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A Stakeholder-Centric Approach to Advancing the Circular Economy in the Building Sector

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Abstract: Since the Industrial Revolution, climate change has intensified due to rising greenhouse gas emissions, leading to severe environmental impacts. Given the building sector's significant contribution to climate change, the circular economy has emerged as a key mitigation strategy. Despite political support and some advancements, significant barriers persist in the building sector's transition to the circular economy. This article explores the pivotal role of stakeholders as essential agents of change, highlighting the necessity of a concentrated effort on stakeholder engagement in the building sector's circular economy transition. Using an online questionnaire, this article evaluated the current status of the building sector, as well as stakeholders' awareness, roles, and perspectives on the transition. The results revealed that while stakeholders are aware of their environmental impacts, knowledge gaps persist, particularly in waste management and circular economy practices. The stakeholders recognize that the transition is happening, but there is a sense of uncertainty about its effectiveness due to substantial barriers. Despite these barriers, there is an increasing commitment toward the practices of the circular economy, underscoring the need for policy development, infrastructure provision, and training programs to support the transition. This article contributes to the literature by providing insights into key stakeholders' perspectives and offering actionable strategies to enhance engagement for a more effective transition to the circular economy in the building sector.

Keywords: building sector; circular economy; climate change; effectiveness; stakeholders

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1. Introduction

Since the beginning of the Industrial Revolution, there has been a marked escalation in climate change and its related effects, primarily driven by increased greenhouse gas emissions from human activities [1]. As these emissions rise, the repercussions of climate change on both human and natural systems become increasingly evident [2]. Significant outcomes of climate change at both global and national scales include the rise in average global temperatures, higher levels of atmospheric CO_2, and shifts in weather patterns, particularly in precipitation [3,4]. These alterations lead to further outcomes, such as melting global ice sheets, which contribute to rising sea levels; ocean acidification; and extreme weather phenomena, including floods, droughts, and heat waves [4].

Among the various sectors that contribute to climate change, the building sector is identified as a major contributor due to its substantial direct and indirect environmental impacts, which arise from high levels of natural resource consumption and the resultant waste and greenhouse gas emissions [5,6]. Consequently, a complex and interdependent relationship exists between climate change and the building sector, characterized by mutual environmental impacts [7].

The relationship between climate change and the building sector necessitates a comprehensive, whole-life system perspective rather than the current fragmented approach, which hinders collaborative efforts to decarbonize the building sector [8]. Engaging stakeholders is crucial to enhance support and improve the likelihood of successfully implementing climate change adaptation and mitigation strategies. In this context, the circular economy emerges as an effective strategy to address climate change challenges within the building sector [9]. It signifies a fundamental transformation in the global economic framework and its operational mechanisms, particularly concerning the relationship between climate change and the building sector [10,11].

While the importance of the circular economy transition in the building sector in the context of climate change is increasingly recognized in the scientific literature [12,13], many barriers remain, particularly in stakeholder engagement. Several authors [14–16] have highlighted the substantial importance of stakeholder engagement in the building sector's circular economy transition while focusing on isolated stages of the building life cycle or narrow groups of stakeholders. Thus, these studies leave a gap in understanding how to effectively reinforce stakeholder engagement across the entire building life cycle [17]. This article addresses this gap by offering a holistic understanding of stakeholder awareness, roles, and perspectives across the entire building life cycle, advancing the existing stakeholder-centric approaches. Unlike these studies that isolate specific phases or stakeholders, this article considers a broader view, offering insights into the perspectives of key stakeholders and providing actionable strategies to enhance stakeholder engagement for a more effective transition to the circular economy in the building sector.

Departing from the relationship between climate change and the building sector, this article addresses the circular economy as a key mitigation strategy (Section 1). This article discusses the circular economy transition while underscoring the importance of stakeholder engagement in driving effective circular economy implementation in the building sector (Section 2). This article then explains its methodological approach as an online questionnaire (Section 3). After conducting the online questionnaire, this article presents and discusses its results (Section 4). Finally, this article concludes its statement (Section 5).

2. Literature Review

The Ellen MacArthur Foundation [10] defines the circular economy as aiming to restore and regenerate resources through design and maximize the utility and value of products, components, and materials throughout their lifecycle. However, even though some authors [18,19] criticize the circular economy due to its perceived lack of attention to social dimensions, unclear contributions to sustainability, overemphasis on technological fixes, lack of clarity and consensus, and normative policy advocacies, they also claim that criticism of the circular economy does not challenge the concept of circularity.

The building sector is recognized as a key player in the transition toward the circular economy [20,21] due to its substantial impact on global resource use, energy demands, and greenhouse gas emissions, which account for 40%, 41%, and 30%, respectively [22,23]. Furthermore, this sector is vital to the economy, significantly contributing to the Gross Domestic Product (GDP) and providing diverse direct and indirect job opportunities [24,25]. As a result, the circular economy aims to harness environmental benefits by reducing environmental impact while promoting socio-economic benefits by implementing innovative business models while seeking to strengthen community resilience, enhancing social well-being and comfort, and generating local employment opportunities within the building sector [26].

The benefits of the circular economy throughout the building life cycle have been progressively integrated into policies, legislation, and incentives. This integration has occurred

in theory and practice through various business models and strategies within the building sector. Key areas of focus include waste management and valorization [27,28], design for reversible buildings [29,30], and the establishment of business and stakeholder networks along the value chain [31,32]. Nevertheless, implementing essential strategies and business models continues to encounter barriers, remaining a niche endeavor in fostering the conditions necessary for the circular economy within the building sector [33,34]. Despite the gradual progress, the effectiveness of the circular economy's implementation in this sector is hindered by the absence of a clear and universally accepted definition [35], resulting in fragmented development and prevalent misconceptions [36]. Consequently, the current transition toward the circular economy in the building sector can be characterized as an infancy stage, marked by various barriers that obstruct its effective implementation [37,38].

The transition to the circular economy within the building sector is progressing slowly, primarily due to the dominance of barriers over drivers. Conservative and traditional social dynamics largely influence this situation in the sector, contributing to intricate organizational dynamics characterized by fragmented stakeholder engagement [39]. The stakeholders often lack a holistic, interdisciplinary understanding of each other's roles, objectives, and the environmental impacts of their decisions. Consequently, it leads to limited information exchange, hindering long-term focus on their practices for regulatory compliance rather than sustainable and circular solutions. Thus, fragmented stakeholder engagement poses significant barriers to promoting the circular economy throughout the building life cycle and beyond [40,41].

Stakeholder engagement is crucial in overcoming these barriers and fostering collaboration and communication across the building life cycle [42]. In the existing scientific literature, several authors focused on this argument, reinforcing stakeholder engagement to address the circular economy transition in the building sector. Their research studies utilized systematic or critical literature review methodology and stakeholder interviews to analyze stakeholder's role [43] and perspective on the barriers and drivers toward the circular economy transition in the building sector [14–17] while not directly seeking to determine the importance of stakeholders across the building life cycle.

This article, thus, offers a novel contribution to understand and evaluate stakeholder's importance in advancing the circular economy while providing a new perspective on its transition in the building sector. This article aims to conduct an online questionnaire to understand and evaluate the building sector's transition toward the circular economy and stakeholders' role in it. Therefore, this article aims to evaluate at which point the building sector is in the circular economy transition, what the stakeholders think and know about it, and which stakeholders have the key roles with respect to others to guide a more effective transition for achieving climate change mitigation. Hence, it aims to strengthen the statement on the importance of stakeholders and the necessity of reinforced stakeholder engagement toward the effective circular economy transition. In conclusion, this article aims to offer actionable strategies to enhance stakeholder engagement for a more effective transition to the circular economy in the building sector.

3. Methodology

This article employed an online questionnaire to achieve the stated objectives by reaching participants from diverse roles, skills, and backgrounds who have been working in the prevailing linear state of the building sector, not only as researchers and other public and governmental roles but also as project professionals, suppliers, and clients. The workflow of the online questionnaire as the methodological approach encompassed three stages, namely data collection; data processing; and data analysis, as illustrated in Figure 1.

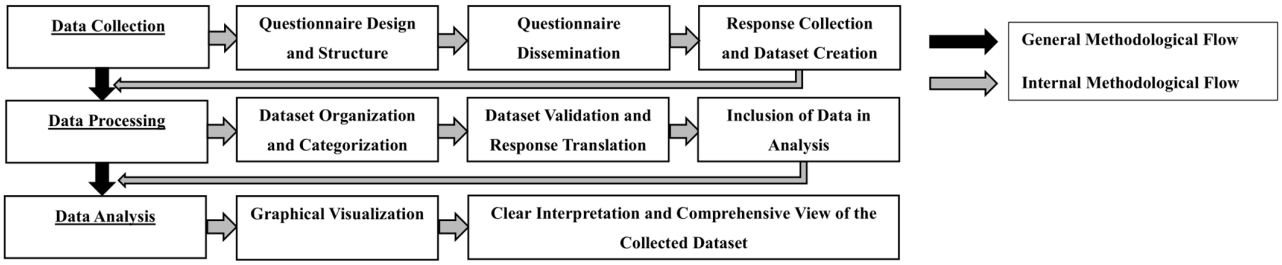


Figure 1. Research methodology workflow (elaborated by the author).

3.1. Data Collection

The online questionnaire was designed by the author in three different languages (English, Turkish, and Italian) to increase the number of participants. The questionnaire was prepared on the Google Forms platform and shared through the institutional mailing list and social networks (LinkedIn). It was further disseminated thanks to the Italian Scientific Society of Architectural Technology (SITdA).

The questionnaire was available in the following links:

- https://forms.gle/EhKhZPp7LVVLkK5P7 (In English) (accessed on 10 November 2024)
- https://forms.gle/7b3DwR8Sstq76SNf9 (In Turkish) (accessed on 10 November 2024)
- https://forms.gle/YSXzpiYvYwb2e7K6A (In Italian) (accessed on 10 November 2024)

The online questionnaire commenced with an introductory page that outlined the background, objectives, and ethical considerations associated with the questionnaire. The participants were free to select their preferred language. No names or other personal information was requested.

The questionnaire contained a total number of six parts with ninety-one questions. The questions were carefully crafted according to several studies [14–17,43] regarding the interview or questionnaire methodologies utilized to analyze stakeholder's role and perspective on the building sector's circular economy transition. A combination of multiple-choice and Likert scale questions was used to collect the data.

The questions were designed to capture the participants' demographic information, general knowledge about building sectors' environmental impacts, their experience with circular economy practices, and their perceptions of the barriers to transitioning to the circular economy. Each section of the questionnaire was structured to ensure clarity and reduce any ambiguity for the participants. The full version of the questionnaire, in English, is available in Appendix A.

