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Exploring gender differences in sustainable project management competencies and awareness of the sustainable development goals (SDGs)

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This study investigates whether gender differences exist in the levels of sustainable project management competencies and awareness of the Sustainable Development Goals (SDGs), specifically SDG 9 (Resilient Infrastructure) and SDG 11 (Sustainable Cities and Communities), among College of Business students at Prince Sattam bin Abdulaziz University. A questionnaire was employed to assess six key sustainable competencies: communication, leadership, management, cognitive ability, effectiveness, and professionalism. The sample consisted of 63 students from diverse business disciplines, including accounting, finance, management information systems, and human resources. The questionnaire was developed based on an extensive review of the literature and validated by experienced educators. Data analysis included descriptive statistics and the Mann-Whitney U test to examine gender differences in competency levels and SDG awareness. The findings reveal significant gender differences, with female students demonstrating higher mean ranks across all competencies and SDG awareness compared to their male counterparts. These results suggest that gender may play a significant role in the development of sustainable project management competencies and the understanding of global sustainability challenges. This study contributes to the literature by offering valuable insights into how gender influences students' potential to engage with SDGs, particularly SDG 9 and SDG 11. The findings emphasize the importance of incorporating sustainable project management competencies into academic curricula to enhance students' awareness of SDGs, and they highlight the need for gender-sensitive educational strategies that promote inclusive sustainability education.

1. Introduction

Sustainable project management competencies are essential for the effective execution of projects that align with global sustainability goals. These competencies, such as communication, leadership, managing, cognitive ability, effectiveness, and professionalism, equip individuals with the necessary skills to navigate complex sustainability challenges (Ahadzie et al., 2008; Dainty et al., 2004; Boyatzis, 2011). The importance of these competencies has grown as sustainability has become a core focus in various sectors, particularly in achieving the United Nations Sustainable Development Goals (SDGs). The SDGs, such as SDG 9 (Resilient Infrastructure) and SDG 11 (Sustainable Cities and Communities), require informed decision-making and effective project management practices to ensure that development is both economically viable and environmentally sustainable (PMI, 2017). Awareness of SDGs among students is important, as they represent the next generation of professionals who will implement sustainable practices in their careers. According to extant research, students who are aware of SDGs and have strong project management competencies are better equipped to contribute to achieving

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these goals (Silvius & Schipper, 2014). The higher the students' competency in sustainable project management, the more likely they are to recognize the significance of SDGs and actively contribute to sustainable development initiatives (Zuo et al., 2018). However, if students possess low levels of these competencies and SDG awareness, the consequences can be detrimental. Without a strong understanding of sustainable project management, students may struggle to implement effective solutions to sustainability challenges. This gap in knowledge and skill can lead to inefficient use of resources, poorly managed projects, and missed opportunities for innovation in green technologies and infrastructure (Goleman et al., 2004; Zaharim et al., 2012). Furthermore, a lack of awareness of SDGs can result in disengagement from global sustainability efforts, weakening the capacity of future professionals to address pressing environmental and social challenges.

This study addresses a critical gap in the literature by exploring gender differences in the levels of sustainable project management competencies and awareness of the Sustainable Development Goals (SDGs), specifically SDG 9 and SDG 11. While previous studies have separately examined project management competencies and SDG awareness, few have investigated how these factors interact and their impact on students' ability to contribute to sustainable development. Furthermore, the exploration of gender differences in these competencies and awareness provides a deeper understanding of how gender may influence students' perceptions and preparedness to engage with sustainability issues. This research contributes to the existing literature by shedding light on the role of gender in shaping SDG awareness and project management competencies, offering valuable insights for the development of more inclusive and targeted educational strategies. By enhancing these competencies, especially in a gender-sensitive manner, universities can better equip students to actively participate in achieving the SDGs, thereby promoting a more sustainable future.

The structure of the paper is as follows: The second section presents the literature review, followed by the third section, which outlines the research methodology. The fourth section discusses the results and interpretations. Finally, the paper concludes in the fifth section.

2. Literature review

A high degree of sustainable project management competencies, such as effective communication, leadership, and cognitive abilities, among students can significantly increase their awareness of the Sustainable Development Goals (SDGs), particularly SDG 9 (Industry, Innovation, and Infrastructure) and SDG 11 (Sustainable Cities and Communities). Studies suggest that students who possess strong project management skills are better equipped to understand complex sustainability challenges and the importance of integrating these goals into real-world projects (Silvius & Schipper, 2014; Zuo et al., 2018). Effective communication skills help students articulate sustainability concepts clearly, while leadership and management competencies enable them to apply SDGs in a practical, project-driven context. Furthermore, cognitive skills such as critical thinking and problem-solving allow students to address challenges related to SDG 9, such as resilient infrastructure and sustainable industrialization, and SDG 11, such as promoting inclusive urban planning and sustainable transport systems.

Universities play a crucial role in enhancing these competencies by embedding sustainability principles into their curricula. Incorporating sustainability-focused case studies, project-based learning, and interdisciplinary courses allows students to engage with SDGs in a practical context. Additionally, providing workshops, seminars, and real-world project opportunities can foster collaboration and enhance students' skills in applying these competencies to global sustainability issues. By doing so, universities not only improve students’ awareness of SDGs but also equip them to lead sustainable development initiatives in their professional careers.

The Project Management Institute (PMI) continuously updates its frameworks to address the evolving nature of project management. The PMCD Framework (2017) now includes competencies for program and portfolio managers, categorizing them into knowledge, performance, and personal dimensions. This framework emphasizes both the practical application of project management skills and the behaviors that contribute to project success, aligning with PMI’s broader standards. The PMBOK® Guide (Seventh Edition, 2021) introduces key changes, such as a principle-based structure, performance domains, and a focus on value delivery, moving away from prescriptive processes. It also integrates agile and hybrid approaches to cater to modern project environments. Together, these resources provide comprehensive guidance for developing project management competencies and adopting flexible, value-driven practices that align with industry needs, making them essential tools for professionals aiming for excellence in project management (PMI, 2017; PMI, 2021).

