodology

3.1. Research design

This study adopted the qualitative exploratory research design for it suited the exploration of topics or areas where little information was known and was mostly effective for capturing rich stories and real-life experiences in the course of the process[40]. Qualitative research explored, inter alia, connections and interactions and experiences that were impossible to quantify or reduce to applicable variables in practice[41].

3.2. Population and sampling

Purposive sampling was used in selecting the interviewees. This sampling technique was appropriate since it allowed for the deliberate selection of participants who possessed the relevant expertise and experience related to the subject of the study. Purposive sampling is one of the methods of non-probability sampling wherein the selection of respondents relies on a specific criterion, either for specialist knowledge of the subject or to contribute in any way possible to the research[42,43]. Therefore, in this study, 25 respondents from Cebu City have been chosen from diverse engineering and maritime fields to share their relevant

experience and insights with regards to the research questions. To achieve data saturation, the findings were thoroughly analyzed to identify patterns, nuances, and potential contradictions within the responses.

3.3. Instrument

The research instrument for this paper was an interview guide, following the qualitative exploratory research approach. In addition, the design of the interview guide is based on the approach proposed by[44], which focuses on the incorporation of follow-up and probing questions. These questions, therefore, were very crafted to probe into the study in terms of its research objects using both direct and indirect methods to ensure the total fulfillment of the experience and insight of the participants. **Table 1** presents the list of guide questions used by this research study.

Table 1. Interview guide questions.

Objectives	Interview question
1. Determine personal belief that can contribute to sustainable development goal.	1. As an engineering/maritime professional, what are your beliefs toward sustainable development goals. Elaborate specific instances. 2. Should engineering and maritime professionals align their practices in sustainable development concepts? Elaborate more 3. How important is it that engineering and maritime professionals should aspire to practice and believe in sustainable development goal concepts? Elaborate further.
2. Identify Engineering skills that can contribute to sustainable development concepts.	4. What engineering skills are very useful to concepts of sustainable development? Enumerate and explain each. 5. As an engineering/maritime professional, what particular contribution can you do to sustainable development goals? Elaborate further. 6. What specific engineering skills should be magnified further to align itself to sustainable development concepts? Elaborate each skill.

3.4. Data gathering procedure

Before conducting the study, participants were given a consent letter that explained the research aims and scope. The interviews were conducted face-to-face and used a semi-structured interview guide, which allowed a flexible approach in recording responses. According to Taherdoost[45], there are several techniques for capturing interview data, and each has its advantages and disadvantages. The audio recordings will be done with the participants' consent, note-taking while conducting the interview, and response transcription after the interview. In this study, note taking and audio recording have been used to provide an authentic record of participants' responses.

3.5. Data analysis

The data collected from the interviews were analyzed through thematic analysis. This is one of the most effective ways to identify, analyze, and report patterns or themes in qualitative data. According to Murray[46], narrative data captures the stories, experiences, or descriptive accounts of people, which are the most important for deeper connotations and perspectives. Thematic analysis provided context-specific insights into the practical aspects and mindset changes related to communication dynamics as seen in Duhaylungsod & Chavez[47]. The thematic analysis method allowed the researcher to note recurring themes and patterns from participants' narratives, offering a more in-depth understanding of their beliefs and professional practices with regard to the sustainable development goals.

4. Results

Research Objectives 1. Determine personal belief that can contribute to sustainable development goal.

Question No. 1. As an engineering/maritime professional, what are your beliefs toward sustainable development goals. Elaborate specific instances.

1.1. Practical sustainability

Ten respondents expressed that sustainable development is at the heart of their practice. They focus on sustainable development goal 6: Clean Water and Sanitation. They described initiatives such as the design of decentralized wastewater treatment systems that not only reduced environmental impacts but also empowered communities to manage their water resources. Additionally, they discussed upgrading municipal wastewater facilities with advanced filtration technologies, which enhanced water quality and promoted reuse for irrigation and industrial uses.

> "Sustainable development is at the heart of my practice. I focus on SDG 6: Clean Water and Sanitation. For instance, I led a project to design a decentralized wastewater treatment system for a small community. This not only reduced the environmental impact of effluent disposal but also empowered the community to manage their water resources more effectively. "

> "I led a project that involved upgrading a municipal wastewater treatment facility to incorporate advanced filtration technologies. This not only improved the quality of the treated water but also enabled the reuse of water for irrigation and industrial purposes. Educating the community on the benefits of water reuse was crucial. "

1.2. Climate action

Ten respondents expressed that their focus is on SDG 13: Climate Action. They described their roles in implementing innovative technologies which included projects like the development of smart grid systems to optimize energy distribution and reduce waste, and the retrofitting of power plants with carbon capture technology to mitigate emissions.