The first part of the questionnaire, Part 1, aimed to obtain the participants' demographic information through multiple choice answers regarding their age group, gender, highest education level, and the stakeholder role representing them in the building sector value chain. The question regarding the participants' country was an open-ended one.

The second part, Part 2, of the questionnaire aimed to obtain the participants' general knowledge about the environmental impact of the building sector. This part contained the questions to be answered based on the Likert scale (1—I don't know at all; 2—I have minimal knowledge; 3—I have some knowledge; 4—I have good knowledge; 5—I know very well), except the last question, which was responded based on multiple choice answers. The questions have been prepared to orientate the participants from the building sector's environmental impacts to the building sector's decarbonization and circular economy concepts. The aim was to understand the participants' knowledge about the circular economy concept as a decarbonization strategy for reducing the building sector's environmental impacts. Part 2 concluded with the last question to understand if the participants had experience in the circular economy practices in the building sector. If the answer

was "Yes", the participants could continue with the successive parts of the questionnaire. However, if it was "No", the questionnaire was terminated. The aim was to make the participants continue with the successive parts of the questionnaire, which were related to the circular economy practice experiences, only if the participants had any. This approach could collect general knowledge even if the participants did not have circular economy experience. Still, the circular economy experience data could be obtained only from real circular economy practitioners.

The third part, Part 3, of the questionnaire aimed to address two questions based on the Likert scale (1—Strongly disagree; 2—Disagree; 3—Neutral; 4—Agree; 5—Strongly Agree). The questions regarded the building sector's transition toward the circular economy. Thus, it aimed to understand the participants' ideas based on their experiences with the circular economy transition and the barriers to it.

The fourth part, Part 4, of the questionnaire addressed ten sub-questions under a single one to the participants. The questions were answered based on the Likert scale (1—Not important at all; 2—Slightly important; 3—Neutral; 4—Important; 5—Extremely Important). The questions concerned the barriers to the building sector's circular economy transition. The barriers have been presented in general themes without specific details from environmental, technical and technological, economic, political and regulatory, organizational, and social barrier groups. The aim was to reduce the time required to complete the questionnaire. Part 4 aimed to collect the general ideas of the participants about the barriers faced by circular economy practices in the building sector. Furthermore, it aimed to understand to what degree the participants think the barriers are important in circular economy practices in the building sector.

The fifth part, Part 5, of the questionnaire contained five sub-questions under a single one that the participants were asked to answer based on the Likert scale (1—Strongly disagree; 2—Disagree; 3—Neutral; 4—Agree; 5—Strongly agree). The questions referred to what the participants think about the practices and current state of the building sector's circular economy transition. Therefore, this part aimed to collect the participants' ideas about the effective implementation of the circular economy, whether it could be achieved or not, and if yes, how it could be achieved. The questions were oriented around the complexity of the building sector as a main cause of the barriers to the circular economy transition and the concept of stakeholders as a solution for its effectiveness. Therefore, this part aimed to comprehend the participants' ideas about whether stakeholders could be the solution for the effective implementation if collaboration and communication among them are ensured. Thus, this part of the questionnaire aimed to reinforce the statement on the importance of stakeholders and the necessity of reinforced stakeholder engagement toward the effective circular economy transition in the building sector.

The sixth part, Part 6, of the questionnaire included a total number of sixty-one questions addressed to the participants who were asked to answer based on the Likert scale (1—Not important at all; 2—Slightly important; 3—Neutral; 4—Important; 5—Extremely important). This part of the questionnaire aimed to collect the participants' ideas about to what degree they think stakeholders, throughout the building life cycle phases, have importance in the practice to achieve an effective implementation of the circular economy in the building sector. Thus, it aimed to comprehend which stakeholders have the key roles with respect to others to guide a more effective transition. The external governmental (public and legal authorities, and governmental institutions) and public (non-governmental organizations, civil society and community, media (press), academia (researchers and experts) and the environment) stakeholders have been listed apart due to their indirect involvement in the whole building life cycle phases.

The online questionnaire was conducted in full agreement with the national and international regulations in compliance with the Declaration of Helsinki (2000). All the participants were fully informed about the requirements and were required to accept the data sharing and privacy policy before participating. Their personal information and data were anonymous to maintain and protect the participants' confidentiality according to the provisions of the General Data Protection Regulation (GDPR 679/2016) [44]. The anonymous nature of the online questionnaire did not allow for tracing in any way sensitive personal data. Therefore, the online questionnaire did not require approval from the Ethics Committee.

3.2. Data Processing

The participants completed the questionnaire directly connected to the Google Form, and each response was sent to the final database. According to Google's privacy policy, the participants' responses were anonymous and confidential [45]. The participants would have been able to withdraw their participation in the questionnaire at any stage before the submission; non-completed responses were not saved.

Once the questionnaire was concluded, the final database was downloaded as a Microsoft Excel sheet. It was organized and categorized to facilitate data analysis. The database was then validated by double-checking the consistency of the responses, even if incomplete responses were not an issue, thanks to the questionnaire's design, as each section of the questionnaire was mandatory for submission. The database validation involved a comparison of responses based on the Likert scale questions to ensure that they were consistent and logically aligned. The database was then reviewed for any discrepancies in responses to ensure that there were no contradictions. Finally, the database was controlled to ensure that all the responses made sense in the context of the question and that no answer was randomly selected or clearly disengaged. The database validation helped to ensure that the data collected accurately represented the views of stakeholders and was free from errors that could distort the findings. After that, the Turkish and Italian responses were translated into English. Finally, all the responses were included in the data analysis.

3.3. Data Analysis

The responses were then visualized using various types of graphs, including bar charts, pie charts, and histograms, to understand stakeholders' perspectives on the circular economy and its transition in the building sector. These visualizations helped identify key patterns and trends in the data, such as the frequency of specific responses and the distribution of perspective regarding the barriers to adopting circular economy practices. The graphical representations enabled a clear interpretation of the stakeholders' awareness, roles, and knowledge about circular economy practices, providing a comprehensive view of the collected data.

4. Results and Discussion

The online questionnaire was launched on 8 March 2024 and concluded on 28 July 2024. A total of 43 responses have been received, encompassing 30 responses for the questionnaire in Italian, 7 in Turkish, and 6 in English.

4.1. Part 1: Demographic Information

The results obtained from the participants' demographic information, as a comprehensive overview, have been demonstrated in Table 1.

The results demonstrated a varied age distribution, with the dominance of the 31–40 and 18–30 age groups, balanced representation of the 51–60 and 41–50 age groups, and

lesser representation of the 60+ age group (Figure 2a). Due to the uneven distribution of the participants across these age groups, it was not possible to draw conclusive insights.

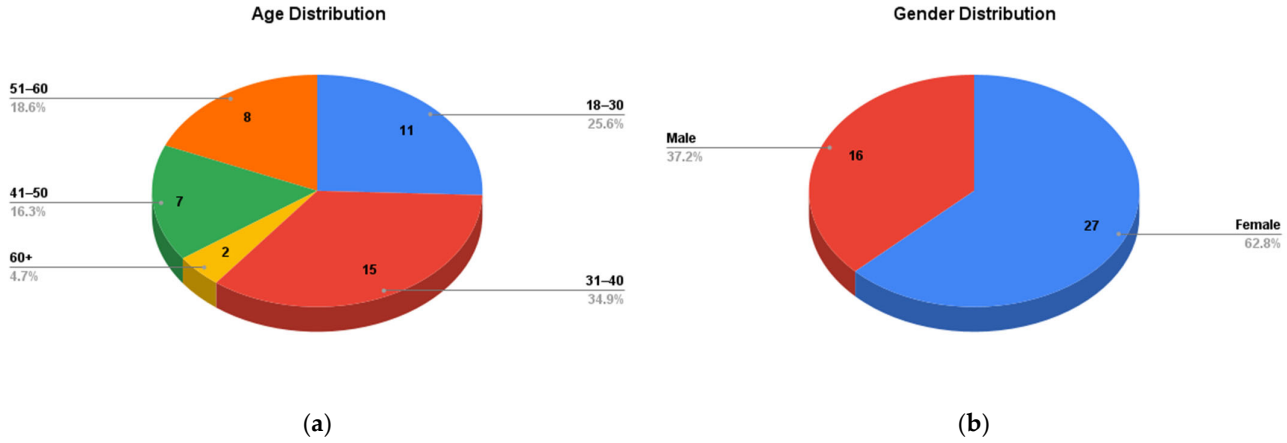
Table 1. Comprehensive overview of demographic information (elaborated by the author).

Demographic Information Category	Response Options	Number of Responses
Age	18–30	11 (25.6%)
	31–40	15 (34.9%)
	41–50	7 (16.3%)
	51–60	8 (18.6%)
	60+	2 (4.7%)
Gender	Male	16 (37.2%)
	Female	27 (62.8%)
Country	Open-Ended Question	Italy—29 (67.4%)
		Türkiye—7 (16.3%)
		Germany—2 (4.7%)
		Colombia—1 (2.3%)
		Egypt—1 (2.3%)
		Romania—1 (2.3%)
		The Netherlands—1 (2.3%)
		The USA—1 (2.3%)
Highest Level of Education	Secondary Education	0 (0%)
	Bachelor's Degree	4 (9.3%)
	Master's Degree	15 (34.9%)
	Doctorate Degree	24 (55.8%)
Stakeholder's Role	Client (Owner and User/Consumer)	0 (0%)
	Project Professional (Bank/Financial Institution, Project Manager, Designer, Architect, Engineer, Facility Manager, Contractor, Subcontractor, Construction Company, Real Estate Agency, Demolition and Deconstruction Company, and Waste Treatment Company)	21 (48.8%)
	Supplier (Supplier/Vendor and Manufacturer)	0 (0%)
	Public (Non-Governmental Organizations, Civil Society and Community, Media, Academia, and Environment)	22 (51.2%)
	Government (Public and Legal Authorities, and Governmental Institutions)	0 (0%)

The results demonstrated a significant representation of females over males (Figure 2b), stating their keen interest in the circular economy transition in the building sector. The female predominance might reflect their significantly growing involvement in sustainability-related roles in the building sector. This, in turn, could provide a unique angle on fostering a more inclusive environment and approach while encouraging participation and enhancing community impact, social sustainability, and communicative and collaborative actions to drive the effective implementation of the circular economy in the building sector [21].

The results demonstrated the highest number of participants from Italy and Türkiye (Figure 3), which could be attributed to the author's network built throughout his career. On the other hand, the remaining participants were spread across various countries, each contributing diversity and enriching varied insights but introducing a limited global

international representation (Figure 3). The results highlighted the predominance of European participants, stating the significance of the European Union's policies, regulations, incentives, and academic research prioritizing sustainability and circular economy practices [20,21]. However, insufficient data made it impossible to compare different countries' perspectives or European and non-European perspectives.