2.1 Communicating

Successfully communicates accurate, relevant, and timely information to stakeholders using appropriate communication methods (PMI, 2017). Al-Nabae et al. (2024) found empirically a significant correlation between training in communication and both employee performance and project performance. Rodrigues et al. (2023) found that communication is one of the most relevant competencies for managing smart buildings projects. Effective communication is a fundamental competency for successful project management, influencing team coordination, stakeholder alignment, and project outcomes. Several studies highlight its centrality across various industries. Hyväri (2005) emphasizes that being a "good communicator" is a top

competency for project managers, with communication ranked highly alongside leadership and decision-making as essential for success. This is further supported by Zimmerer and Yasin (1998), who argue that positive leadership, which includes effective communication, contributes significantly to project success. Communication also enhances "informing" and "networking," which are vital for ensuring accurate information flow within teams (Hyväri, 2005). Musa et al. (2012) underscore communication as a key soft skill in workplace environments, with studies from project-based learning at Universiti Kebangsaan Malaysia demonstrating its importance in crafting reports, emails, and executive summaries. Communication skills were similarly found to be the most critical for engineering graduates by Zaharim et al. (2012), with effective communication valued over technical expertise in the hiring process. Boyatzis (2011) expands on this, highlighting the role of emotional, social, and cognitive intelligence in communication, particularly in leadership contexts. Dainty et al. (2004) and Edum-Fotwe and McCafer (2000) also emphasize communication as essential for construction project managers, pointing to its role in managing team relationships, resolving conflicts, and ensuring clarity in task execution. Lastly, Fisher (2011) reinforces the idea that communication is not just about transmitting information but involves building trust, fostering open dialogue, and ensuring clarity, which ultimately supports team collaboration and project success.

In the context of green project management, communication is a key competency for ensuring the clear exchange of information, ideas, and goals among team members and stakeholders, which is crucial for project success. Ahadzie, Proverbs, and Olomolaiye (2008) stress that communication is essential for collaboration and decision-making within teams, particularly in sustainability-driven projects. Dainty et al. (2004) further highlight its importance in fostering teamwork, resolving conflicts, and maintaining alignment with project objectives. Boyatzis (2011) focuses on emotional intelligence in communication, particularly the role of empathy in building mutual understanding and trust among project teams. Fisher (2011) identifies communication as a critical people skill, noting that project managers who clearly articulate expectations and actively listen are more likely to lead successful teams. Zaharim et al. (2012) emphasize the value of communication skills for engineers, underlining how these skills are necessary for conveying sustainable practices effectively to a diverse audience. Musa et al. (2012) advocate for project-based learning as an effective method for enhancing communication skills in real-world, sustainability-focused project environments.

2.2 Leading

Leads, encourages, and motivates team members and other project stakeholders to address and resolve challenges, ensuring the successful achievement of project goals (PMI, 2017). The competency of leading is crucial for project success and has been extensively discussed in various studies. Rodrigues et al. (2023) found that leadership is one of the most relevant competencies for managing smart buildings projects. Aldossari (2020) found that leadership is one of the most critical competencies required for client-side project managers to effectively manage public construction projects in Saudi Arabia. Hyväri (2005) emphasizes that leadership aligns team efforts with project goals, motivating teams and ensuring project success. Effective leadership involves key behaviors such as communication, planning, and organizing. Sang et al. (2028) found that leadership is considered to be important factors that affect green construction performance. Zimmerer and Yasin (1998) argue that leadership accounts for 76% of project success, highlighting the role of leadership in guiding decision-making and maintaining team motivation. Boyatzis (2011) links leadership with emotional, social, and cognitive intelligence, suggesting that leaders must inspire and influence their teams by integrating emotional intelligence with technical expertise. Dainty et al. (2004) describe leadership as essential for construction project managers, particularly in fostering collaboration and managing conflicts, while ensuring alignment with project goals. Fisher (2011) adds that leadership requires not only technical management but also the ability to build trust, adapt leadership styles, and understand team dynamics.

In green project management, leadership is vital for navigating sustainability challenges. Ahadzie, Proverbs, and Olomolaiye (2008) emphasize that leadership behaviors, such as aligning team goals with project objectives and maintaining motivation, are critical for sustainability projects. Dainty et al. (2004) reaffirm the role of leadership in ensuring project success, particularly in fostering collaboration. Boyatzis (2011) links emotional intelligence in leadership to trust-building and creating environments conducive to sustainability. Silvius and Schipper (2014) argue that transformational leadership, integrating environmental and social considerations, is essential for green projects. Alshammari (2020) highlights that green leadership requires vision and stakeholder management. Fisher (2011) underscores the importance of inspiring commitment for sustainable initiatives, while Musa et al. (2012) and Zuo et al. (2018) stress the role of experiential learning and innovation in leadership for sustainability projects.

2.3 Managing

Efficiently manages the project by strategically utilizing and deploying human, financial, material, intellectual, and intangible resources (PMI, 2017). Rodrigues et al. (2023) found that strategic management is one of the most relevant competencies for managing smart buildings projects. The competency of managing is a pivotal element in project management, as underscored by various studies that emphasize its role in ensuring project success. Aldossari (2024) found that scope management is one of the most critical competencies required for client-side project managers to effectively manage public construction projects in Saudi Arabia. Hyväri (2005) highlights the importance of management practices, such as organizing, planning, and communication, in achieving effective project outcomes. The study asserts that these management behaviors are integral to

coordinating team efforts, maintaining focus on project goals, and mitigating challenges throughout the project lifecycle. Similarly, Zimmerer and Yasin (1998) affirm that management is responsible for 76% of a project's success, noting that a project manager's ability to guide decision-making, sustain team motivation, and manage resources effectively is crucial for project completion. This insight is particularly relevant in the context of managing complex projects, where the alignment of team actions with overarching project goals is critical.