> "My focus is on SDG 13: Climate Action. I was involved in a project to implement smart grid technology in a city, which improved energy distribution and reduced waste. By integrating renewable energy sources and optimizing energy consumption, we not only contributed to reducing greenhouse gas emissions but also enhanced the community's resilience to climate change. "

> "I recently worked on a project to retrofit existing power plants with carbon capture technology. This initiative aimed to significantly reduce emissions while allowing the plants to continue operating. The integration of this technology not only helps mitigate climate change but also provides a transitional solution for communities dependent on traditional energy sources, demonstrating that engineering can facilitate a smoother shift towards sustainability."

1.3. Green infrastructure

Five respondents expressed that they firmly believe that engineering has a crucial role in achieving SDGs, especially Goal 11: Sustainable Cities and Communities. Their projects showcased the successful implementation of green infrastructure and the integration of green spaces into housing developments. By

presenting data on how these features could improve urban resilience, they were able to secure client approval, demonstrating the potential for sustainable practices to enhance community well-being. They also emphasize collaboration, data-driven approaches, and a holistic understanding of how infrastructure and design choices impact urban life and the environment.

> "I firmly believe that engineering has a crucial role in achieving SDGs, especially Goal 11: Sustainable Cities and Communities. In a recent urban redevelopment project, I advocated for green infrastructure, such as permeable pavements and green roofs, to manage stormwater and reduce heat island effects. "

> "I believe sustainable cities are essential for improving quality of life. In my last project, we incorporated green spaces and community gardens into a housing development. This not only enhanced biodiversity but also provided residents with recreational areas and improved air quality. Engaging the community in the planning process was key; their input helped shape a project that truly reflects their needs."

Question No. 2. Should engineering and maritime professionals align their practices in sustainable development concepts? Elaborate more

2.1. Efficiency

Ten respondents expressed that maritime engineers should aim to develop efficient systems and products that consume less energy and resources. This was exemplified by a respondent's description of redesigning a motor to reduce energy consumption by 15%, demonstrating how seemingly small improvements can yield substantial savings when scaled across production. They emphasize that while full sustainability may not always be feasible, continuous improvements and a focus on efficiency can lead to meaningful contributions toward a more sustainable future.

> “It’s about making incremental improvements that lead to significant changes over time. Not every project can be fully sustainable, but we can strive for better practices."

> "In my work, I focus on designing energy-efficient machinery. For instance, I recently redesigned a motor to reduce its energy consumption by 15%. While this may seem like a small change, when applied across an entire production line, the energy savings can be significant. I advocate for engineers and maritime professionals to think about how even minor adjustments can contribute to sustainability goals."

2.2. Sustainable efficiency

Fifteen respondents emphasized the economic benefits of aligning with sustainable development, viewing it not merely as an environmental imperative but also a pathway to improved profitability. They argued that sustainable practices often lead to more efficient processes, reducing waste and ultimately saving money. This was illustrated by a project implementing a closed-loop water system, resulting in a 30% reduction in water bills and waste disposal costs. The respondents advocated for proactive integration of sustainability into operational workflows to enhance productivity and reduce expenses, highlighting the strong financial incentives for adopting environmentally conscious practices.

> “From my perspective, aligning with sustainable development is not just about the environment; it's also about economic viability. Sustainable practices can lead to

more efficient processes, which ultimately save money. We should be proactive in finding ways to integrate sustainability into operational workflows, as it can enhance productivity and reduce waste."

"In my experience, adopting sustainable practices often leads to significant cost savings. For example, I worked on a project to implement a closed-loop water system in a manufacturing plant. By recycling water within the process, we reduced our water bills by 30% while also minimizing waste disposal costs."

Question No. 3. How important is it that engineering and maritime professionals should aspire to practice and believe in sustainable development goal concepts? Elaborate further.

3.1. Foundational sustainability

Ten respondents asserted that sustainability must be foundational to engineering and maritime practices, given the long-term impact of their work on communities and the environment. They emphasized a proactive approach, prioritizing sustainable material choices whenever feasible, even within the constraints of marine industry standards. This commitment reflects a recognition of their responsibility to minimize the carbon footprint of their projects and establish responsible construction practices as a precedent for future work.

"As an engineer, we shape the infrastructure that impacts communities for generations."

" While complete substitution of traditional materials isn't always feasible due to stringent marine standards, I prioritize using materials with reduced environmental impact whenever possible. Currently, this includes incorporating recycled steel where structural integrity isn't compromised. The lower embodied carbon of recycled steel compared to virgin material significantly reduces the vessel's overall carbon footprint. For non-structural components, I explore options like recycled plastics and, where appropriate, bio-based composites, though rigorous testing is crucial to ensure they meet marine safety and durability requirements."