(**a**) (**b**)

Figure 2. (**a**) Age distribution; (**b**) gender distribution (elaborated by the author).

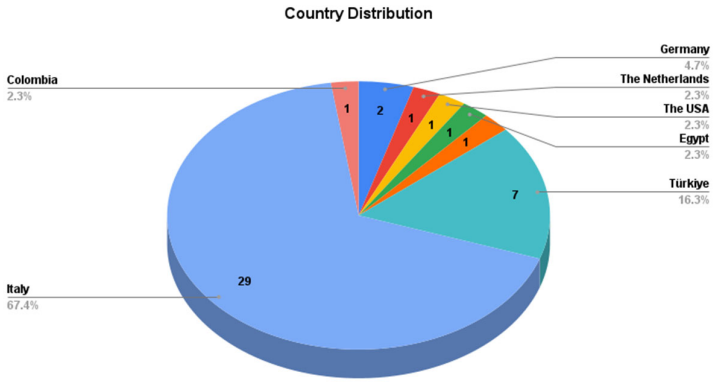
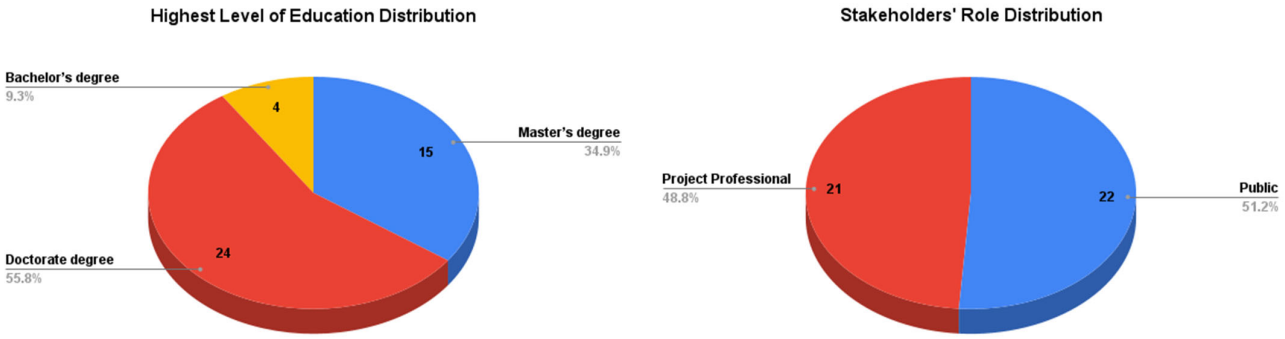


Figure 3. Country distribution (elaborated by the author).

The results demonstrated that the questionnaire was administered to participants with significant expertise and a deep understanding of the issues related to the circular economy in the building sector (Figure 4a). This, in turn, could enhance the reliability and depth of the insights gathered, making the results particularly valuable for academic and sectoral, and thus theoretical and practical purposes. Thus, it reflects the complexity of the topic and the specific interest of more academically inclined or specialized stakeholders in the circular economy implementation in the building sector [46]. As a result, it marks the lack of circular economy integration in architecture, engineering, and urban planning curriculums at the bachelor's degree level at the universities, stating it as a concept for higher degree education for the master's and doctoral degrees [47].

The results demonstrated an almost equal distribution of well-rounded data from public and project professional perspectives (Figure 4b). The public external stakeholders involved non-governmental organizations, civil society and community, media, academia, and the environment. On the other hand, the project professionals were a sub-stakeholder group under the internal stakeholders, which involved bank and financial institutions, project managers, designers, architects, engineers, facility managers, contractors, subcontractors, construction companies, real estate agencies, demolition and deconstruction companies, and waste treatment companies. Per the highest education level distribution,

this questionnaire captures that most public stakeholders had an academic background, reflecting the specific stakeholder type of academia focusing on sustainability and the circular economy. This, in turn, brings the academia's both theoretical and practical perspectives to the questionnaire's results. On the other hand, the project professionals' involvement brings a detailed practical perspective. Even though the questionnaire also aimed to reach the other internal stakeholders, encompassing owners, users/consumers, suppliers, manufacturers, and governmental external stakeholders, no responses have been received. There is a notable gap in the results of this questionnaire.



(**a**) (**b**)

Figure 4. (**a**) Highest level of education distribution; (**b**) stakeholder's role distribution (elaborated by the author).

4.2. Part 2: General Knowledge About the Environmental Impact of the Building Sector

The results of the first question (Figure 5), "To what extent do you know the building sectors' environmental impact?" indicated the stakeholders' high level of knowledge and awareness about the building sector's environmental impact, specifically for the natural resource demand and consumption and greenhouse gas emissions, while notably for waste production, their knowledge and awareness are less comprehensive [48,49]. These results highlighted the need for training and educational campaigns to address the stakeholder knowledge gap, particularly regarding waste production in the building sector [14,42].

The results of the second question (Figure 6), "Do you know the concept of decarbonization in the building sector?" indicated that the stakeholders are very well informed about the circular economy concept as a decarbonization strategy for the reduction in the building sector's environmental impacts while underscoring a considerably moderate level of understanding about some educational programs to be targeted that could further enhance understanding, especially on the impact of decarbonization on goods production and usage [50]. However, per the previous results obtained with Part 1, the questionnaire has been performed by highly educated academic and project professionals in the sustainability and the circular economy concepts, showcasing that the results obtained with Part 2 may not represent the actual state of the knowledge and awareness of the stakeholders in the building sector. Therefore, further educational and training initiatives and targeted policies, regulations, and incentives could help address the knowledge gaps and foster greater awareness, as also noted by [51,52], toward implementing the circular economy in the building sector while reducing the building sector's environmental impacts and mitigating climate change.

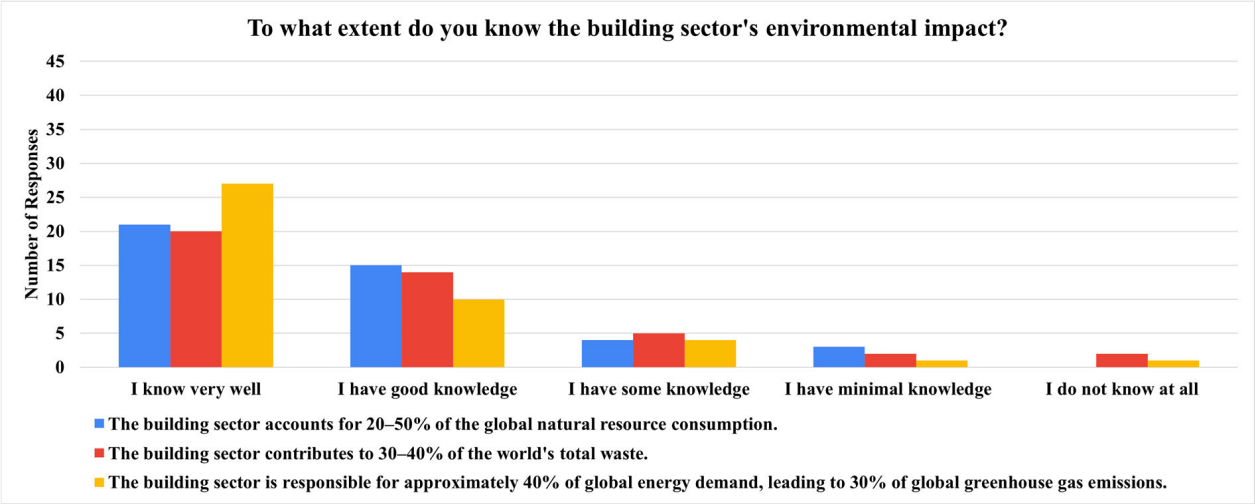


Figure 5. General knowledge about the building sector's environmental impacts (elaborated by the author).

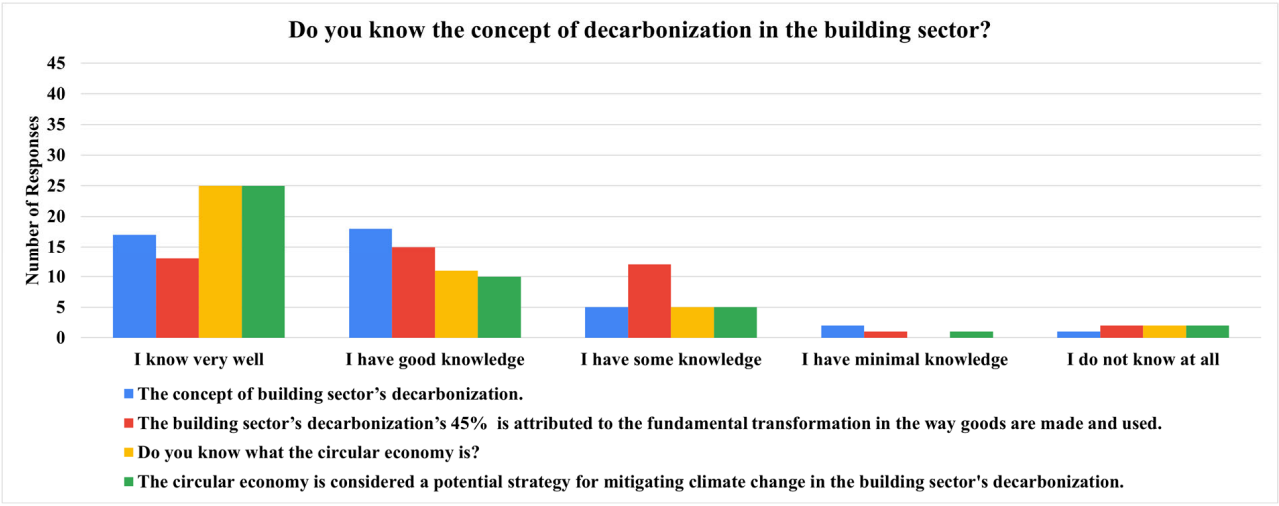


Figure 6. General knowledge about the building sector's decarbonization and the circular economy concepts (elaborated by the author).

The results of the third question (Figure 7), "Do you have experience in the circular economy practices in the building sector?" indicated the stakeholders' high engagement and familiarity with the circular economy practices while showcasing a rich pool of experience to be leveraged to advance circular economy initiatives into practice by providing valuable insights and feedback on what works and what does not, helping to refine and improve the circular economy implementation in the building sector. Thus, only 33 participants, as the real circular economy practitioners, succeeded in the following parts of the questionnaire, while the questionnaire was terminated for the remaining 10 participants. Therefore, the results highlighted that despite strong existing engagement, there is still room for growth, showcasing the importance of education and the involvement of real practitioners to broaden the base, enhancing the overall effective implementation of the circular economy in the building sector [53,54].

