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Theoretical relationships between circular economy practices and the agile approach in construction projects

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ABSTRACT

The construction industry is a major consumer of natural resources and a generator of waste, resulting in significant environmental impacts. At the same time, the sector faces management challenges, including project inconsistencies, missed deadlines, budget overruns, and environmental degradation. The Circular Economy (CE) has shown promise in addressing inefficient resource use and minimizing negative environmental impacts, while agile project management aims to deliver more successful and efficient projects. This paper explores the synergy between the agile approach and CE in the construction industry through a content analysis of CE practices and agile attributes for construction projects, examining positive and negative interactions. The results show a positive synergy between the two approaches, highlighting the use of digital technologies to promote CE and the design of modular buildings, focusing on the early phase of the life cycle (design), which has the most relationships. Flexibility and transparency were the agile attributes most associated with CE practices, with the "management processes" category highlighted as the most interactive. The study suggests adapting the Scrum agile framework to manage circular innovation projects in parallel with construction to promote the transition from a linear to a CE model in the construction industry.

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1 Introduction

The construction industry is a major global consumer of natural resources, requiring large volumes of raw materials and generating significant amounts of waste. Continuous reliance on non-renewable resources has turned the built environment into a vast stock of accumulated materials while contributing to future resource scarcity. Under current production patterns, waste generation is expected to increase substantially by 2050, intensifying environmental pressures associated with construction activities [1]. In this context, the implementation of the Circular Economy (CE) in the sector emerges as a promising solution to combat inefficient resource use and minimize negative environmental impacts [2]. Amid forecasts of rising global greenhouse gas emissions, CE in construction plays an essential role in contributing to national climate goals, promoting practices that include waste reduction, process improvement, and material reuse [1].

The EU proposes a paradigm shift regarding the linear economic system of "take-make-dispose", aiming for innovation, waste mitigation, and efficiency in material use [3]. However, the implementation of these practices is still in development [2]. Incorporating circular strategies into construction projects requires changes and overcoming obstacles, but it can make economic growth independent of excessive natural resource use, promoting more efficient use of materials and minimizing waste generation [4]. Nevertheless, resistance to change, product complexity, and technological barriers have hindered the adoption of circular principles in the construction industry [5].

The current landscape of the construction industry faces challenges that negatively impact the efficiency and success of projects, such as inconsistencies in designs, overlapping deadlines, excessive budgets, and environmental disadvantages [6]. In addition to low productivity and rigidity in adopting innovations [7]. In this regard, researchers have been seeking tools and methods to achieve more successful projects [6]. Given the rapid technological changes, the application of agile project management models has proven to be a promising approach to address these specific challenges in the construction sector [7].

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The pursuit of increased efficiency in project delivery changes necessitates modifications to the traditional construction management method. To overcome the obstacles of change management, maximize project value, and manage risks, agile methods have stood out as effective techniques. Agile is an iterative methodology that plans and guides project development and has been widely used across various industries, including construction [8].

Among agile methods, Scrum is the most widely used in construction projects [9]. Scrum is an agile approach designed to support collaborative work through iterative and incremental development. The framework organizes activities into recurring cycles that promote adaptability, continuous feedback, and progressive improvement throughout the development process. With proper training, project teams can gain agility in decision-making, resulting in transparent and effective communication, which contributes to better control of costs, schedules, and project quality. Scrum's flexibility enables adaptations to meet the specific needs of each team, ensuring an agile implementation across projects of different scales [10].

This article's main objective is to investigate the interactions between the agile approach and the CE in the construction industry through content analysis. To achieve this, the fundamentals of Bardin's method (1977) [11] were adopted, aiming to answer the following question: "What are the theoretical relationships between the Agile approach and the CE in projects within the Architecture, Engineering, and Construction (AEC) sector?" Considering the socioeconomic importance of civil construction, its environmental impact, the sector's complexity, and the challenges related to change, adopting agile practices and the CE can lead to more efficient and sustainable management of construction projects. Therefore, it is of utmost importance to investigate the synergy between the CE and agility to enable them to collaborate in the implementation of the construction industry.

This research contributes to the advancement of knowledge about the application of agile management in CE projects within the construction industry, enabling the development of more efficient and sustainable management strategies and models. Based on the discussions presented, the main theoretical relationships identified are explored, and possible practical applications of this synergy are suggested. With these results, it is hoped that this study will stimulate future investigations and initiatives that promote the joint adoption of these innovative approaches in the pursuit of a more sustainable and efficient construction sector. The article is organized into four parts: introduction, methods, results, relevant discussions, and principal conclusions.