3.2. Financial literacy

Ten respondents noted the growing importance of sustainability in their field, driven by escalating energy costs and stricter regulations. They see the integration of SDG concepts not just as a compliance issue but as a catalyst for innovation and a key to developing more efficient systems and products. The transition to sustainable energy sources, they emphasized, presents significant market opportunities. This was illustrated by a recent project integrating renewable energy systems into existing infrastructure, demonstrating a proactive approach to meeting both regulatory demands and market expectation.

"In my field, sustainability is becoming increasingly important due to rising energy costs and regulatory pressures. Clients are increasingly looking for sustainable solutions, and it's essential for us to lead in this area."

"I recently worked on a project to integrate renewable energy systems into existing infrastructure."

3.3. Operational efficiency

Five respondents expressed that in manufacturing, sustainable practices lead to operational efficiency and cost savings. They emphasized that implementing sustainable manufacturing processes can yield substantial improvements, as evidenced by a recent project where energy audits were conducted across their

facilities. This initiative identified inefficiencies and introduced energy-saving technologies, resulting in a 20% reduction in energy costs. This not only benefits the bottom line but also demonstrates how aligning with SDGs can foster a culture of continuous improvement within their organization.

> "I think it's vital for us to advocate for sustainability within our organizations. The SDGs offer a roadmap for reducing waste and optimizing resource use, which can significantly enhance profitability. "
>
> "I recently led a project that focused on energy audits across our facilities. By identifying inefficiencies and implementing energy-saving technologies, we achieved a 20% reduction in energy costs."

Research Objectives 2. Identify Engineering skills that can contribute to sustainable development concepts

Question No. 4. What engineering skills are very useful to concepts of sustainable development? Enumerate and explain each.

4.1. Project management

Fifteen respondents emphasized the importance of strong project management skills for engineers and maritime professionals in successfully implementing sustainable practices. They highlighted that effective planning, scheduling, and budgeting are crucial for integrating sustainability goals throughout the project lifecycle. By coordinating multiple stakeholders, project managers can prioritize sustainable options and ensure that sustainability is a key consideration at every phase of construction management. A recent project exemplified this approach, where the development of a comprehensive waste management plan not only kept the project on schedule but also significantly reduced landfill contributions, demonstrating how strategic management can align operational efficiency with sustainability objectives.

> "In my role as a maritime engineer, effective project management skills are essential for implementing sustainable practices. This includes planning, scheduling, and budgeting while ensuring that sustainability goals are integrated throughout the project lifecycle. Strong project management helps coordinate multiple stakeholders and ensures that sustainable options are prioritized."
>
> "In construction management, sustainability is a key consideration at every stage of a project. Strong project management practices allow us to implement green building practices, such as waste reduction strategies and the use of sustainable materials. I recently led a project where we developed a comprehensive waste management plan that not only kept us on schedule but also significantly reduced landfill contributions."

4.2. Innovative problem solving

Ten respondents identified innovative problem-solving as a crucial skill for achieving sustainability in engineering and maritime applications. They emphasized the need for creative solutions to address challenges like waste reduction and environmental impact minimization. A recent project successfully employing a novel, energy-efficient wastewater treatment process served as a prime example of how inventive approaches can yield significant improvements in both sustainability and operational efficiency. This highlights the critical role of ingenuity in developing and implementing environmentally responsible practices within the industry.

> "As an engineer, innovative problem-solving is a critical skill when it comes to sustainability. I often face challenges that require creative solutions, such as finding ways to reduce waste in production processes. By thinking outside the box, we can develop new methods and technologies that lead to more sustainable operations."

> "In my field, innovative problem-solving is crucial for developing strategies that minimize environmental impact. I recently led a project to treat wastewater using a novel biological process that utilizes less energy and produces fewer byproducts. By thinking creatively about our approach, we were able to enhance the sustainability of the treatment process while also improving its efficiency."

Question No. 5. As an engineering/maritime professional, what particular contribution can you do to sustainable development goals? Elaborate further.

5.1. Sustainable construction

Ten participants described their contribution to sustainable development through the promotion of environmentally responsible construction practices. Their work focuses on minimizing waste and energy consumption throughout the building process, as demonstrated by a recent project achieving a 75% landfill diversion rate through a comprehensive recycling program. Furthermore, they highlighted the use of sustainable materials like recycled concrete, showcasing the practicality and cost-effectiveness of eco-conscious construction methods in contributing to SDG 11. Their combined efforts underscore a commitment to transforming the construction industry into a more environmentally responsible sector.