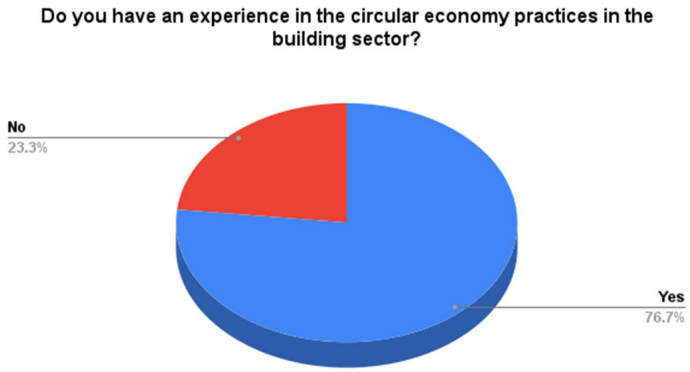


Figure 7. Experience in the circular economy practices in the building sector (elaborated by the author).

4.3. Part 3: Experience About the Circular Economy Practices in the Building Sector

The results of the question (Figure 8), "What do you think about the building sector's circular economy transition in the practices?" indicated a mixed perception of the circular economy transition in the building sector. The results highlighted that the consensus of the stakeholders is on the idea that some level of transition is occurring, but there is significant uncertainty or ambivalence among many stakeholders [55,56]. On the other hand, the results indicated that a substantial majority agree that there are barriers to the circular economy transition in the building sector while highlighting the recognition of barriers that need to be addressed to facilitate a more effective transition. These results align with [57], whereas [58] state that these barriers are not as insurmountable as often perceived, highlighting that they could be progressively overcome, potentially leading to a more widespread adoption of the circular economy than the stakeholders currently anticipate.

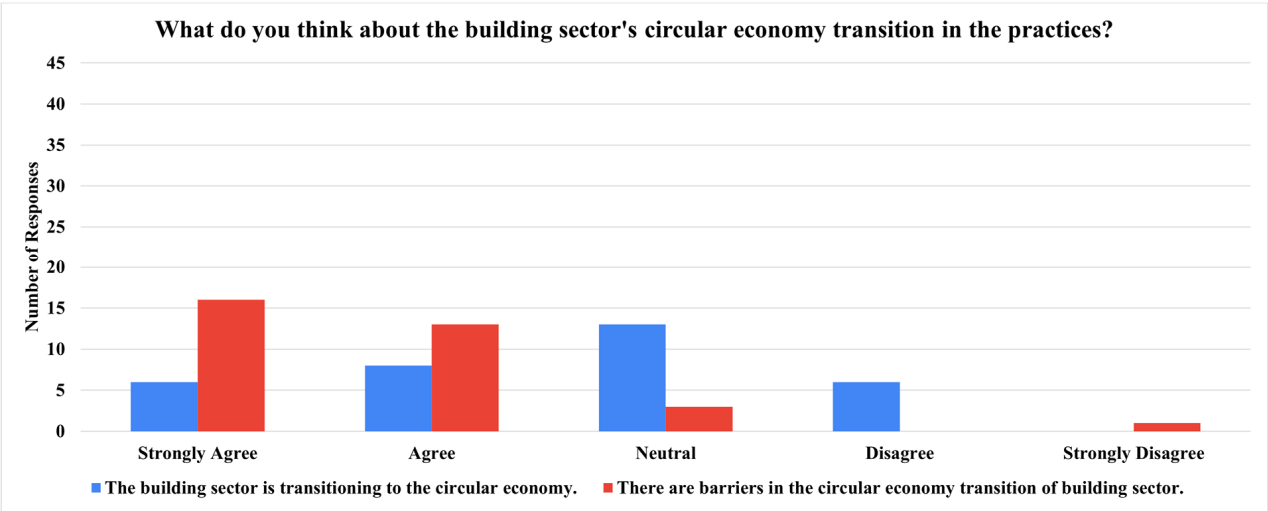


Figure 8. General idea about the building sector's circular economy transition in practices (elaborated by the author).

4.4. Part 4: Experience About the Barriers to the Circular Economy Practices in the Building Sector

The results of the question (Figure 9), "To what degree do you think the following barriers have importance in the circular economy practices in the building sector?" indicated the stakeholders' ideas based on their experiences about the barriers to the circular economy transition in the building sector. The results stated that the political and regulatory barriers are the most important barriers blocking effective implementation, while the

lack of circular vision as a social barrier is equally important. Thus, while echoing [35,59], the results highlighted a need for robust policy and regulatory frameworks and strategic vision to facilitate a more effective transition toward the circular economy in the building sector. Additionally, the results stated that the lack of integrated technological information systems as a technological and technical barrier emerges as crucially important, as highlighted by [60], suggesting the need for better technological infrastructure to manage the circular economy transition in the building sector. The results indicated that the materials' chemical content and features are marked as environmental barriers, stating the critical role of material properties in circular economy practices. Thus, as also discussed [61], it is fundamental to ensure suitable material selection for future recovery, reuse, and recycling while ensuring the secondary materials' chemical and physical quality. The results also stated that the lack of collaboration, networking, and connections among stakeholders as an organizational barrier is equally important, as also noted by [62], highlighting the significance of fostering networks to facilitate knowledge sharing and collaborative efforts to achieve more effective implementation of the circular economy in the building sector. Followingly, the results demonstrated the importance of economic barriers, such as the lack of financial aid, grants, or taxes, followed by the lack of market value in the supply chain, as also highlighted by [63] stating the importance of providing financial incentives while suggesting a need for economic incentives to make the circular economy practices more viable. Furthermore, while echoing [64], the results highlighted the significance of social barriers, such as the lack of social and institutional awareness and knowledge, indicating a need for educational initiatives to raise awareness about the drivers, opportunities, and practices of the circular economy in the building sector. Finally, the results emphasized the significance of the complexity of buildings and their supply chains, as also underscored by [65], stating the importance of managing the complexity to support the circular economy transition more effectively in the building sector.

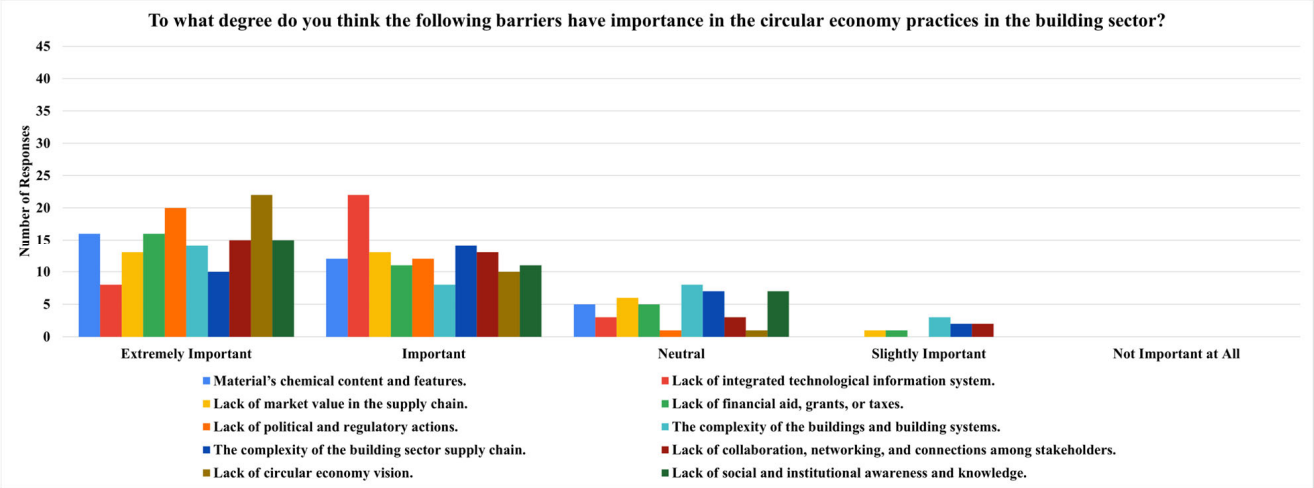


Figure 9. General idea about the barriers' importance in the circular economy practices in the building sector (elaborated by the author).

4.5. Part 5: Experience About the Current Status of the Circular Economy Practices in the Building Sector

The results of the question (Figure 10), "What do you think about the current state of the building sector's circular economy transition in the practices?" indicated that the stakeholders' perception of the circular economy is not effectively incorporated in practices in building life cycle [66]. Furthermore, the results stated the stakeholders' consensus on the conservative and complex nature of the building sector hindering the effective circular

economy implementation, as also highlighted by [42], while some minority stakeholders' perception is contrary, stating that the complexity is not the only barrier. However, others also play an important role in blocking the circular economy's effective implementation. Furthermore, the results highlighted that the stakeholders do not have sufficient awareness regarding the environmental consequences of their actions, leading to their contribution to climate change, which is aligned with [49]. Similarly, the results highlighted a general skepticism among the stakeholders, indicating that the stakeholders are not sufficiently or effectively committed to the circular economy or sustainability practices in the building sector, even if a notable minority recognizes some level of commitment, as discussed by [67]. Finally, the results indicated that most stakeholders believe their collaboration and communication are inadequate, as also noted [42], to implement the circular economy in the building sector effectively.

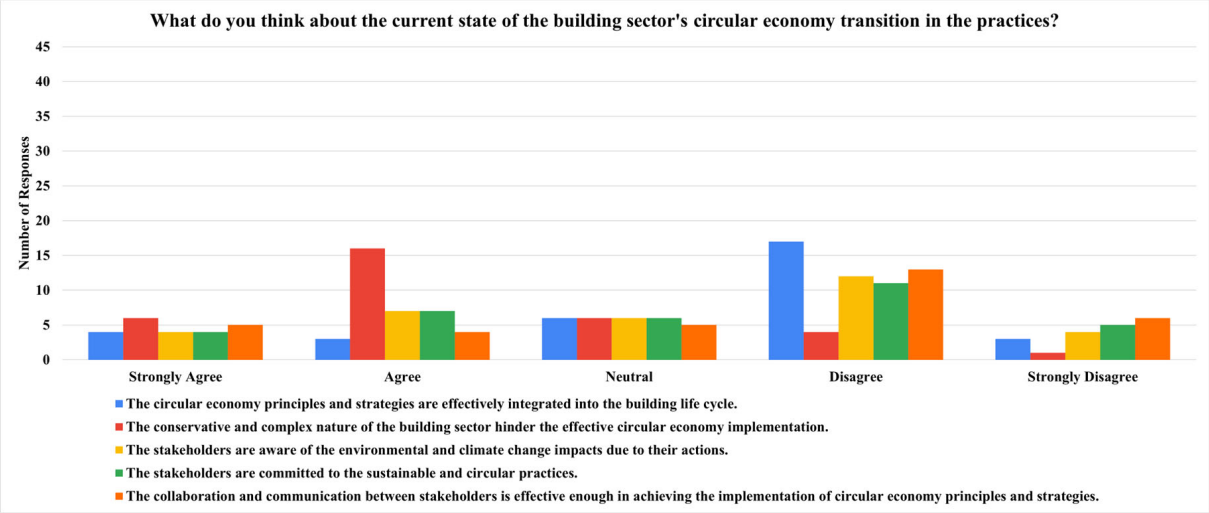


Figure 10. General idea about the current state of the building sector' circular economy transition in practices (elaborated by the author).