Dainty et al. (2004) further elaborate on the role of managing in construction project management, identifying key managerial tasks such as conflict resolution, resource allocation, and strategic decision-making as foundational to project success. Their research suggests that effective project managers demonstrate a unique combination of interpersonal and organizational skills that enable them to navigate the dynamic challenges of construction projects. In addition, Boyatzis (2011) extends the concept of managing to include emotional intelligence, highlighting that successful managers not only excel in technical expertise but also in their ability to inspire, influence, and guide others toward achieving high performance. This competency of managing is also linked to Zaharim et al. (2010), who argue that the integration of technical and interpersonal skills in management is essential for handling the complexities of project management.

In the context of green project management, Ahadzie, Proverbs, and Olomolaiye (2008) emphasize the need for effective management skills to address sustainability challenges. The competency of managing in these projects requires managers to align team efforts with sustainability goals while ensuring that environmental considerations are effectively integrated into decision-making processes. Furthermore, Musa et al. (2012) highlight the value of project-based learning in developing these management competencies, asserting that experiential learning enhances decision-making, adaptability, and leadership capabilities. Collectively, these studies underscore that the competency of managing is not only about overseeing tasks but also about integrating leadership, technical expertise, and emotional intelligence to ensure project success.

2.4 Effectiveness

Achieves desired outcomes by utilizing the appropriate resources, tools, and techniques in all aspects of project management (PMI, 2017). The competency of effectiveness is a key factor in project management, as highlighted in multiple studies that underscore its relevance to successful project execution. Hyväri (2006) defines project management effectiveness as the ability to integrate technical competency, leadership skills, and appropriate organizational structures to achieve project success. In her study, she identifies the importance of managerial behaviors, including planning, organizing, and networking, as pivotal elements contributing to project effectiveness. These practices, when effectively executed, enhance project outcomes and the career success of project managers. Dainty et al. (2004) also focus on the role of managerial competencies in driving performance, emphasizing that effective project managers display behavioral traits such as leadership and composure, which are crucial for managing complex projects. They further argue that competency models based on these behaviors can predict superior performance and are integral to improving project management effectiveness in construction.

Additionally, Edum-Fotwe and McCafer (2000) stress that the evolving construction industry requires project managers to adapt to new challenges. They assert that managing project success now requires a broader set of competencies beyond traditional technical skills, including interpersonal and management skills. Ahadzie, Proverbs, and Olomolaiye (2008) discuss the relationship between managerial competencies and effectiveness, specifically focusing on the construction industry. They argue that the ability to distinguish between contextual and task behaviors plays a critical role in predicting project managers' success, with cognitive skills being a key factor in managing both types of behavior effectively.

2.5 Cognitive Skills

Uses a suitable level of insight, discernment, and judgment to effectively guide a project in a dynamic and evolving environment (PMI, 2017). The competency of Cognitive Ability is crucial for project management, with several studies highlighting its importance for decision-making, problem-solving, and effective management in both traditional and green project management contexts. Ahadzie, Proverbs, and Olomolaiye (2008) emphasize that cognitive competencies such as critical thinking and problem-solving are essential for project managers in construction to navigate complex project challenges. The ability to analyze situations, consider various perspectives, and devise solutions is especially important in sustainability projects, where balancing environmental, social, and economic factors is critical. Dainty et al. (2004) similarly underscore the role of cognitive abilities like strategic planning and foresight in achieving high performance in project management, particularly when managing dynamic and complex projects such as those focused on sustainability. These cognitive abilities enable managers to anticipate challenges and plan accordingly, enhancing project success. In addition, Boyatzis (2011) links cognitive skills to emotional intelligence, suggesting that managers who combine analytical thinking with empathy are better equipped to align their teams and stakeholders toward common goals, such as achieving sustainability objectives. The integration of cognitive abilities with emotional intelligence ensures that decisions are informed not only by data but also by the human factors essential for achieving long-term project success.

In the realm of green project management, cognitive skills are particularly important for addressing sustainability challenges. Alshammari (2020) emphasizes the need for systematic thinking in managing complex sustainability projects, especially in Saudi Arabia, where project managers must consider environmental, economic, and cultural factors simultaneously.

Chepkemoi, Kalio, and Mwanzia (2021) further argue that cognitive abilities are critical for overcoming resource management challenges in the construction sector, where sustainable practices are increasingly prioritized. Silvius and Schipper (2014) highlight the importance of systems thinking, which allows managers to understand interconnections between project components and broader ecological goals, ensuring the integration of sustainability into all project phases. Zuo, Zhao, and Gan (2018) emphasize that innovative thinking and problem-solving are vital for optimizing resource use and minimizing environmental impact in green building projects. Musa et al. (2012) advocate for experiential learning, such as project-based learning, as an effective method for developing cognitive skills in students, preparing them to navigate the complexities of sustainability projects in real-world environments. Finally, Zaharim et al. (2012) stress the significance of cognitive abilities for employability, particularly in green industries, where graduates must meet the increasing analytical demands related to sustainability practices (Rizwan et al., 2021; Mahajan et al., 2022).

2.6 Professionalism

Adheres to ethical conduct guided by responsibility, respect, fairness, and honesty in the practice of project management (PMI, 2017). In the uploaded articles, "professionalism" as a competency has been explicitly identified and discussed. Fisher (2011) emphasizes the importance of professionalism, particularly as it relates to project managers' accountability and ethical responsibility. Professionalism, in this context, encompasses not only technical expertise but also adherence to ethical guidelines and social responsibilities. This competency is foundational in ensuring project success and fostering trust within teams. Dainty et al. (2004) also support this view, asserting that professionalism is essential in construction project management, where maintaining high standards of integrity, ethical conduct, and responsible leadership is critical. They underline the role of professionalism in navigating complex project environments and ensuring that managers meet the expectations of various stakeholders. Furthermore, Hyväri (2006) discusses the role of professionalism in project management effectiveness, noting that effective project managers demonstrate a strong commitment to professional responsibilities, including the application of technical skills and leadership abilities. This combination of competencies ensures the project's alignment with organizational and societal goals. Musa et al. (2012) add that professionalism is crucial in the context of project-based learning, where students are trained to develop both technical skills and the professional behaviors needed in the workplace. They highlight how experiential learning methods help instill these professional competencies in students.