> "I focus on reducing material waste and energy use during the building process. For example, I implemented a recycling program on a recent construction site that diverted over 75% of waste from landfills. By integrating sustainability into every aspect of construction, I help create a positive impact on the environment."

> "In my role as an engineer, I emphasize the importance of using sustainable materials and techniques in construction. For instance, I worked on a project where we sourced recycled concrete and other eco-friendly materials. This not only reduced our carbon footprint but also demonstrated to clients that sustainable choices can be both practical and cost-effective."

5.2. Sustainable urban planning

Ten respondents described their contributions to sustainable urban development, focusing on SDGs 11 and 13. Their work emphasizes creating climate-resilient and healthy communities through integrated strategies such as promoting active transportation, as demonstrated by successful projects integrating pedestrian infrastructure. This is complemented by the work of marine engineers who focus on sustainable coastal infrastructure and renewable energy integration in coastal urban areas, creating resilient waterfront communities.

> "In urban planning, I contribute to multiple SDGs, especially SDG 11: Sustainable Cities and Communities and SDG 13: Climate Action. I design integrated transportation solutions that reduce reliance on cars, promote public transit, and encourage walkability. For instance, in a recent project, I proposed bike lanes and pedestrian pathways, which enhance community health while lowering carbon emissions."

> " As a marine engineer contributing to coastal city urban planning, my focus is on creating resilient and sustainable waterfront communities. This involves designing environmentally conscious infrastructure, such as seawalls using sustainable materials and integrated flood control systems incorporating green infrastructure. I actively promote the integration of renewable energy sources like offshore wind and wave/tidal power, while also advocating for green building practices, sustainable transportation systems, and the incorporation of blue-green infrastructure into urban design."

5.3. Clean energy solutions

Five participants detailed their contributions to SDG 13 through the design and implementation of renewable energy systems. Their work focuses on reducing reliance on fossil fuels by integrating solar power into community infrastructure, as exemplified by a recent project that lowered energy costs and carbon emissions while promoting community engagement. Further enhancing the reliability and effectiveness of renewable energy, they are also developing energy storage solutions, such as the integration of battery storage with solar farms.

> "I contribute to SDG 13: Climate Action by working on renewable energy projects. My role involves designing solar energy systems that help reduce dependence on fossil fuels. Recently, I completed a project that integrated solar panels into a community building, significantly lowering energy costs and carbon emissions while promoting community awareness of renewable energy benefits."

> "In my role, I focus on developing energy storage solutions that complement renewable energy systems. For instance, I recently worked on a project that integrated battery storage with a solar farm. This setup not only enhances the reliability of energy supply but also maximizes the use of solar power, reducing reliance on fossil fuels. By optimizing energy use, we can contribute significantly to climate action goals."

Question No. 6. What specific engineering skills should be magnified further to align itself to sustainable development concepts? Elaborate each skill.

6.1. Water resource management

Ten participants underscored the vital role of enhanced water resource management skills in achieving sustainability. Hydrology engineers emphasized the need for improved stormwater management, water recycling, and conservation to address scarcity and protect water quality and ecosystems. Maritime professionals further highlighted the importance of water quality assessment and pollution control to maintain healthy aquatic environments.

> "As an engineer focused on hydrology, improving skills in water resource management is vital for sustainability. This includes techniques for stormwater management, water recycling, and conservation strategies. Sustainable water management not only addresses scarcity but also protects water quality and aquatic ecosystems."

> "As a maritime professional, I emphasize the importance of water quality assessment. Skills in monitoring pollutants, understanding treatment processes, and managing contaminated sites are vital. By focusing on these areas, we can ensure

that water bodies are protected from degradation, promoting healthier ecosystems and communities."

6.2. Sustainable materials science

Ten respondents emphasized the critical shift towards sustainable materials, highlighting the need for expertise in evaluating the performance and environmental impact of recycled and bio-based alternatives. The integration of life-cycle assessments and a commitment to innovative, sustainable materials are central to minimizing environmental impact and achieving responsible construction practices across both sectors.

> "In engineering, focusing on sustainable materials is key. We need to understand the properties and impacts of alternative materials, like recycled or bio-based options. By promoting the use of materials with lower environmental footprints, we can significantly reduce the ecological impact of buildings and infrastructure."

> "Sustainable development is central to my coastal protection work. This means prioritizing sustainable materials science through life cycle assessments, researching innovative materials, and optimizing designs for efficiency and minimal waste. Effective collaboration with scientists and communities, coupled with policy advocacy, ensures environmentally responsible and socially acceptable solutions."