2 Method

The method adopted in this research was content analysis, following the premises of Bardin (1977) [11] to investigate the interactions between the Agile approach and the CE in the Architecture, Engineering, and Construction (AEC) sector. Since few studies have addressed this combination of targeted concepts, it was decided to study them separately and then analyze their interactions. As the starting point will be the investigation of the existing literature on both topics, the research is classified as qualitative. Through content analysis, relevant texts on the subject will be examined to identify and understand the potential correlation between the CE and Agile in construction projects.

Bardin's (1977) content analysis is divided into pre-analysis, exploration of the material, and treatment of results and interpretations. The pre-analysis phase involves steps such as a floating reading of the materials, defining objectives and/or hypotheses, establishing indices or analysis categories, and preparing the material for the coding process. In the exploration phase, the researcher codes the content, assigning relevant theoretical codes to predefined categories established during the pre-analysis. The final stage consists of treating the results, making inferences, and interpreting the data, which involves studying the coded data, analyzing the connections between categories, and extracting meaningful insights related to the research objectives.

For the pre-analysis, preliminary readings were conducted on the concepts of agility and on CE practices in the construction industry. After that, the following objective was established: to identify the interactions between the attributes of agile management and the CE practices applied to the construction industry.

Based on the literature review conducted by Enembreck et al. [12], the main agile attributes for construction projects were identified. The most frequently mentioned attributes among the authors became the categories for analyzing the agile concept in this content analysis. Regarding the CE, the pre-analyzed material included the study by Benachio et al. (2020) [13] and a complementary literature review. The literature review included 52 articles, and 12 additional practices were mapped.

Concluding the pre-analysis phase, the material was prepared. Table 1 was created, which is a compiled list of CE practices. To complement the analysis of the relationships, the practices were separated into categories based on the first stage of the project lifecycle they impact.

The categorization was based on the life cycle stages outlined in the EN 15804 [14] standard and on the classification of phases performed in the article by Benachio et al. (2020) [13].An additional stage was also considered, as proposed in the article, to be added to the existing phases in the standard, previously called A0, to include activities related to the conception, planning, and design stage, adapting the model proposed by CEN [14]. Under EN 15804, stage A3 refers to the manufacturing of construction products and all processes from cradle to gate, considering both goods and services used during the life cycle of a building as "construction products" [15]. However, it is observed that reaching stage A3 requires a planning and design phase, for example, to determine which materials will be used. Therefore, the CE practices were subdivided into the following stages: Design (practices where A0 would be the first impact phase); Product (practices focused on manufacturing); Construction; Use; and Benefits and burdens beyond the life cycle.

This list of practices is related to Group 6 of the created codes, called "Characteristics" in the Agile Methodology category, which encompasses the main characteristics of agility and is presented in Table 2. These characteristics were also divided into three categories: project delivery, team and/or stakeholders, and management processes.

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Table 1. Coding of the circular economy theme in the construction industry. Adapted from (*) [12] and (**) [13]

Key	CE practice in the construction industry	Life Cycle Stage
1	Use of digital technologies to support the promotion of the circular economy (*).	Design (Stage "A0")
2	Energy efficiency project (*).	
3	Modeling and Application of Life Cycle Cost (*).	
4	DfMA approach in manufacturing and assembly design (*).	
5	Design and use of modular buildings (**).	
6	Project for the adaptability of existing buildings (**).	
7	Project for dismantling building structures (**).	
8	Use of a scale to analyze the level of implementation of Circular Economy practices in the company (**).	
9	Use of a simulation in a BIM model to analyze the potential for reusing materials from different types of projects at the beginning of the project (**).	
10	Use of life cycle assessment to find the benefits of reusing different types of materials during the design phase (**).	
11	Use of inventory data to assist in the reuse of materials from a new building (**).	
12	Use of water management practices (**).	
13	Use of bio-based materials (*).	Product (Stage A1-A3)
14	Hazardous materials management (*).	
15	Use of local materials (*).	
16	Change in the use of materials, giving ownership to manufacturers to reuse the materials after the end of the first building's lifespan. (**).	
17	Development of materials passports (**).	
18	Reuse of secondary materials in the production of building materials (**).	
19	Reuse of construction materials in a new building (**).	
20	Use of BIM for Construction and Demolition Waste Management (*).	Construction (Stage A4-A5)
21	Waste reduction (**).	
22	Off-site construction (**).	
23	Use of BIM to improve operation, maintenance, and asset management (*).	Use (B1-B7)
24	Operational management of building space occupancy (*)	
25	Use of a tool to assess the condition of materials during the lifespan and end of life of a building (**).	
26	Minimize corrective maintenance with preventive maintenance (**).	
27	Use of BIM for building deconstruction (*).	End of Life (C1-C4)
28	On-site waste recycling (*).	
29	Analyze the potential for reuse or recycling of existing materials and whether it is feasible compared to using new materials (**).	
30	Demolition Waste Management (**).	
31	Deconstruction of structures and building materials (**).	
32	Use of a circularity tool to assess existing buildings and provide the best possible solutions for rehabilitation (**).	Benefits and burdens beyond the end of life (D)