4.6. Part 6: Importance of Stakeholders Toward the Effective Implementation of the Circular Economy in the Building Sector

The question, "To what extent do you think building sector stakeholders are important to effectively achieve the circular economy implementation?" has been addressed firstly for all the building life cycle phases and beyond, encompassing only external stakeholders due to their indirect involvement in the whole building life cycle phases. Following this, the question has been directed to each building life cycle phase, from the production phase to the end-of-life phase and beyond the building life cycle.

The results for all the building life cycle phases and beyond (Figure 11) indicated that the governmental external stakeholders, encompassing the public and legal authorities and the governmental institutions, are the most crucial external stakeholders. Thanks to their enforcement capabilities through policies, regulations, and incentives, these stakeholders play a fundamental role, underscoring their vital governance role in creating a conducive environment. Academia is attributed to significant importance thanks to its role in research, innovation, and education, while knowledge generation and dissemination are crucial. The environment, or environmental organizations and associations, is crucial thanks to its advocacy for raising awareness and pushing other stakeholders to promote environmental sustainability and the circular economy. Civil society and community are crucial in establishing social support and the acceptance of the circular economy; thus, their role is as important as that of the others, but it is less direct. The media's role is vital in raising awareness and shaping

public opinion about the circular economy. Finally, non-governmental organizations have a less critical role than other external stakeholders, reflecting their limited direct influence or resources compared to others. Therefore, these external stakeholders' decision-making processes could be significantly influential, ensuring comprehensive communication and collaboration across the whole building life cycle and beyond to achieve a more effective transition toward the circular economy in the building sector.

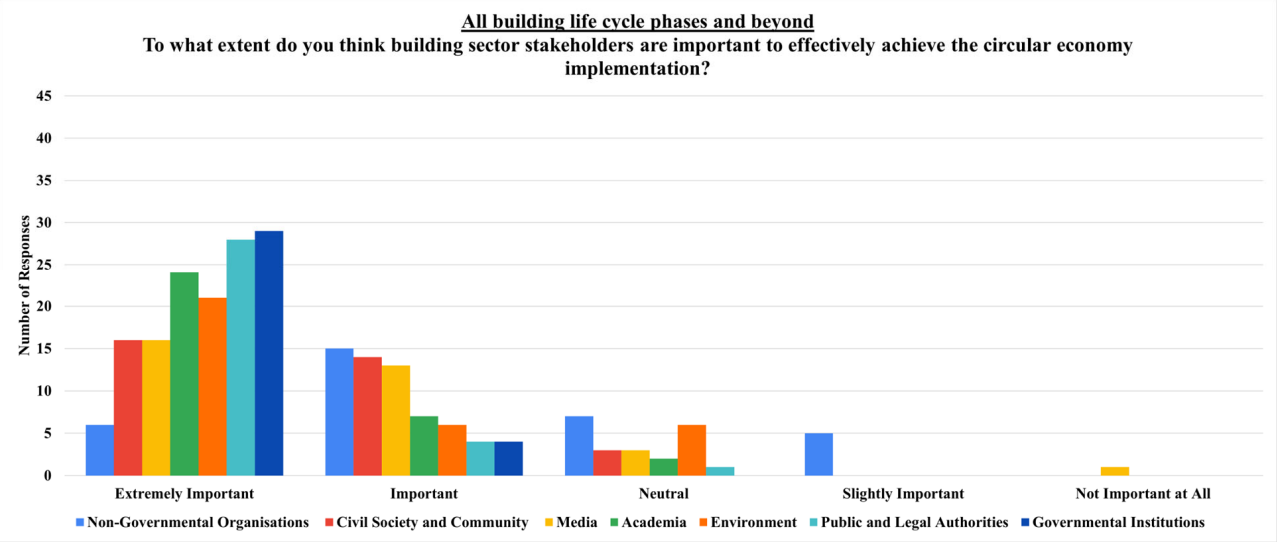


Figure 11. General idea about the building sector stakeholder's importance in all the building life cycle phases and beyond (elaborated by the author).

The results for the production phase (Figure 12) indicated that manufacturers overwhelmingly seem to be the most important internal stakeholders in the production phase, stating their crucial role in building materials and components adhering to the circular economy. The project managers are also considered highly important in the production phase but are still less important than manufacturers. Their decision-making process in overseeing and coordinating the operations, processes, and the other stakeholders in the production phase is essential. However, their critical importance could vary depending on the project or the effectiveness of the individual project manager. Finally, even though suppliers/vendors are seen to be less important compared to the others, their role in providing materials and products that meet the circular economy is critical. However, their critical importance could depend on their commitment to the circular economy initiatives and practices, product quality, and physical and chemical content. Therefore, these internal stakeholders' decision-making processes could be significantly influential, ensuring comprehensive communication and collaboration across the production phase to achieve a more effective transition toward the circular economy in the building sector.

The results for the design phase (Figure 13) indicated that architects significantly seem to be the most important internal stakeholders in the design phase thanks to their role in conceptualizing and planning buildings to implement circular design thinking into building designs while ensuring the circular economy is embedded more effectively. Project managers have a crucially important role in overseeing the design process and ensuring that the circular economy is effectively integrated and adhered to throughout the project's lifecycle, starting from the design phase. Engineers' vital importance in the design phase is thanks to their role in contributing technical expertise to ensure that the circular economy initiatives are feasible and can be implemented effectively as practices in building design projects. Designers have crucial importance in effectively translating circular economy initiatives into sustainable and innovative practices in the design phase while reflecting their

role in creativity and functionality in circular building designs. Through their commitment to implementing the circular economy in the design phase effectively, owners' importance is vital to driving the initiatives and practices in building design projects depending on their level of engagement and knowledge of sustainability and circular economy issues. Contractors' importance in practically implementing the circular design in the design phase varies based on their expertise and commitment to the circular economy. Banks and financial institutions are important thanks to their role in building design project's financial funding in the design phase. Thus, their financial decision-making process crucially influences the implementation of the circular economy even though they are seen as less critical, indicating variability in their perceived influence. Finally, subcontractors' role is considered less important than the others, suggesting that they are crucial for specific tasks, while their overall influence on the design phase may vary based on their involvement and adherence to the circular economy. Therefore, these internal stakeholders' decision-making processes could be significantly influential, ensuring comprehensive communication and collaboration across the design phase to achieve a more effective transition toward the circular economy in the building sector.

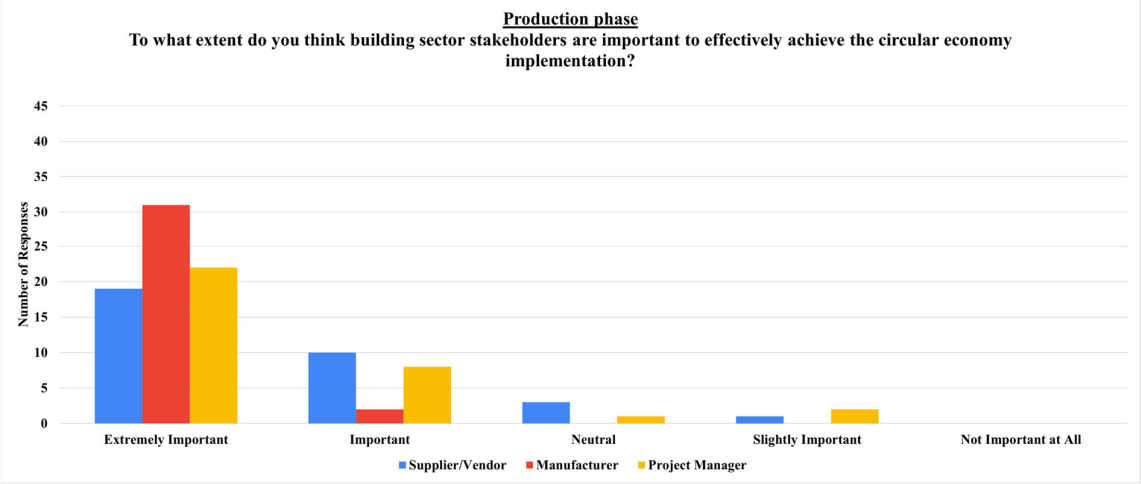


Figure 12. General idea about the building sector stakeholder's importance in the production phase (elaborated by the author).

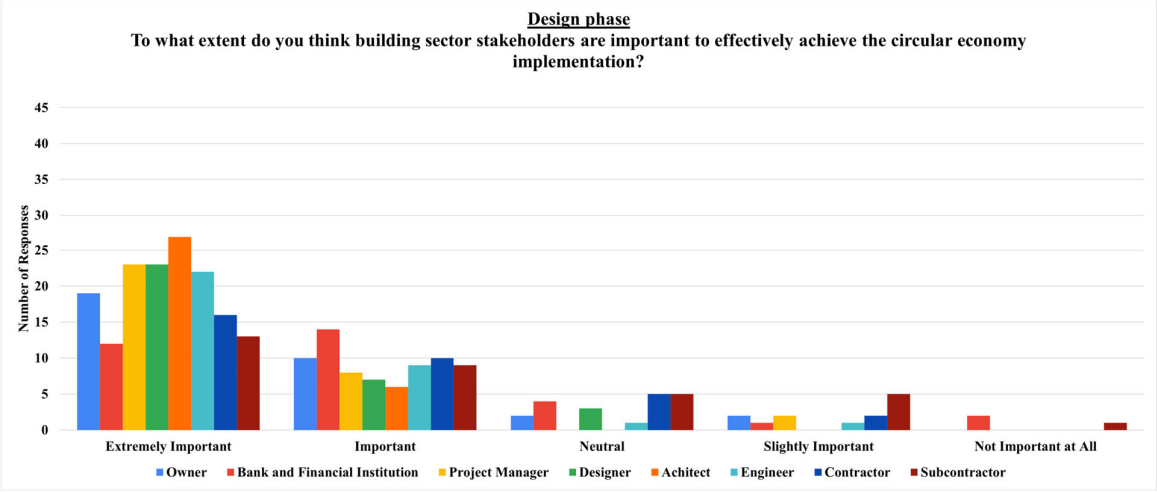


Figure 13. General idea about the building sector stakeholder's importance in the design phase (elaborated by the author).