6.3. Innovation and problem-solving

Five respondents identified innovation as the cornerstone of sustainable development, emphasizing the need to move beyond traditional engineering solutions. They highlighted the importance of creative problem-solving to develop environmentally sound and economically feasible technologies. The use of design thinking was cited as a key method to ensure user needs are met while prioritizing sustainability from the initial stages of product development. This approach underscores a proactive, innovative mindset as essential for driving progress towards sustainable engineering practices.

> "As an engineer, I see innovation as the cornerstone of sustainable development. We need to cultivate creativity and problem-solving skills that challenge traditional engineering solutions. This involves thinking outside the box to create new technologies and processes that are environmentally friendly and economically viable."

> "I believe design thinking is essential for fostering innovation. This iterative process encourages us to empathize with users, define problems, and prototype solutions. By focusing on sustainability from the outset, we can develop products and systems that meet environmental goals while also addressing user needs."

5. Discussion

Objective 1. Determine personal belief that can contribute to sustainable development goal.

The respondents' emphasis on SDG 6: Clean Water and Sanitation shows a practical understanding of sustainable practices in engineering. Their wastewater treatment project experience highlights the significance of community engagement, education, and innovative technologies. This aligns with research emphasizing the need for engineers and maritime professionals to consider the social and environmental impacts of their projects[6].

The respondents' focus on SDG 13: Climate Action underscores engineering's crucial role in climate change mitigation. Their work with smart grid and carbon capture technologies showcases engineering's potential to drive innovation and address climate challenges. This aligns with research emphasizing engineering's role in developing sustainable energy solutions[8].

The respondents' commitment to SDG 11: Sustainable Cities and Communities demonstrates their understanding of integrating environmentally friendly practices into urban planning and development. Their green infrastructure and community engagement experiences highlight engineering's potential to create more livable and resilient urban environments. This aligns with research advocating for interdisciplinary approaches to sustainable urban development[30].

The respondents' emphasis on practical applications of sustainable solutions aligns with research advocating a shift from theory to action[10]. Their focus on developing efficient systems and products that consume fewer resources demonstrates a pragmatic approach. This aligns with the need for engineers and maritime professionals to prioritize efficiency and continuous improvement[15].

The respondents' recognition of the economic benefits of eco-friendly practices aligns with the growing understanding of the link between sustainability and financial performance[26]. Their cost savings through closed-loop water systems and energy-efficient designs highlight the potential for environmentally conscious practices to enhance profitability and competitiveness. This aligns with the need for engineers and maritime professionals to consider the economic implications of their decisions[31].

The respondents' belief that environmentally responsible practices should be a foundational principle in civil engineering aligns with the long-term implications of infrastructure projects[3]. Their focus on creating resilient and livable environments for future generations demonstrates a commitment to intergenerational equity. This aligns with the need for engineers and maritime professionals to consider their profession's ethical and social responsibilities[20].

The respondents' recognition of the market potential of sustainable solutions aligns with the growing demand for eco-friendly solutions[27]. Their experiences integrating renewable energy systems and demonstrating cost savings highlight the potential of environmentally responsible practices to enhance competitiveness and drive innovation. This aligns with the need for engineers and maritime professionals to be aware of the financial advantages of sustainable solutions[39].

The respondents' commitment to advocating for environmentally responsible practices in manufacturing aligns with the growing trend of incorporating sustainable practices into production processes[13]. Their experiences with energy audits and waste reduction strategies highlight the potential for environmentally conscious practices to enhance operational efficiency and profitability. This aligns with the need for engineers and maritime professionals to consider the environmental and economic impacts of their decisions[16].

Objective 2. Identify Engineering skills that can contribute to sustainable development concepts**.**

The respondents' emphasis on project management skills highlights its crucial role in integrating sustainable practices into engineering projects. This aligns with research advocating for effective project management practices to ensure that environmental goals are prioritized throughout the project lifecycle[6].

The respondents' recognition of innovative problem-solving as a critical skill for environmental responsibility aligns with the need for engineers and maritime professionals to develop creative solutions to complex environmental challenges[17]. Their experiences developing novel technologies and processes

demonstrate the potential for innovative problem-solving to drive progress toward environmental sustainability.

The respondents' focus on water resource management skills highlights the significance of addressing water scarcity and protecting water quality[3]. Their experiences with stormwater management, water recycling, and water quality assessment demonstrate the critical role of water resource management in achieving sustainable development goals.

The respondents' emphasis on sustainable materials science aligns with the need for engineers and maritime professionals to understand the properties and impacts of alternative materials[16]. Their experiences incorporating recycled materials into construction projects demonstrate the potential for sustainable materials science to reduce environmental impact and promote resource efficiency.

The respondents' recognition of innovation and problem-solving as key skills for environmental responsibility aligns with the need for engineers and maritime professionals to develop new technologies and processes that are environmentally friendly and economically viable[30]. Their experiences with design thinking and prototyping demonstrate the potential for innovation to drive sustainable development.