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Table 2. Coding of the agile management theme in the construction industry. Adapted from [12]

Key	Agile attribute	Category of attributes
A	Add value / Deliver with maximum value	Project delivery
B	Increase in delivery efficiency	
C	Time management / Shorter deadlines	
D	Customer satisfaction	
E	Budget control / Cost reduction	
F	Increase in team productivity	Team and/or stakeholders
G	Team self-organization	
H	Colaboration	
I	Improvement in communication / quick feedback	
J	Easy implementation / Simplicity	Management processes
K	Flexibility	
L	Change Management	
M	Inspection	
N	Continuous improvement	
O	Improvement / Sustainable development	
P	Effective risk resolution / Risk management	
Q	Transparency	

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After defining the codifications described in Tables 1 and 2, the material exploration phase was initiated, guided by Bardin (1977) [11], with coding operations in which each CE practice is related to each agile attribute. In this phase, a qualitative assessment is made to determine if there is synergy between the CE and agility, based on the analysis of the author's relationships, through the development of a contingency matrix. Each row of the matrix corresponds to one of the CE practices, and the columns represent the characteristics of agility. To assist in organizing the matrix, numeric keys were established for the rows and alphabetic keys for the columns, according to the keys in Tables 1 and 2. Additionally, at the intersection of a row and a column, when identified, the number referring to the interaction found was recorded.

To conclude the content analysis based on Bardin (1977) [11], there is the "treatment of results and interpretations" phase. In this phase, systematic confrontations and inferences of the relationships in the matrix are performed, allowing the establishment of theoretical relationships between concepts, whether in positive interactions, when benefits arise from the combination, or in negative interactions, when the association of variables results in disadvantages. Based on this content analysis, inferences and interpretations of the obtained results were made. The quantitative results were also treated to map the frequency of relationships between the concepts.

3 Results

This section presents the mapping of interactions through content analysis by Bardin (1977) [11]. The qualitative results consisted of a contingency matrix and the respective interactions between CE practices and agile attributes. An interaction is defined as the conceptual relationship identified between a CE practice and an agile attribute based on their alignment or complementary characteristics. The contingency matrix was composed of positive interactions between the concepts and negative interactions. The establishment of interactions was made through inferences and interpretations between the categories, identifying theoretical relationships between the themes of CE and agile methodology in the construction industry based on the current state of the literature. A total of 153 interactions were identified, including 146 positive and seven negative. The complete contingency matrix is available in full in the dissertation presented in [16].

Through the contingency matrix, the incidence of interactions by CE practices was quantitatively analyzed through a frequency-based aggregation, in which each interaction identified between a CE practice and an agile attribute was coded and counted as a unit of occurrence. Figure 1 graphically shows the number of interactions for each practice, including positive interactions (in green) and negative interactions (in red).

Regarding positive interactions, Practice 1, related to the use of digital technologies to support the promotion of the CE, had the highest number of interactions, totaling positive interactions with 12 different agile attributes. Practice 5, related to the design and use of modular buildings, received 11 positive interactions. The practices with the fewest positive interactions were Practice 15 (use of local materials) and Practice 18 (reusing secondary materials in the production of building materials), each totaling one interaction.

Analyzing the negative interactions, only five distinct practices were negatively related to agile characteristics. Practices 22 (Off-site construction) and 31 (Deconstruction of structures and building materials) had two negative each. One negative interaction was mapped for practices 3 (Modeling and application of Life Cycle Cost), 7 (Design for disassembly of building structures), and 12 (Use of water management practices).