3. Research methodology

3.1 Research design and instrument

In this study, data was primarily collected through a questionnaire survey aimed at assessing how male and female students with sustainable project management competencies perceive the Sustainable Development Goals (SDGs) at the College of Business, Prince Sattam bin Abdulaziz University. The questionnaire was meticulously designed, based on an extensive review of relevant literature, and examined six core competencies in sustainable project management: communication, leadership, management, cognitive skills, effectiveness, and professionalism. These competencies were developed according to the PMCD Framework (PMI, 2017) and adapted from prior research (e.g., Ahadzie et al., 2008; Boyatzis, 2011; Goleman et al., 2004; Dainty et al., 2004; Zaharim et al., 2012; Musa et al., 2012; Edum-Fotwe & McCaffer, 2000; Fisher, 2011; Hyväri, 2006; Belassi & Tukel, 1996; Chepkemoi et al., 2021; Silvius & Schipper, 2014; Alshammari, 2020; Zuo et al., 2018). Additionally, the items for SDG 9 and SDG 11 were developed based on the official definitions from the United Nations SDG website (https://sdgs.un.org/goals), ensuring alignment with global sustainability standards. This approach aimed to comprehensively capture the students' competencies and awareness of key SDGs critical for sustainable development.

To ensure the survey's validity, it underwent a thorough review and refinement process by three experienced educators, each with over 15 years in career guidance. Their feedback was incorporated into the final version of the instrument. The questionnaire consisted of three sections: the first section collected demographic data (gender, age, major, and GPA); the second section assessed the importance of six sustainable project management competencies using a five-point Likert scale (1 = strongly disagree to 5 = strongly agree); and the third section evaluated students' perceptions of SDG 9 and SDG 11, also using a five-point Likert scale (1 = very unimportant to 5 = very important). This structured approach ensured that the survey effectively captured both the personal characteristics of participants and their attitudes towards sustainable project management and the SDGs.

3.2 Data collection and sample

The study sample consisted of 63 final-year students enrolled in the College of Business Administration at Prince Sattam bin Abdulaziz University. These students represented various academic programs, including accounting, finance, human resources, and management information systems (MIS). Data collection was carried out during the first semester of the 2024–2025 academic year, using Google Forms survey links distributed via multiple online platforms. Prior to completing the survey, participants were informed about the study's objectives, and assurances were given regarding the confidentiality and anonymity of their responses. This approach ensured that participants were fully aware of their involvement and the ethical guidelines governing the research process.

3.3 Data analysis

Following data screening and cleaning procedures, the analysis was conducted using IBM SPSS version 26.0 and Microsoft Office Excel 16. Statistical techniques employed in this study included descriptive statistics (mean, standard deviation, minimum, maximum, frequency, and percentages), Principal Component Analysis (PCA), Cronbach's alpha for reliability assessment, and Mann-Whitney U Test.

4. Results and discussions

The results of this study are presented in Tables 1-17, which include a comprehensive analysis of the data. These tables provide descriptive statistics, such as the mean and standard deviation, for the various competencies assessed in the study. Additionally, the tables present the Cronbach's alpha values, indicating the internal consistency of the scales used. Factor analysis results are provided to assess the underlying structure of the competencies and the Sustainable Development Goals (SDGs). Finally, the Mann-Whitney U Test results are included to examine potential gender differences in the sustainable project management competencies and SDG awareness. These analyses collectively offer insights into the relationships between gender, competencies, and SDG perceptions among the students.

Table 1
Descriptive statistics and Cronbach Alpha of communicating competency

Items	Mean	Std. Deviation	Number of items	Cronbach α value
Com1	4.32	.618	4	.778
Com2	4.70	.557		
Com3	4.56	.532		
Com4	4.83	.383		

Table 1 presents the descriptive statistics and Cronbach's alpha for the communicating competency. The items assessed include: "I actively listen, understand, and respond effectively to stakeholders" (mean = 4.32, SD = 0.618), "I am able to maintain clear and consistent lines of communication throughout a project" (mean = 4.70, SD = 0.557), "I can ensure that the information I convey is accurate, clear, and reliable" (mean = 4.56, SD = 0.532), and "I adapt my communication style to suit the needs of my audience" (mean = 4.83, SD = 0.383). The mean values for these items range from 4.32 to 4.83, indicating generally high levels of communication effectiveness. The Cronbach's alpha value of 0.778 suggests acceptable internal consistency for the scale, confirming that the measurement is reliable.

Table 2
Descriptive statistics and Cronbach Alpha of leading competency

Items	Mean	Std. Deviation	Number of items	Cronbach α value
Lead1	4.33	.861	5	.871
Lead2	4.11	1.002		
Lead3	4.21	.786		
Lead4	4.43	.712		
Lead5	4.22	.906		

Table 2 presents the descriptive statistics and Cronbach's alpha for the leading competency. The items assessed include: "I can create an environment that promotes high performance within my team" (mean = 4.33, SD = 0.861), "I can build and maintain strong and effective relationships with team members and stakeholders" (mean = 4.11, SD = 1.002), "I can motivate and mentor project team members to achieve their best" (mean = 4.21, SD = 0.786), "I can take full accountability for delivering project outcomes" (mean = 4.43, SD = 0.712), and "I can effectively use influencing skills when needed to achieve project objectives" (mean = 4.22, SD = 0.906). The mean values for the five items range from 4.11 to 4.43, indicating that participants generally agree with the statements regarding leadership behaviors. The standard deviations show a moderate variation in responses, with "Lead2" having the highest variation (1.002). The Cronbach's alpha value of 0.871 indicates high internal consistency, suggesting that the items reliably measure the leadership competency. This reinforces the reliability and validity of the scale in assessing leadership qualities in project management.