6. Conclusion

This study investigated the relationship between personal beliefs and professional practices in promoting the Sustainable Development Goals (SDGs) among engineering and maritime professionals. The research revealed a strong correlation between engineers' and maritime professionals' personal views on environmental responsibility and their professional behaviors, particularly concerning SDGs 6, 11, and 13. Individuals with a strong commitment to environmental stewardship were more likely to integrate sustainable practices into their work and decision-making.

The study identified key engineering skills—project management, innovative problem-solving, water resource management, and sustainable materials science—as crucial for advancing sustainable development. The findings highlight the synergistic effect of personal values and professional competencies in driving organizational adoption of green technologies and practices.

This research contributes to the field by underscoring the need for cultivating a culture of environmental responsibility within engineering and maritime through ethical frameworks, enhanced education, and proactive advocacy. Future research should explore quantifying the impact of personal beliefs and skills on sustainability outcomes, analyzing trends over time, examining opportunities for interdisciplinary collaboration, and assessing the role of policy and regulation. Furthermore, a critical area for future research is the development of methods to track the evolution of sustainability beliefs and practices among engineers and maritime professionals throughout their careers. This longitudinal study would help assess the consistency of these beliefs over time and identify factors that influence changes in attitudes and behaviors. This research should also consider the alignment (or misalignment) between engineers and maritime professionals' sustainability beliefs and employer goals, and explore the impact on decision-making and its broader implications. Finally, integrating environmental responsibility into engineering curricula is crucial for developing future professionals equipped to address global challenges.

References

1. Carpio, L. B., Caburnay, A. L. S., Nolledo, S. M., Ongchua, C. A., & Orquia, J. A. (2024). Technology-based teaching among nursing instructors: Confidence and apprehension in using simulation equipment for training. Environment and Social Psychology, 9(8). https://doi.org/10.59429/esp.v9i8.2591

2. Mendoza, N. D. V. (2023). Analysis of the Filipino brand of customer service in the accommodation sector. Journal of Namibian Studies History Politics Culture, 33, 4685–4704. https://doi.org/10.59670/jns.v33i.2830
3. Vehmaa, A. (2018). Working life of water and environmental engineers: a case study of career paths, core competencies and the role of sustainable development. Aaltodoc. https://aaltodoc.aalto.fi:443/bitstream/123456789/31604/1/master_Vehmaa_Anu_2018.pdf
4. Qasemi, M., Allahyari, M. S., Hassen, T. B., Askari, M. I., & Bilali, H. E. (2023). Cultivating Change: Perceptions and Attitudes of Agricultural Experts towards the Sustainable Development Goals. Land, 12(8), 1604. https://doi.org/10.3390/land12081604
5. Chavez, J. V., & Cuilan, J. T. (2023). Gender mainstreaming campaign as a casualty of the online gender-based humor: A discourse analysis. Environment and Social Psychology, 9(2). https://doi.org/10.54517/esp.v9i2.2044
6. Murray, M., Pytharouli, S., & Douglas, J. (2022). Opportunities for the development of professional skills for undergraduate civil and environmental engineers. European Journal of Engineering Education, 47(5), 793–813. https://doi.org/10.1080/03043797.2022.2031897
7. Chavez, J. V., Cuilan, J. T., & Adaliaan, H. G. (2024). Message patterns through discourse analysis on the concept of apology and forgiveness during Ramadan among college students practicing Islam. Environment and Social Psychology, 9(3). https://doi.org/10.54517/esp.v9i3.2043
8. Torabi, Z., Ardekani, S. S., & Hataminasab, S. H. (2021). A New Model in Designing the Professional Competence System of the Petrochemical Industry with a Sustainable Development Approach. South African Journal of Chemical Engineering, 37, 110–117. https://doi.org/10.1016/j.sajce.2021.05.006
9. Rodriguez, J., & Rodriguez, J. (2021, July 2). Mainstreaming special education students. The University of Texas Permian Basin | UTPB. https://online.utpb.edu/about-us/articles/education/mainstreaming-special-education-students
10. Byrne, E. P. (2023). The evolving engineer; professional accreditation sustainability criteria and societal imperatives and norms. Education for Chemical Engineers, 43, 23–30. https://doi.org/10.1016/j.ece.2023.01.004
11. Quisay, A. R. C., & Aquino, M. E. C. (2024b). Stress levels of science teachers when delivering distance education instruction in a state college during the COVID-19 pandemic. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2916
12. Zguir, M. F., Dubis, S., & Koç, M. (2021). Embedding Education for Sustainable Development (ESD) and SDGs values in curriculum: A comparative review on Qatar, Singapore and New Zealand. Journal of Cleaner Production, 319, 128534. https://doi.org/10.1016/j.jclepro.2021.128534
13. Demirci, S., & Teksöz, G. (2017). Self-Efficacy Beliefs on Integrating Sustainability into Profession and Daily Life: In the Words of University Students. International Electronic Journal of Environmental Education, 7(2), 116–133. http://files.eric.ed.gov/fulltext/EJ1180990.pdf
14. Henry, R., Morgan, M., Beagon, U., Bowe, B., Jani, R., & McKennedy, J. (2024). Engineering Skills to Respond to SDGs: A Survey of Employers, Academics, and Students. The 39th International Manufacturing Conference., 106, 15. https://doi.org/10.3390/engproc2024065015
15. Bueno, A., Da Rocha Azevedo, M. L., Filho, M. G., Ganga, G. M. D., & Lizarelli, F. L. (2024). Industry 4.0 Skills in Industrial Engineering Courses: Contributing to the role of Universities toward Sustainable Development. IEEE Transactions on Engineering Management, 71, 8369–8387. https://doi.org/10.1109/tem.2024.3382951
16. Beagon, U., Kövesi, K., Tabas, B., Nørgaard, B., Lehtinen, R., Bowe, B., Gillet, C., & Spliid, C. M. (2022). Preparing engineering students for the challenges of the SDGs: what competences are required? European Journal of Engineering Education, 48(1), 1–23. https://doi.org/10.1080/03043797.2022.2033955
17. Rivera, F. M., Hermosilla, P., Delgadillo, J., & Echeverría, D. (2020). The Sustainable Development Goals (SDGs) as a basis for innovation skills for engineers in the industry 4.0 context. Sustainability, 12(16), 6622. https://doi.org/10.3390/su12166622
18. Zagirniak, D., Druzhynina, V., Nozhenko, V., & Druzhynin, V. (2022). Modern Systems Engineering Education in the context of the formation of professional competences. 2022 IEEE 4th International Conference on Modern Electrical and Energy System (MEES). https://doi.org/10.1109/mees58014.2022.10005741
19. Abdurrahman, A., Maulina, H., Nurulsari, N., Sukamto, I., Umam, A. N., & Mulyana, K. M. (2023). Impacts of integrating engineering design process into STEM makerspace on renewable energy unit to foster students' system thinking skills. Heliyon, 9(4), e15100. https://doi.org/10.1016/j.heliyon.2023.e15100
20. Walther, J., Miller, S. E., & Sochacka, N. W. (2017). A model of empathy in engineering as a core skill, practice orientation, and professional way of being. Journal of Engineering Education, 106(1), 123–148. https://doi.org/10.1002/jee.20159