The results for the construction phase (Figure 14) indicated that construction companies are considered the most important internal stakeholders thanks to their role in executing building projects and ensuring adherence to the circular economy. Project managers' crucial importance is thanks to their role in coordinating processes and operations and ensuring the circular economy is embedded in the construction phase. Manufacturer's role is crucial in making the building materials and components in line with the circular economy in the construction phase. Architects have a pivotal role in the construction phase while ensuring that their circular building design is accurately executed, thus translating the design initiatives into practices, such as circular buildings. Contractors' importance is displayed through their role in being responsible for the day-to-day execution of processes and operations in line with the circular economy in the construction phase. Engineers provide the technical expertise to implement the circular economy in construction. Suppliers/vendors' vital importance is demonstrated through their role in proving materials and products in the construction phase, stating their significance in responsible material selection and natural resources. Designers must ensure that the original design intent, including the circular economy initiatives, is executed in practice during the construction phase. Subcontractors are important in executing specific tasks within the construction phase's operations and processes. Finally, owners' importance is displayed through their role and commitment to drive the adoption of the circular economy initiatives and practices, arguing that their impact can be inconsistent, possibly depending on their level of involvement and understanding of the circular economy issues. Therefore, these internal stakeholders' decision-making processes could be significantly influential, ensuring comprehensive communication and collaboration across the construction phase to achieve a more effective transition toward the circular economy in the building sector.

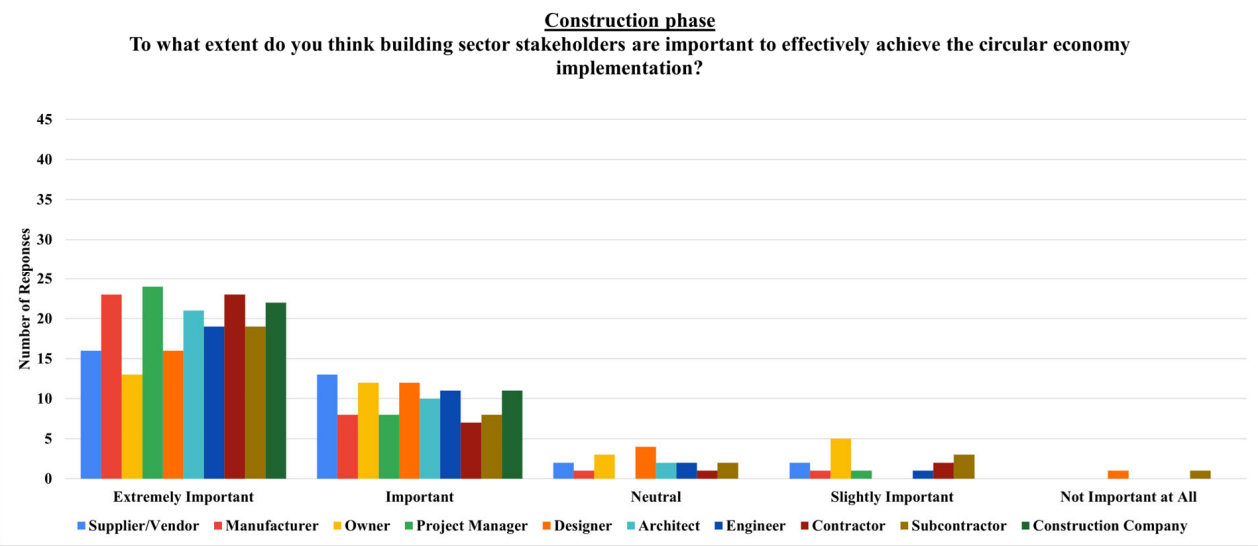


Figure 14. General idea about the building sector stakeholder's importance in the construction phase (elaborated by the author).

The results for the use phase (Figure 15) indicated that the users/consumers are considered the most critically important stakeholders in the use phase. Their actions and behaviors, thus the decision-making process, motivate the circular economy implementation in the use phase processes and operations, stating their significant role. Owners' vital role in their decision-making process is to be responsible for the building's maintenance, repair, renovation, refurbishment, or use while ensuring the building remains aligned with the circular economy. Project managers' importance is demonstrated through their role in

overseeing the operational efficiency, as well as the sustainability and the circularity of the buildings in repair, renovation, and refurbishment stages, indicating their dependence on the specific context and their level of involvement in the use phase. Manufacturers' role is important in providing innovative, sustainable, circular, specifically durable materials, products, and components to prolong the building's functional lifetime in the use phase' repair, renovation, and refurbishment stages. Facility manager's role is important in the day-to-day operation and maintenance of buildings while ensuring that circular economy practices are implemented in the use phase. Construction companies' role is crucial in providing ongoing technical support aligned with the circular economy in the use phase's repair, renovation, and refurbishment stages. Suppliers'/vendors' critical role is to provide replacement materials, products, and components in the use phase's repair, renovation, and refurbishment stages while ensuring availability and circularity. Engineers play a crucially important role in ongoing maintenance and addressing any technical issues that arise during the use phase's maintenance, repair, renovation, and refurbishment stages while having their vital expertise for the circularity performance of the building. Architects ensure that circular design integrity is maintained in the use phase's maintenance, repair, renovation, and refurbishment stages, while their involvement is particularly important for aesthetic and functional upgrades. Real estate agencies play a crucial role in leasing and selling properties, influencing user/consumer engagement and property value in the use phase while promoting buildings that adhere to circular economy practices and initiatives. Contractors are important in maintaining, repairing, renovating, and refurbishing the buildings in the use phase while having less critical importance than the other stakeholders involved. Designers' role is essential in contributing to the aesthetic and functional modifications in the use phase, while their ongoing role is not as essential as that of the other stakeholders. Subcontractors' role is important in providing specialized services for the use phase's maintenance, repair, renovation, and refurbishment stages while having less critical importance than the other stakeholders involved. Therefore, these internal stakeholders' decision-making processes could be significantly influential, ensuring comprehensive communication and collaboration across the use phase to achieve a more effective transition toward the circular economy in the building sector.

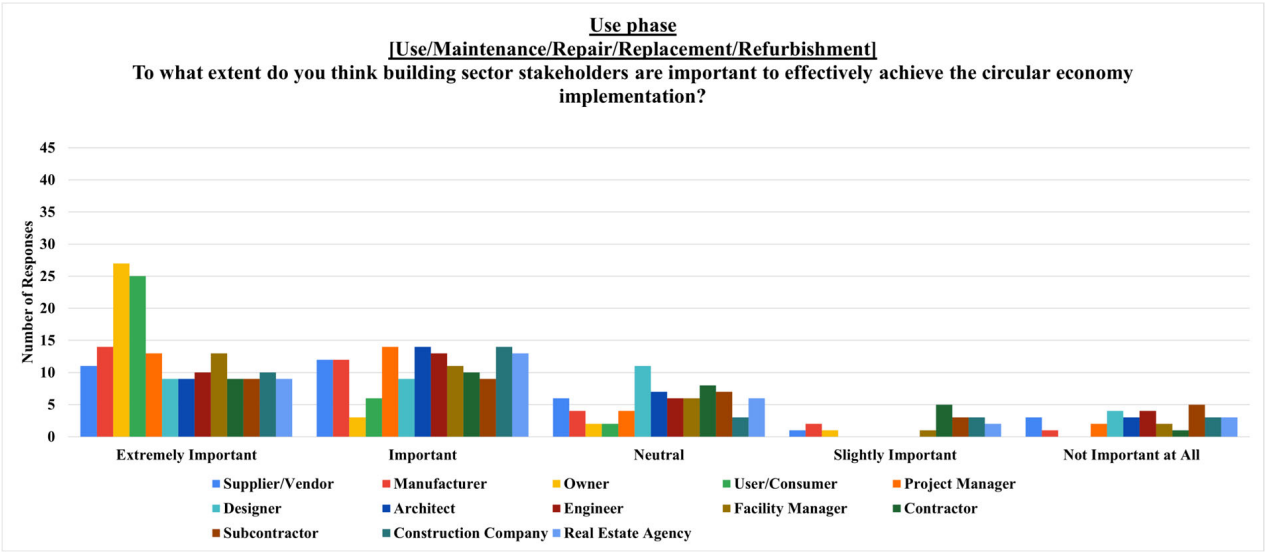


Figure 15. General idea about the building sector stakeholder's importance in the use phase (elaborated by the author).

The results for the end-of-life phase (Figure 16) indicated that the waste treatment companies are considered the most important internal stakeholders due to their crucial role in managing and processing waste materials. Thus, their role is crucial to ensure that the waste of materials, products, and components is recovered, reused, or recycled effectively. Demolition and deconstruction companies are crucial in carefully dismantling buildings to maximize material recovery for reuse or recycling. Project manager's crucial importance in overseeing end-of-life operations and processes while ensuring that the circular economy is adhered to throughout the deconstruction, waste management, and minimization strategies. Owners' commitment to circular economy practices in the end-of-life phase is critically important. Manufacturers must ensure that materials, products, and components have a second life to close the loops in the end-of-life phase. Likewise, suppliers/vendors are critical in sourcing and delivering circular materials, products, and components while ensuring their second life is close to the loop. Contractors' important role in implementing the deconstruction plan of the building, as well as recovering, reusing, and recycling plans set on-site to ensure the building's efficient repurposing and the material, product, and component efficient recovery, reuse, and recycling. Engineers' crucial role in technical expertise in designing systems operations and processes that facilitate circular economy practices in the end-of-life phase. Subcontractor's importance is emphasized through their specialized task expertise in the circular economy practices in the end-of-life phase. Therefore, these internal stakeholders' decision-making processes could be significantly influential, ensuring comprehensive communication and collaboration across the end-of-life phase to achieve a more effective transition toward the circular economy in the building sector.