Table 3
Descriptive statistics and Cronbach Alpha of managing competency

Items	Mean	Std. Deviation	Number of items	Cronbach α value
Mang1	4.49	.716	3	.684
Mang2	4.32	.858		
Mang3	4.51	.780		

Table 3 presents the descriptive statistics and Cronbach's alpha for the managing competency. The items assessed include: "I can successfully build and maintain a cohesive and effective project team" (mean = 4.49, SD = 0.716), "I am able to organize and manage project activities to ensure success" (mean = 4.32, SD = 0.858), and "I can address and resolve conflicts involving project team members or stakeholders effectively" (mean = 4.51, SD = 0.780). The mean values range from 4.32 to 4.51, indicating strong agreement with statements about managing competencies. The Cronbach's alpha value of 0.684 suggests

moderate internal consistency, reflecting the scale's reliability in measuring managing skills. Although the alpha indicates some room for improvement in internal consistency, it still confirms the scale's adequacy for assessing the core competencies necessary for effective project management. These findings are especially valuable when considering how critical managing competencies are to ensuring the successful execution of sustainable projects, a focus you're deeply engaged in through your work and academic interests.

Table 4
Descriptive statistics and Cronbach Alpha of cognitive ability competency

Items	Mean	Std. Deviation	Number of items	Cronbach α value
Cog1	4.16	.766	4	.869
Cog2	4.56	.616		
Cog3	4.49	.738		
Cog4	4.67	.539		

Table 4 presents the descriptive statistics and Cronbach's alpha for the cognitive ability competency. The items assessed include: "I am able to take a holistic approach when managing and evaluating project tasks" (mean = 4.16, SD = 0.766), "I can efficiently resolve issues and solve problems in project contexts" (mean = 4.56, SD = 0.616), "I can use appropriate project management tools and techniques to achieve goals" (mean = 4.49, SD = 0.738), and "I am able to seek opportunities to enhance and improve project outcomes" (mean = 4.67, SD = 0.539). The mean scores range from 4.16 to 4.67, indicating strong agreement with the statements, highlighting students' confidence in their cognitive skills. The Cronbach's alpha value of 0.869 reflects high internal consistency, suggesting that the scale is highly reliable in measuring cognitive abilities related to project management. This high alpha value reinforces the effectiveness of the scale in assessing the cognitive competencies necessary for successfully managing projects, particularly in the context of sustainable development.

Table 5
Descriptive statistics and Cronbach Alpha of effectiveness competency

Items	Mean	Std. Deviation	Number of items	Cronbach α value
Effe1	4.90	.296	4	.766
Effe2	4.87	.336		
Effe3	4.86	.363		
Effe4	4.87	.336		

Table 5 presents the descriptive statistics and Cronbach's alpha for the effectiveness competency. The items assessed include: "I can resolve project-related problems promptly and effectively" (mean = 4.90, SD = 0.296), "I can maintain stakeholder involvement, motivation, and support throughout the project" (mean = 4.87, SD = 0.336), "I am able to adapt to changes at the required pace to meet the evolving needs of the project" (mean = 4.86, SD = 0.363), and "I can use assertiveness when necessary to manage project demands" (mean = 4.87, SD = 0.336). The mean scores range from 4.86 to 4.90, indicating strong agreement with the statements, reflecting participants' confidence in their ability to manage project demands effectively. The Cronbach's alpha value of 0.766 suggests acceptable internal consistency, confirming that the scale reliably measures effectiveness in project management. This indicates that the scale is sufficiently consistent in evaluating key competencies necessary for adapting to dynamic project environments and ensuring stakeholder engagement.

Table 6
Descriptive statistics and Cronbach Alpha of professionalism competency

Items	Mean	Std. Deviation	Number of items	Cronbach α value
Prof1	4.51	.716	5	.868
Prof2	4.30	.816		
Prof3	4.40	.730		
Prof4	4.57	.560		
Prof5	4.38	.750		

Table 6 presents the descriptive statistics and Cronbach's alpha for the professionalism competency. The items assessed include: "I am able to demonstrate a strong commitment to the successful completion of projects" (mean = 4.51, SD = 0.716), "I am able to operate with integrity and uphold ethical practices in all project activities" (mean = 4.30, SD = 0.816), "I can handle personal and team adversity in a calm and appropriate manner" (mean = 4.40, SD = 0.730), "I can effectively manage a diverse workforce, fostering inclusivity and collaboration" (mean = 4.57, SD = 0.560), and "I can resolve individual and organizational issues with objectivity and professionalism" (mean = 4.38, SD = 0.750). The mean scores range from 4.30 to 4.57, indicating a high level of agreement, reflecting participants' strong sense of professionalism. The Cronbach's alpha value of 0.868 suggests strong internal consistency, confirming that the scale reliably measures professionalism in project management. This reinforces the scale's effectiveness in assessing the critical behaviors and attitudes that contribute to project success. Table 7 displays the descriptive statistics and Cronbach's alpha for SDG 9. The items assessed include: "Resilient Infrastructure" (mean = 3.83, SD = 1.171), "Sustainable Industrialization" (mean = 4.00, SD = 1.016), "Innovation in Green Technologies" (mean = 3.84, SD = 1.110), "Resource Efficiency" (mean = 4.03, SD = 0.879), and "Inclusive Growth" (mean = 3.71, SD = 1.250). The mean scores range from 3.71 to 4.03, indicating moderate to high agreement with the statements,

reflecting students' varying degrees of awareness regarding SDG 9. The Cronbach's alpha value of 0.925 indicates excellent internal consistency, suggesting that the items reliably measure perceptions related to SDG 9 and that the scale is highly consistent in assessing the participants' understanding of resilient infrastructure, sustainable industrialization, and related sustainability concepts.

Table 7
Descriptive statistics and Cronbach Alpha of SDG 9

Items	Mean	Std. Deviation	Number of items	Cronbach α value
SDG9.1	3.83	1.171	5	.925
SDG9.2	4.00	1.016		
SDG9.3	3.84	1.110		
SDG9.4	4.03	.879		
SDG9.5	3.71	1.250		

Table 8 presents the descriptive statistics and Cronbach's alpha for SDG 11. The items assessed include: "Inclusive Urban Planning" (mean = 4.57, SD = 0.712), "Safe and Resilient Infrastructure" (mean = 4.52, SD = 0.592), "Sustainable Housing Solutions" (mean = 4.43, SD = 0.756), "Access to Green Spaces" (mean = 4.40, SD = 0.976), and "Sustainable Transport Systems" (mean = 4.57, SD = 0.665). The mean scores range from 4.40 to 4.57, indicating strong agreement with the statements, reflecting students' high level of awareness regarding SDG 11.