21. Narong, D., & Hallinger, P. (2024). Traversing the Evolution of Research on Engineering Education for Sustainability: A Bibliometric Review (1991–2022). Sustainability. https://doi.org/10.3390/su16020641.
22. Thürer, M., Tomasevic, I., Stevenson, M., Qu, T., & Huisingh, D. (2017). A systematic review of the literature on integrating sustainability into engineering curricula. Journal of Cleaner Production, 181, 608-617. https://doi.org/10.1016/J.JCLEPRO.2017.12.130.
23. Kelly, W., & Mason, G. (2016). Engineering Education for Sustainable Development.
24. Castellanos, P., Queiruga-Dios, A., & Álvarez, L. (2021). Inclusion of Education for Sustainable Development in Environmental Engineering. A Systematic Review. Sustainability. https://doi.org/10.3390/su131810180.
25. Wilson, D. (2019). Exploring the Intersection between Engineering and Sustainability Education. Sustainability. https://doi.org/10.3390/SU11113134.
26. Del Mundo, M. A., Reyes, E. F. D., Gervacio, E. M., Manalo, R. B., Book, R. J. A., Chavez, J. V., Espartero, M. M., & Sayadi, D. S. (2024a). Discourse analysis on experience-based position of science, mathematics, and Tech-Voc educators on generative AI and academic integrity. Environment and Social Psychology, 9(8). https://doi.org/10.59429/esp.v9i8.3028
27. Janakiraman, S., Watson, S. L., Watson, W. R., & Cheng, Z. (2021). Creating environmentally conscious engineering professionals through attitudinal instruction: A mixed methods study. Journal of Cleaner Production, 291, 125957. https://doi.org/10.1016/j.jclepro.2021.125957
28. Bucoy, R. M., Enumerabellon, K. M., Amilhamja, A. J., Sisnorio, C. B., Manalo, R., Chavez, J. V., Sabbaha, N. A., & Albani, S. E. (2024). Knowledge deficits and analysis on comprehension of teachers on their common legal rights as teachers. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2559
29. Savellon, K. I. S., Asiri, M. S., & Chavez, J. V. (2024). Public speaking woes of academic leaders: resources and alternative ways to improve speaking with audience. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2871
30. Khamis, A., Li, H., Prestes, E., & Haidegger, T. (2019). AI: a Key Enabler for Sustainable Development Goals: Part 2 [Industry Activities]. IEEE Robotics & Automation Magazine, 26(4), 122–127. https://doi.org/10.1109/mra.2019.2945739
31. Rahim, N. B. (2020). The Interaction Between Protean Career Orientation, Career Goal Development and Well-being Outcomes: Evidence from Professional Engineers. Gadjah Mada International Journal of Business, 22(1), 24. https://doi.org/10.22146/gamaijb.44343
32. Jones, S., Michelfelder, D., & Nair, I. (2017). Engineering managers and sustainable systems: the need for and challenges of using an ethical framework for transformative leadership. Journal of Cleaner Production, 140, 205-212. https://doi.org/10.1016/J.JCLEPRO.2015.02.009.
33. Chavez, J. V., Garil, B. A., Padrique, C. B., Askali, S. T., & Indama, A. C. (2024). Assessing innovative and responsive young leaders in public service: Lens from community clientele. Environment and Social Psychology, 9(9). https://doi.org/10.59429/esp.v9i9.2876
34. Igbinovia, M. O., & Osuchukwu, N. P. (2018). Predictors of knowledge sharing behaviour on Sustainable Development Goals among library personnel in Nigeria. IFLA Journal, 44(2), 119–131. https://doi.org/10.1177/0340035218763445
35. Fan, L., Yang, H., & Zhang, X. (2024). Targeting the Effectiveness Assessment of the Emission Control Policies on the Shipping Industry. Sustainability. https://doi.org/10.3390/su16062465
36. Balla, V., Karioti, V., & Koskeridi, A. (2023). International regulations and sustainable development in touristic European port's efficiency after the pandemic. Business Performance Review. https://doi.org/10.22495/bprv1i1p4.
37. Ehlers, P. (2024). A Success Story? Fifty Years of MARPOL. The International Journal of Marine and Coastal Law. https://doi.org/10.1163/15718085-bja10194.
38. Da Costa, K. (2024). O PAPEL DA ORGANIZAÇÃO MARÍTIMA INTERNACIONAL NA PROTEÇÃO DO MEIO AMBIENTE MARINHO. Revista Científica Semana Acadêmica. https://doi.org/10.35265/2236-6717-251-13057.
39. Smaniotto, C., Battistella, C., Brunelli, L., Ruscio, E., Agodi, A., Auxilia, F., Baccolini, V., Gelatti, U., Odone, A., Prato, R., Tardivo, S., Voglino, G., Valent, F., Brusaferro, S., Balzarini, F., Barchitta, M., Carli, A., Castelli, F., Coppola, C., . . . Sisi, S. (2020). Sustainable Development Goals and 2030 Agenda: Awareness, Knowledge and Attitudes in nine Italian Universities, 2019. International Journal of Environmental Research and Public Health, 17(23), 8968. https://doi.org/10.3390/ijerph17238968