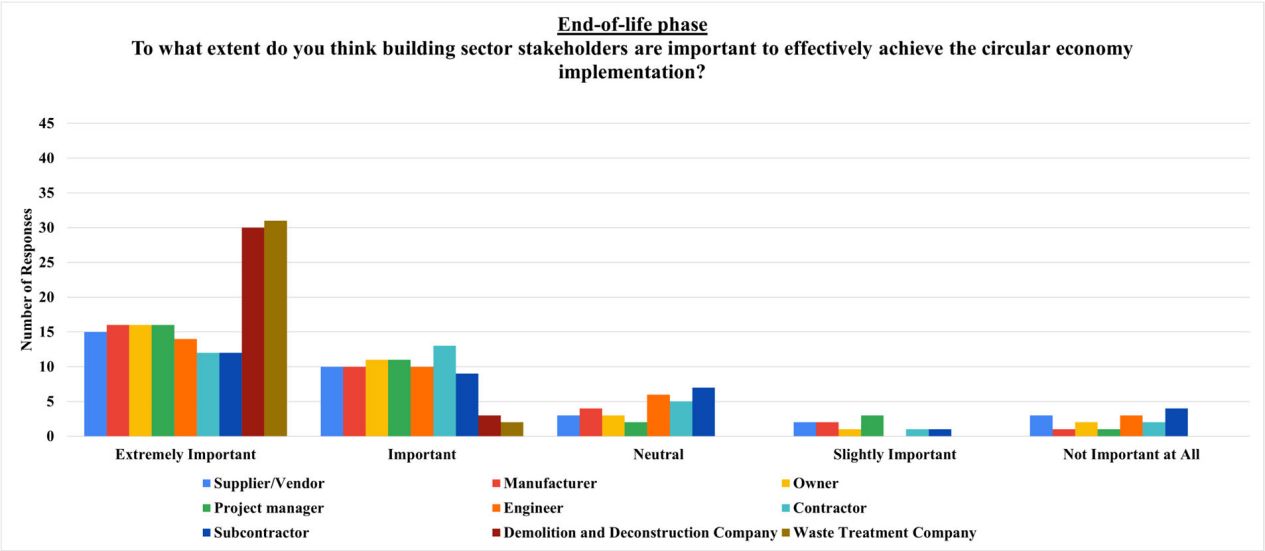


Figure 16. General idea about the building sector stakeholder's importance in the end-of-life phase (elaborated by the author).

The results for beyond the life cycle—recovery, reuse, and recycle potential (Figure 17) indicated that waste treatment companies are considered the most important internal stakeholders beyond the life cycle thanks to their role in managing and processing waste materials while ensuring materials, products, and components are recovered, reused, or recycled effectively toward closing the loop. Demolition and deconstruction companies' crucially important role in carefully dismantling buildings to maximize material recovery for reuse or recycling is aligned with the circular economy. Manufacturers play an extremely important role beyond the life cycle thanks to their provision of recyclable and reusable materials, products, and components, ensuring their contribution to the circular

economy at the end of their lifecycle. Architects' crucial importance emphasizes their role in designing buildings with end-of-life considerations, facilitating easier repurposing of buildings and the recovery, reuse, and recycling of building materials, products, and components. Project managers' and engineers' crucial role is overseeing and implementing circular economy practices and ensuring adherence to the circular economy beyond the life cycle. Suppliers/vendors are equally important beyond the life cycle due to their role in sourcing and delivering circular materials and natural resources, contributing to the overall circularity. Designers are also marked as crucial, given their role in translating circular design thinking into practical and innovative solutions for buildings beyond the life cycle, contributing to closing the loop. Construction companies' role in the practical implementation of deconstruction and recycling plans is essential for the efficient deconstruction and repurposing of buildings while recovering, reusing, and recycling materials, products, and components. The roles of contractors and subcontractors are less important beyond the life cycle. Therefore, these internal stakeholders' decision-making processes could be significantly influential, ensuring comprehensive communication and collaboration beyond the building life cycle to achieve a more effective transition toward the circular economy in the building sector.

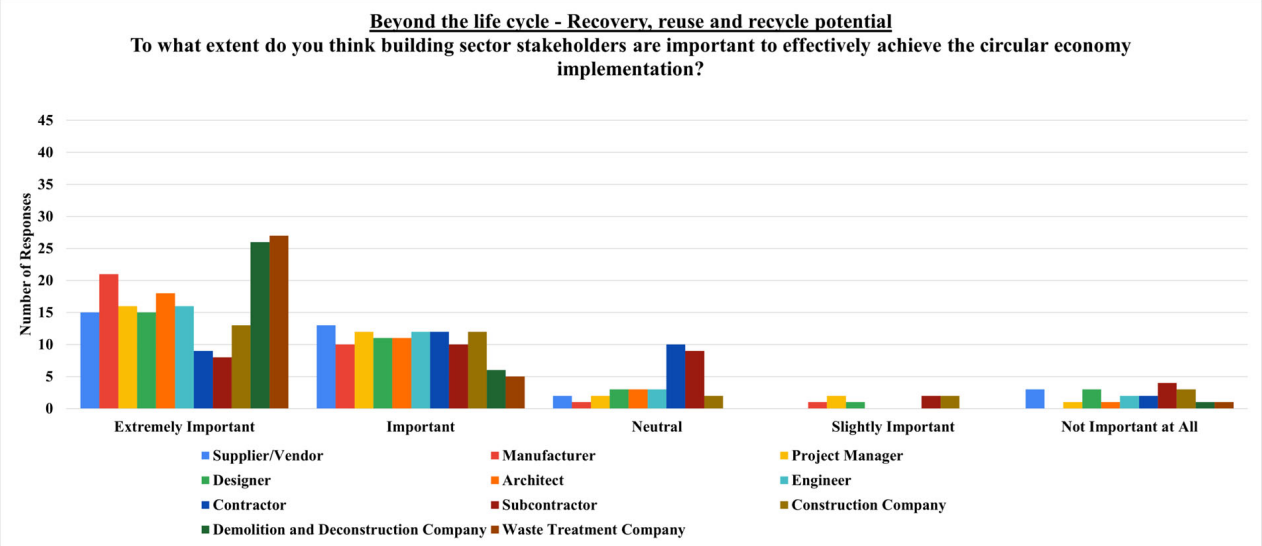


Figure 17. General idea about the building sector stakeholder's importance beyond the building life cycle (elaborated by the author).

Similar research studies with results in terms of stakeholders' importance in the building life cycle could not be found in the literature to compare these results. Only some research studies focus on the same argument, reinforcing stakeholder engagement to address the circular economy transition in the building sector. These research studies utilized systematic or critical literature review methodology and stakeholder interviews to analyze stakeholder's role [43] and perspective on the barriers and drivers toward the circular economy transition in the building sector [14–17]. Therefore, the results obtained for the last part of the questionnaire could not be directly compared with those of these research studies since they did not directly seek to determine the importance of stakeholders across the building life cycle. Thus, this methodological approach offered a novel contribution to understand and evaluate their importance in advancing the circular economy, providing a new perspective on its transition in the building sector.

5. Conclusions

This article was oriented around a stakeholder-centric approach to address the necessity of a concentrated effort on stakeholder engagement toward effectively implementing the circular economy within the building sector. By employing an online questionnaire, the study aimed to assess the building sector's current status in the circular economy transition, evaluate stakeholders' awareness and knowledge, and identify which stakeholders have key roles in driving this transition for climate change mitigation.

The results indicated that many stakeholders are aware of their decisions' environmental impacts and understand their role in sustainability and decarbonization. However, there was also a notable gap in knowledge regarding waste production and circular economy practices in the sector, highlighting the need for targeted educational and training initiatives. Despite this, many participants indicated engagement with circular economy practices, reflecting a growing awareness and desire for change within the sector.

Furthermore, the results indicated that while stakeholders generally agreed that the circular economy transition is underway in the building sector, many expressed uncertainties regarding its effectiveness. Regulatory challenges, a lack of technological infrastructure, and social conservatism were critical barriers hindering the transition. These barriers were further emphasized, with stakeholders calling for targeted policies, better technological infrastructure, ongoing educational initiatives, and enhanced technological systems to enhance stakeholder knowledge, awareness, and thus their engagement to facilitate a more effective transition.

This article offers several key actionable strategies tailored to each stakeholder (Table 2) to enhance stakeholder engagement toward the facilitation of the effective implementation of the circular economy in the building sector.

Table 2. Key actionable strategies tailored to each stakeholder (elaborated by the author).

Stakeholder	Key Actionable Strategies
Owner and User/Consumer	Prioritize sustainable and circular buildings; engage in resource conservation; invest in reversible design and construction; foster a culture of circular economy.
Bank/Financial Institution	Provide financial incentives for sustainability and circular economy-integrated building projects.
Project Manager	Oversee the integration of circular economy strategies; coordinate stakeholders in the entire building life cycle.
Designer, Architect, and Engineer	Integrate circular economy strategies, particularly design for reversible building strategies principles; prioritize circular materials, products, and technologies.
Facility Manager	Manage building resources efficiently; ensure long-term maintenance and circular economy practices.
Contractor, Subcontractor and Construction Company	Source sustainable materials; minimize construction and demolition waste; ensure circular economy practice integration.
Real Estate Agency	Promote properties with circular economy features; educate clients on the benefits of sustainable and circular buildings.
Demolition and Deconstruction Company and Waste Treatment Company	Facilitate selective deconstruction; recover reusable materials and products; recycle construction and demolition waste; promote material recovery.
Supplier/Vendor and Manufacturer	Provide sustainable and circular materials; innovate products for future disassembly and reuse; prioritize low-environmental impact production.

Table 2. *Cont.*

Stakeholder	Key Actionable Strategies
Public and Legal Authorities, and Governmental Institutions	Establish policies and regulations; provide financial incentives; regulate waste management; invest in circular infrastructure.
Non-Governmental Organizations, Civil Society and Community, Media, Academia, and Environment	Advocate for circular economy adoption; raise awareness; conduct research; influence policy changes; educate the public.

This article, through the online questionnaire, provides valuable insights into the practical and theoretical aspects of circular economy transition while offering actionable strategies to enhance engagement for a more effective transition to the circular economy in the building sector. This article's innovativeness lies in its comprehensive approach to understanding stakeholders' awareness, roles, and perspectives on the circular economy transition within the building sector. This article's focus on stakeholder perspectives uniquely contributes to the literature, emphasizing improved engagement, communication, collaboration, and knowledge sharing.

The sample size is marked as an important limitation. Hence, it may not fully represent the diversity of stakeholders across the building sector. Additionally, the predominance of responses from Italy and Türkiye introduces potential biases that should be considered when generalizing the results. The results are likely reflective of the experiences and perspectives of the participants from these regions, potentially overlooking other important geographical and cultural dynamics. The lack of responses from some internal stakeholders (e.g., owners, users, and suppliers) further impacts the comprehensiveness of the results.

Although this article received a relatively small number of responses, which is viewed as a limitation, this could also underscore the niche nature of the topic. The results suggest that the circular economy transition within the building sector is a highly specialized area of focus, attracting a specific group of stakeholders with deep expertise in sustainability and circular economy. This targeted response base could lend credibility to the argument that the circular economy transition is a complex yet crucial issue.

Future research should aim to increase the sample size by including a broader and more geographically diverse set of participants. In addition, future research could address the underrepresentation of certain internal stakeholders as they are crucial for a comprehensive understanding of stakeholder engagement in the building sectors' circular economy transition. Additionally, it would be beneficial to explore how various countries' policies and market conditions influence stakeholder engagement to provide more robust global insights. Future research could also incorporate longitudinal data to examine the evolution of stakeholder engagement and the effectiveness of key actionable strategies over time. Combining qualitative data, such as stakeholder interviews, with quantitative data could provide richer insights into the barriers affecting the transition.