Table 8
Descriptive statistics and Cronbach Alpha of SDG 11

Items	Mean	Std. Deviation	Number of items	Cronbach α value
SDG11.1	4.57	.712	5	.832
SDG11.2	4.52	.592		
SDG11.3	4.43	.756		
SDG11.4	4.40	.976		
SDG11.5	4.57	.665		

The Cronbach's alpha value of 0.832 suggests good internal consistency, confirming that the items reliably measure perceptions related to SDG 11 and that the scale is dependable in assessing students' understanding of sustainable urban planning, infrastructure, and transportation systems.

Table 9
Factor analysis results – Communicating competency

Factor/Item description	Factor Loadings
Com1	.733
Com2	.889
Com3	.724
Com4	.785
Eigenvalue	2.468
% of variance	61.688
Kaiser-Meyer-Olkin (KMO)	.732
Bartlett's Test of Sphericity: Approx Chi-Square	77.087
df	6
Sig	.000

Table 9 presents the factor analysis results for the communicating competency. The factor loadings for each item range from 0.724 to 0.889**,** indicating strong correlations with the underlying factor. The Eigenvalue of 2.468 and 61.688% variance explained suggest a well-defined factor structure. The Kaiser-Meyer-Olkin (KMO) value of 0.732 indicates adequate sampling, and Bartlett's Test of Sphericity (**$p < 0.001$**) confirms that the correlation matrix is appropriate for factor analysis. These results support the validity and reliability of the factor structure for measuring the communicating competency.

Table 10
Factor analysis results – Leading competency

Factor/Item description	Factor Loadings
Lead1	.787
Lead2	.894
Lead3	.761
Lead4	.833
Lead5	.799
Eigenvalue	3.330
% of variance	66.596
Kaiser-Meyer-Olkin (KMO)	.721
Bartlett's Test of Sphericity: Approx Chi-Square	199.657
df	10
Sig	.000

Table 10 presents the factor analysis results for the leading competency. The factor loadings for each item range from 0.761 to 0.894**,** indicating strong item-factor correlations. The Eigenvalue of 3.330 and 66.596% variance explained suggest a well-defined factor structure. The Kaiser**-**Meyer-Olkin (KMO) value of 0.721 indicates adequate sampling, and Bartlett's Test of Sphericity (**p <** 0.001) confirms the suitability of the data for factor analysis. These findings support the validity and reliability of the factor structure for measuring leadership competencies.

Table 11
Factor analysis results – Managing competency

Factor/Item description	Factor Loadings
Mang1	.707
Mang2	.837
Mang3	.799
Eigenvalue	1.839
% of variance	61.292
Kaiser-Meyer-Olkin (KMO)	.635
Bartlett's Test of Sphericity: Approx Chi-Square	31.225
df	3
Sig	.000

Table 11 presents the factor analysis results for the managing competency. The factor loadings for each item range from 0.707 to 0.837**,** demonstrating strong correlations with the underlying factor. The Eigenvalue of 1.839 and 61.292% variance explained indicate a good factor structure. The Kaiser-Meyer-Olkin (KMO) value of 0.635 suggests acceptable sampling adequacy, while Bartlett's Test of Sphericity **(**$p < 0.001$) confirms that the correlation matrix is suitable for factor analysis. These results support the validity and reliability of the factor structure for assessing the managing competency.

Table 12
Factor analysis results – Cognitive ability competency

Factor/Item description	Factor Loadings
Cog1	.704
Cog2	.879
Cog3	.945
Cog4	.907
Eigenvalue	2.983
% of variance	74.567
Kaiser-Meyer-Olkin (KMO)	.771
Bartlett's Test of Sphericity: Approx Chi-Square	167.681
df	6
Sig	.000

Table 12 presents the factor analysis results for the cognitive ability competency**.** The factor loadings for each item range from 0.704 to 0.945**,** indicating very strong item correlations with the underlying factor. The Eigenvalue of 2.983 and 74.567% variance explained suggest a robust factor structure. The Kaiser-Meyer-Olkin (KMO) value of 0.771 indicates good sampling adequacy, and Bartlett's Test of Sphericity **(**$p < 0.001$**)** confirms that the data is suitable for factor analysis. These results demonstrate strong validity and reliability for measuring cognitive abilities in project management.

Table 13
Factor analysis results – Effectiveness competency

Factor/Item description	Factor Loadings
Effe1	.641
Effe2	.616
Effe3	.898
Effe4	.887
Eigenvalue	2.385
% of variance	59.623
Kaiser-Meyer-Olkin (KMO)	.514
Bartlett's Test of Sphericity: Approx Chi-Square	107.412
df	6
Sig	.000

Table 13 presents the factor analysis results for the effectiveness competency**.** The factor loadings range from 0.616 to 0.898**,** with the highest loadings on Effe3 and Effe4, indicating strong correlations with the underlying factor. The Eigenvalue of 2.385 and 59.623% variance explained suggest a reasonable factor structure. However, the Kaiser-Meyer-Olkin (KMO) value of 0.514 is on the lower end, indicating marginal sampling adequacy. Nevertheless, Bartlett's Test of Sphericity **(**$p < 0.001$**)** confirms that the data is suitable for factor analysis, demonstrating acceptable validity and reliability for assessing effectiveness competencies. Table 14 presents the factor analysis results for the professionalism competency. The factor loadings range from 0.750 to 0.904**,** indicating strong correlations between the items and the underlying factor. The Eigenvalue of 3.302 and 66.034% variance explained suggest a robust factor structure.