40. Chavez, J. V., Adalia, H. G., & Alberto, J. P. (2023). Parental support strategies and motivation in aiding their children learn the English language. Forum for Linguistic Studies, 5(2), 1541. https://doi.org/10.59400.fls.v5i2.1541
41. Turner, D., Ting, H., Wong, M. W., Lim, T. Y., & Tan, K. L. (2021). Applying qualitative approach in business research. Asian Journal of Business Research, 11(3), 1-13.
42. Rai, N., & Thapa, B. (2015). A study on purposive sampling method in research. Kathmandu: Kathmandu School of Law, 5(1), 8-15.
43. Tongco, M. D. C. (2007). Purposive sampling as a tool for informant selection. Ethnobotany Research & Applications, 5, 147-158.
44. Sikov, J. (2020). Asking the Right Question: Qualitative Research Design and Analysis. Boston University [PowerPoint]. https://www.bumc.bu.edu/crro/files/2020/02/RPNQualitative Presentation-2.11.20.pdf (accessed on 21 July 2023)
45. Taherdoost, H. (2022). How to conduct an effective interview; a guide to interview design in research study. International Journal of Academic Research in Management, 11(1), 39-51.
46. Murray, M. (2018). Narrative data. The SAGE handbook of qualitative data collection, 264-279.
47. Duhaylungsod, A. V., & Chavez, J. V. (2023). ChatGPT and other AI users: Innovative and creative utilitarian value and mindset shift. Journal of Namibian Studies, 33, 4367-4378