By addressing these limitations, future research would contribute to a more nuanced understanding of how stakeholder engagement could be fostered across the entire building life cycle to drive the circular economy transition to mitigate climate change and promote environmental sustainability. This article was derived from the ongoing PhD thesis of Fuat Emre Kaya while providing a solid foundation for understanding the current state of the building sector's circular economy transition and presenting key actionable strategies tailored to each stakeholder to guide and accelerate this crucial transition.

Funding: This research received no external funding.

Institutional Review Board Statement: The study was conducted in compliance with the Declaration of Helsinki (2000). Ethics Committee approval was waived as the online questionnaire was anonymous and did not involve sensitive personal data.

Informed Consent Statement: Informed consent was waived due to the anonymous nature of the online questionnaire, which did not involve direct contact with participants.

Data Availability Statement: The dataset obtained is available in the corresponding author's Google repository (Google Form). The feedback of 43 participants is available at the following link: https://docs.google.com/spreadsheets/d/1MCPWOVIFaQkQk8JIu9-3mZ-zPzTq1ZsgbfALoEd9hns/edit?resourcekey=&gid=1026124810#gid=1026124810, accessed on 7 January 2025.

Acknowledgments: The author thanks Antonello Monsù Scolaro, the PhD thesis supervisor, for his help in disseminating the questionnaire.

Conflicts of Interest: The author declares no conflict of interest.

Appendix A

The Questionnaire

This questionnaire was prepared under the objectives and methodological approach of the Ph.D. thesis titled "Circular Economy in the Building Sector Towards Climate Change Mitigation and Environmental Sustainability: Players and Effective Measures" by Ph.D. Candidate Fuat Emre Kaya, with the Ph.D. supervisor Prof. Antonello Monsù Scolaro, within the Ph.D. Course in Architecture and Environment at the Department of Architecture, Design and Urban Planning, University of Sassari (Italy).

Introduction:
Thank you for participating in this questionnaire. Your contribution is crucial for advancing research on the circular economy practices in the building sector and their impact on climate change and environmental sustainability.

Confidentiality and Consent:
Your participation in this questionnaire is entirely voluntary, and all responses will be treated confidentially and anonymously. By completing this questionnaire, you consent to participate in this study.

Instructions:
Please carefully read each question and provide your most honest and accurate responses. If you have any questions or encounter any difficulties, please feel free to contact Fuat Emre Kaya via f.kaya@studenti.uniss.it.

Estimated Time:
Completing this questionnaire should take approximately 10 min.

Your contribution is appreciated:
Thank you for taking the time to contribute to the advancement of the circular economy in the building sector. Your contribution will help identify key players and effective measures for achieving climate change mitigation and environmental sustainability goals.

Part 1: Demographic Information
Question 1: Please select the option that corresponds to your age group:

(a) 18–30
(b) 31–40
(c) 41–50
(d) 51–60
(e) 61+

Question 2: Please select your gender:

(a) Male
(b) Female
(c) Not specified

Question 3: Please specify the country:
Question 4: What is your highest level of education?

(a) Secondary education
(b) Bachelor's degree
(c) Master's degree
(d) Doctorate degree

Question 5: Which stakeholder role do you believe best represents you?

(a) Client (Owner, User/Consumer)
(b) Project Professional (Bank/Financial Institution, Project Manager, Designer, Architect, Engineer, Facility Manager, Contractor, Subcontractor, Construction Company, Real Estate Agency, Demolition and Deconstruction Company, Waste Treatment Company)
(c) Supplier (Supplier/Vendor, Manufacturer)
(d) Public (Non-Governmental Organizations, Civil Society and Community, Media, Academia, Environment)
(e) Government (Public and Legal Authorities, Governmental Institutions)

Part 2: General Knowledge about the Environmental Impact of the Building Sector

1	2	3	4	5
I do not know at all	I have minimal knowledge	I have some knowledge	I have good knowledge	I know very well

To what extent do you know the building sector's environmental impact?							
Question 6	The building sector accounts for 20–50% of the global natural resource consumption.	1	2	3	4	5
Question 7	The building sector contributes to 30–40% of the world's total waste.	1	2	3	4	5
Question 8	The building sector is responsible for approximately 40% of global energy demand, leading to 30% of global greenhouse gas emissions.	1	2	3	4	5

Do you know the concept of decarbonization in the building sector?							
Question 9	The concept of building sector's decarbonization.	1	2	3	4	5
Question 10	The building sector's decarbonization's 45% is attributed to the fundamental transformation in the way goods are made and used.	1	2	3	4	5
Question 11	Do you know what the circular economy is?	1	2	3	4	5
Question 12	The circular economy is considered a potential strategy for mitigating climate change in the building sector's decarbonization.	1	2	3	4	5

Question 13: Do you have experience in the circular economy practices in the building sector?

(a) Yes
(b) No

Part 3: Experience about the Circular Economy Practices in the Building Sector

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Building Life Cycle Phases						
What do you think about the building sector's circular economy transition in the practices?						
Question 14	The building sector is transitioning to the circular economy.	1	2	3	4	5
Question 15	There are barriers to the circular economy transition of the building sector.	1	2	3	4	5

Part 4: Experience about the Barriers to the Circular Economy Practices in the Building Sector

1	2	3	4	5
Not important at all	Slightly important	Neutral	Important	Extremely Important

Building Life Cycle Phases						
To what degree do you think the following barriers have importance in the circular economy practices in the building sector?						
Question 16	Material's chemical content and features.	1	2	3	4	5
Question 17	Lack of integrated technological information system.	1	2	3	4	5
Question 18	Lack of market value in the supply chain.	1	2	3	4	5
Question 19	Lack of financial aid, grants, or taxes.	1	2	3	4	5
Question 20	Lack of political and regulatory actions.	1	2	3	4	5
Question 21	The complexity of the buildings and building systems.	1	2	3	4	5
Question 22	The complexity of the building sector supply chain.	1	2	3	4	5
Question 23	Lack of collaboration, networking, and connections among stakeholders.	1	2	3	4	5
Question 24	Lack of circular economy vision.	1	2	3	4	5
Question 25	Lack of social and institutional awareness and knowledge.	1	2	3	4	5

Part 5: Experience about the Current Status of the Circular Economy Practices in the Building Sector

1	2	3	4	5
Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree

Building Life Cycle Phases						
What do you think about the current state of the building sector's circular economy transition in the practices?						
Question 26	The circular economy principles and strategies are effectively integrated into the building life cycle.	1	2	3	4	5
Question 27	The conservative and complex nature of the building sector hinders the effective circular economy implementation.	1	2	3	4	5
Question 38	The stakeholders are aware of the environmental and climate change impacts due to their actions.	1	2	3	4	5
Question 29	The stakeholders are committed to sustainable and circular practices.	1	2	3	4	5
Question 30	The collaboration and communication between stakeholders are effective enough in achieving the implementation of circular economy principles and strategies.	1	2	3	4	5

Part 6: Importance of the Stakeholders Toward the Effective Implementation of the Circular Economy in the Building Sector

1	2	3	4	5		
Not important at all	Slightly important	Neutral		Important	Extremely Important	
All Building Life Cycle Phases and Beyond						
Question 31	Non-Governmental Organizations	1	2	3	4	5
Question 32	Civil Society and Community	1	2	3	4	5
Question 33	Media (Press)	1	2	3	4	5
Question 34	Academia (Researchers and Experts)	1	2	3	4	5
Question 35	Environment	1	2	3	4	5
Question 36	Public and Legal Authorities	1	2	3	4	5
Question 37	Governmental Institutions	1	2	3	4	5
Production Phase						
Question 38	Project Manager	1	2	3	4	5
Question 39	Supplier/Vendor	1	2	3	4	5
Question 40	Manufacturer	1	2	3	4	5
Design Phase						
Question 41	Owner	1	2	3	4	5
Question 42	Bank/Financial Institution	1	2	3	4	5
Question 43	Project Manager	1	2	3	4	5
Question 44	Designer	1	2	3	4	5
Question 45	Architect	1	2	3	4	5
Question 46	Engineer	1	2	3	4	5
Question 47	Contractor	1	2	3	4	5
Question 48	Subcontractor	1	2	3	4	5
Construction Phase						
Question 49	Owner	1	2	3	4	5
Question 50	Project Manager	1	2	3	4	5
Question 51	Designer	1	2	3	4	5
Question 52	Architect	1	2	3	4	5
Question 53	Engineer	1	2	3	4	5
Question 54	Contractor	1	2	3	4	5
Question 55	Subcontractor	1	2	3	4	5
Question 56	Construction Company	1	2	3	4	5
Question 57	Supplier/Vendor	1	2	3	4	5
Question 58	Manufacturer	1	2	3	4	5

Use Phase						
Question 59	Owner	1	2	3	4	5
Question 60	User/Consumer	1	2	3	4	5
Question 61	Project Manager	1	2	3	4	5
Question 62	Designer	1	2	3	4	5
Question 63	Architect	1	2	3	4	5
Question 64	Engineer	1	2	3	4	5
Question 65	Facility Manager	1	2	3	4	5
Question 66	Contractor	1	2	3	4	5
Question 67	Subcontractor	1	2	3	4	5
Question 68	Construction Company	1	2	3	4	5
Question 69	Real Estate Agency	1	2	3	4	5
Question 70	Supplier/Vendor	1	2	3	4	5
Question 71	Manufacturer	1	2	3	4	5
End-of-Life Phase						
Question 72	Owner	1	2	3	4	5
Question 73	Project Manager	1	2	3	4	5
Question 74	Engineer	1	2	3	4	5
Question 75	Contractor	1	2	3	4	5
Question 76	Subcontractor	1	2	3	4	5
Question 77	Demolition and Deconstruction Company	1	2	3	4	5
Question 78	Waste Treatment Company	1	2	3	4	5
Question 79	Supplier/Vendor	1	2	3	4	5
Question 80	Manufacturer	1	2	3	4	5
Beyond the Life Cycle—Recovery, Reuse, and Recycle Potential						
Question 81	Project Manager	1	2	3	4	5
Question 82	Designer	1	2	3	4	5
Question 83	Architect	1	2	3	4	5
Question 84	Engineer	1	2	3	4	5
Question 85	Contractor	1	2	3	4	5
Question 86	Subcontractor	1	2	3	4	5
Question 87	Construction Company	1	2	3	4	5
Question 88	Demolition and Deconstruction Company	1	2	3	4	5
Question 89	Waste Treatment Company	1	2	3	4	5
Question 90	Supplier/Vendor	1	2	3	4	5
Question 91	Manufacturer	1	2	3	4	5

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