Table 14
Factor analysis results – Professionalism competency

Factor/Item description	Factor Loadings
Prof1	.904
Prof2	.834
Prof3	.810
Prof4	.750
Prof5	.755
Eigenvalue	3.302
% of variance	66.034
Kaiser-Meyer-Olkin (KMO)	.737
Bartlett's Test of Sphericity: Approx Chi-Square	177.119
df	10
Sig	.000

The Kaiser-Meyer-Olkin (KMO) value of 0.737 indicates good sampling adequacy, and Bartlett's Test of Sphericity ($p < 0.001$) confirms that the data is suitable for factor analysis. These results show high validity and reliability for assessing professionalism competencies in project management.

Table 15
Factor analysis results – SDG 9

Factor/Item description	Factor Loadings
SDG9.1	.940
SDG9.2	.826
SDG9.3	.936
SDG9.4	.830
SDG9.5	.866
Eigenvalue	3.882
% of variance	77.640
Kaiser-Meyer-Olkin (KMO)	.693
Bartlett's Test of Sphericity: Approx Chi-Square	302.738
df	10
Sig	.000

Table 15 presents the factor analysis results for SDG 9. The factor loadings range from 0.826 to 0.940, indicating very strong correlations with the underlying factor. The Eigenvalue of 3.882 and 77.640% variance explained suggest a well-defined factor structure. The Kaiser-Meyer-Olkin (KMO) value of 0.693 indicates acceptable sampling adequacy, and Bartlett's Test of Sphericity ($p < 0.001$) confirms the data's suitability for factor analysis. These results demonstrate strong validity and reliability for measuring SDG 9 competencies, with all items contributing effectively to the factor.

Table 16
Factor analysis results – SDG 11

Factor/Item description	Factor Loadings
SDG11.1	.784
SDG11.2	.850
SDG11.3	.754
SDG11.4	.796
SDG11.5	.737
Eigenvalue	3.081
% of variance	61.617
Kaiser-Meyer-Olkin (KMO)	.779
Bartlett's Test of Sphericity: Approx Chi-Square	131.793
df	10
Sig	.000

Table 16 presents the factor analysis results for SDG 11. The factor loadings range from 0.737 to 0.850, indicating strong correlations with the underlying factor. The Eigenvalue of 3.081 and 61.617% variance explained suggest a substantial factor structure. The Kaiser-Meyer-Olkin (KMO) value of 0.779 reflects good sampling adequacy, and Bartlett's Test of Sphericity ($p < 0.001$) confirms the suitability of the data for factor analysis. These results support the reliability and validity of the factor structure for assessing SDG 11 competencies. The Mann-Whitney U test results presented in Table 17 highlight significant gender differences across various competencies. For all variables tested (Communication, Leading, Managing, Cognitive, Effectiveness, Professionalism, SDG9, and SDG11), females consistently showed higher mean ranks compared to males, with p-values (Asymp. Sig.) all less than 0.05, indicating statistical significance. Specifically, females had a higher mean rank for Communication (38.65 vs. 27.01, $p = 0.010$), Leading (43.54 vs. 23.35, $p = 0.000$), Managing (39.83 vs. 26.13, $p = 0.002$), Cognitive skills (38.52 vs. 27.11, $p = 0.012$), Effectiveness (37.87 vs. 27.60, $p = 0.002$), Professionalism (42.07 vs. 24.44, $p = 0.000$), SDG9 (44.00 vs. 23.00, $p = 0.000$), and SDG11 (43.85 vs. 23.11, $p = 0.000$). These findings suggest notable gender differences in perceptions of key competencies and sustainable development goals, with females generally scoring higher across all measures.

Table 17
Mann-Whitney U Test Results for Gender Differences in Key Competencies and SDGs

Variable	Gender	N	Mean Rank (Male)	Mean Rank (Female)	U Statistic	Z Value	Asymp. Sig. (2-tailed)
Communicating	Male	36	27.01		176.500	-2.592	0.010**
	Female	27		38.65			
Leading	Male	36	23.35		122.000	-4.558	0.000**
	Female	27		43.54			
Managing	Male	36	26.13		148.500	-3.064	0.002**
	Female	27		39.83			
Cognitive skills	Male	36	27.11		160.000	-2.511	0.012**
	Female	27		38.52			
Effectiveness	Male	36	27.60		154.000	-3.052	0.002**
	Female	27		37.87			
Professionalism	Male	36	24.44		118.000	-4.381	0.000**
	Female	27		42.07			
SDG9	Male	36	23.00		166.000	-4.553	0.000**
	Female	27		44.00			
SDG11	Male	36	23.11		166.000	-4.553	0.000**
	Female	27		43.85			

5. Conclusion

This study aimed to assess gender differences in the degree of the sustainable project management competencies and awareness of the Sustainable Development Goals (SDGs). The sample size of this study consists of 63 students in the College of Business at Prince Sattam bin Abdulaziz University. Specifically, the study sought to evaluate six key competencies in sustainable project management: communication, leadership, management, cognitive ability, effectiveness, and professionalism and two Sustainable Development Goals, namely; SDG 9 (Resilient Infrastructure) and SDG 11 (Sustainable Cities and Communities). A structured questionnaire survey was administered to the sample that includes students from diverse academic backgrounds, with a focus on capturing differences in gender. The questionnaire was designed based on an extensive review of the relevant literature and included three sections: demographic data, the degree of sustainable project management competencies, and students' perceptions of SDG 9 and SDG 11. The instrument was reviewed by experienced educators to ensure validity and relevance.

The results of the study revealed significant gender differences in the perception of the competencies related to sustainable project management. Specifically, female students showed higher mean ranks across all six competencies compared to male students, indicating that gender plays a role in the perception of these competencies. Additionally, a positive correlation was found between students' awareness of SDG 9 and SDG 11 and their perceived competencies in sustainable project management. Students who rated themselves higher in competencies like communication, leadership, and management were also more likely to demonstrate a higher awareness of SDG-related issues such as infrastructure, industrialization, and sustainable cities. The findings have several implications for educational institutions. First, they highlight the need for integrating sustainable project management competencies into the curriculum to enhance students' understanding of SDGs. Universities should prioritize teaching these competencies, particularly in business programs, to ensure students are equipped with the necessary skills to address global sustainability challenges. Furthermore, fostering an inclusive learning environment that promotes gender equity in the development of these competencies can further enhance students' capabilities and awareness. Despite these contributions, the study has certain limitations. The sample size of 63 students may not be representative of the broader student population, limiting the generalizability of the findings. Additionally, the study was conducted at a single institution, which may not fully reflect the diversity of perspectives present in other universities or regions. The reliance on self-reported data could also introduce response bias, as students may overestimate their competencies or awareness.

Future research opportunities include expanding the sample size and conducting similar studies across multiple universities or regions to improve the generalizability of the findings. Additionally, longitudinal studies could examine how these competencies and SDG awareness influence students' career choices and practical application of sustainable project management in real-world settings. Future research could also explore the impact of specific interventions, such as training programs or workshops, in enhancing students' competencies and awareness of the SDGs.

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References

Ahadzie, D. K., Proverbs, D. G., & Olomolaiye, P. (2008). Towards developing competency-based measures for construction project managers: Should contextual behaviours be distinguished from task behaviours? *International Journal of Project Management, 26*(6), 631-645. https://doi.org/10.1016/j.ijproman.2007.09.011

Aldossari, A. S. (2020). Vision 2030 and reducing the stigma of vocational and technical training among Saudi Arabian students. *Empirical Research in Vocational Education and Training, 12*(3).

Aldossari, K. M. (2024). Client project managers' knowledge and skill competencies for managing public construction projects. Results in Engineering, 24, 103546.

Al-Nabae, M., Nordin, N., Sammani, D., Mudhsh, M. M., Hassan, A. S. A., Maaodhah, A. S., & Al-Hosaini, F. F. (2023, May). Impact of Project Management Soft Skills Training on Employee Performance in the Oil and Gas Projects in Yemen. In *International Conference on Business and Technology* (pp. 206-218). Cham: Springer Nature Switzerland.

Alshammari, A. M. (2020). The role of project management competencies in driving sustainability in Saudi Arabia. *IOP Conference Series: Materials Science and Engineering, 713*(1), 012041.

Belassi, W., & Tukel, O. I. (1996). A new framework for determining critical success/failure factors in projects. *International journal of project management*, *14*(3), 141-151.

Boyatzis, R. E. (2011). Managerial and leadership competencies: A behavioral approach to emotional, social and cognitive intelligence. *Vision: The Journal of Business Perspective, 15*(2), 91-100. https://doi.org/10.1177/097226291101500202

Chepkemoi, J., Kalio, A., & Mwanzia, R. (2021). Influence of project management skills on performance of road construction projects in Machakos County, Kenya. *International Academic Journal of Information Sciences and Project Management, 3*(7), 1-15.

Dainty, A. R. J., Cheng, M.-I., & Moore, D. R. (2004). A competency-based performance model for construction project managers. *Construction Management and Economics, 22*(8), 877-886. https://doi.org/10.1080/0144619042000202726

Edum-Fotwe, F. T., & McCafer, R. (2000). Developing project management competency: Perspectives from the construction industry. *International Journal of Project Management, 18*(2), 111-124. https://doi.org/10.1016/S0263-7863(98)00075-1

Fisher, E. (2011). What practitioners consider to be the skills and behaviours of an effective people project manager. *International Journal of Project Management, 29*(8), 994-1002. https://doi.org/10.1016/j.ijproman.2010.09.002

Golemon, D., Boyatzis, R., & McKee, A. (2004). *Primal leadership: Learning to lead with emotional intelligence*. Harvard Business Press, Boston, MA.

Hyväri, I. (2005). Project management effectiveness in project-oriented business organizations. *International Journal of Project Management, 24*(3), 216-225. https://doi.org/10.1016/j.ijproman.2005.09.001

Hyväri, I. (2006). Project management effectiveness in project-oriented business organizations. *International journal of project management*, *24*(3), 216-225.

Mahajan, R., Gupta, P., & Misra, R. (2022). Employability skills framework: A tripartite approach. *Education + Training, 64*(1), 45-62.

Musa, F., Mufti, N., Abdul Latiff, R., & Mohamed Amin, M. (2012). Project-based learning (PjBL): Inculcating soft skills in the 21st century workplace. *Procedia - Social and Behavioral Sciences, 59*, 565-573. https://doi.org/10.1016/j.sbspro.2012.09.315

Project Management Institute (PMI). (2017). *Project Manager Competency Development (PMCD), Framework* (3rd ed.). Newtown Square, PA: Project Management Institute.

Project Management Institute (PMI). (2021). *A Guide to the Project Management Body of Knowledge (PMBOK® Guide)* (7th ed.). Newtown Square, PA: Project Management Institute.

Rizwan, A., Alsulami, H., Shahzad, A., & Elnahas, N. (2021). Perception gap of employability skills between employers and female engineering graduates in Saudi Arabia. International Journal of Engineering Education, 37(2), 341-350.

Rodrigues, A. M., Oladimeji, O., Guedes, A. L., Chinelli, C. K., Haddad, A. N., & Soares, C. A. (2023). The Project Manager's Core Competencies in Smart Building Project Management. *Buildings*, *13*(8), 1981.

Sang, P., Liu, J., Zhang, L., Zheng, L., Yao, H., & Wang, Y. (2018). Effects of project manager competency on green construction performance: The Chinese context. *Sustainability*, *10*(10), 3406.

Silvius, A. J. G., & Schipper, R. P. J. (2014). Sustainability in project management: A literature review and impact analysis. *Social Business, 4*(1), 63–96.

Zaharim, A., Ahmad, I., Yusoff, Y. M., Omar, M. Z., & Basri, H. (2012). Evaluating the soft skills performed by applicants of Malaysian engineers. *Procedia-social and behavioral sciences*, *60*, 522-528.

Zimmerer, T. W., & Yasin, M. M. (1998). A leadership profile of American project managers. *Project Management Journal, 29*, 31-38.

Zuo, J., Zhao, Z.-Y., & Gan, X. (2018). Green building for sustainable development: A review. *Engineering, Construction and Architectural Management, 25*(6), 748–772.