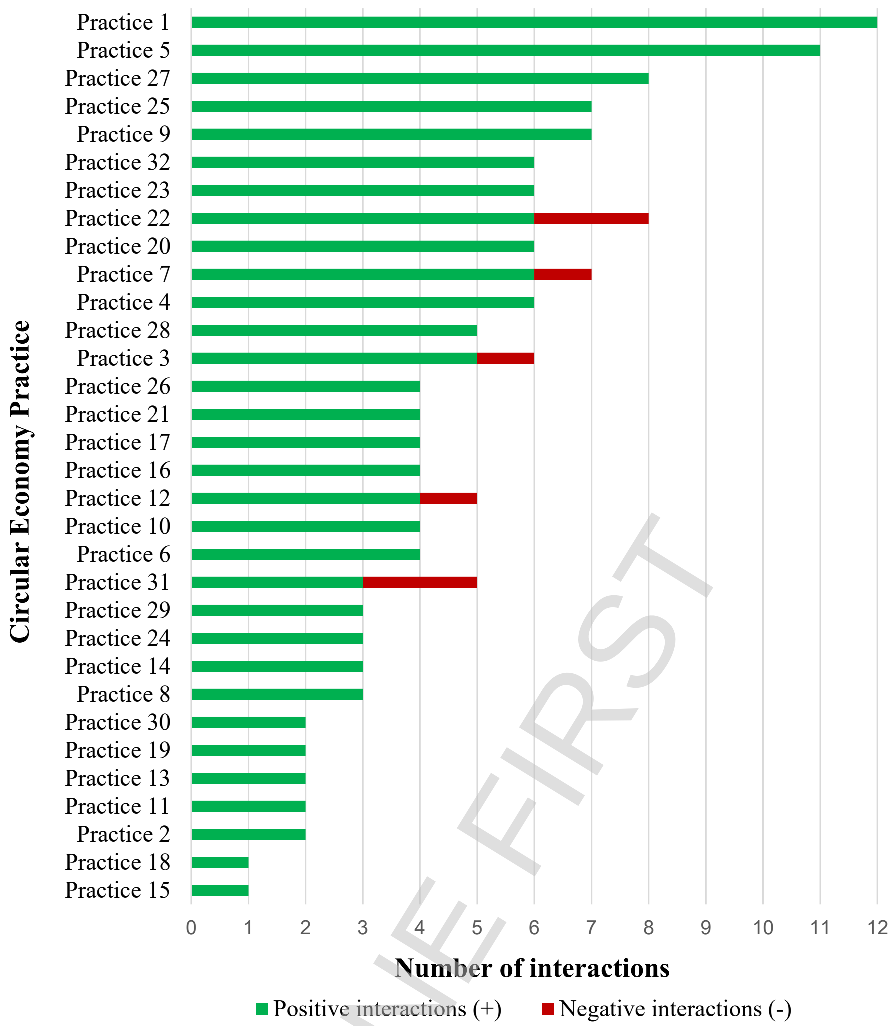

Figure 1. Incidence of interactions by CE practice

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The incidence of interactions was also analyzed by agile attributes. The number of interactions for each agility characteristic in the construction industry was assessed and graphically represented in Figure 2.

Regarding positive interactions, the agile attributes with the highest occurrence were flexibility and transparency, each with 16 positive interactions. Next, among the most related attributes, there are budget control, continuous improvement, and risk management each with 14 positive interactions. The team self-organization attribute, however, did not have any mapped interactions.

The identification of negative interactions occurred in four different agile attributes, with the attribute "easy implementation/simplicity" having four negative relationships with CE practices. The attributes "budget control", "flexibility", and "shorter time management/deadlines" each showed one negative interaction.

In the context of the initial phases of the building's life cycle, which are impacted by the considered practices, the interactions present at each stage were investigated. For this analysis, both positive and negative interactions were considered, since unfavorable interactions are infrequent and the total volume of interactions is already significant.

Figure 3 shows that the design stage had the highest number of interactions, totaling 66 positive and three negative interactions (Project), which accounts for 45% of the total relationships identified (values derived from the contingency matrix, which comprises a total of 153 interactions). In contrast, the stage of benefits and loads beyond the end of life recorded the fewest interactions, representing only 4% of the total identified, that is, six positive interactions.

Based on the categories of CE practices at different stages of the lifecycle (design, product, construction, use, end of life, and post-end-of-life benefits), along with the agile attributes influenced by specific characteristics (project delivery, team and/or stakeholders, and management processes), an analysis was conducted to understand the interactions between these variables.

Figure 4 illustrates this analysis and reveals that the relationships related to agile attributes in the context of management processes are predominant in all stages of the lifecycle. On the other hand, agile attributes associated with the team and stakeholders show fewer interaction occurrences in almost all stages, except in the "benefits and post-life charges" phase, where the "project delivery" category had the lowest frequency of interactions.

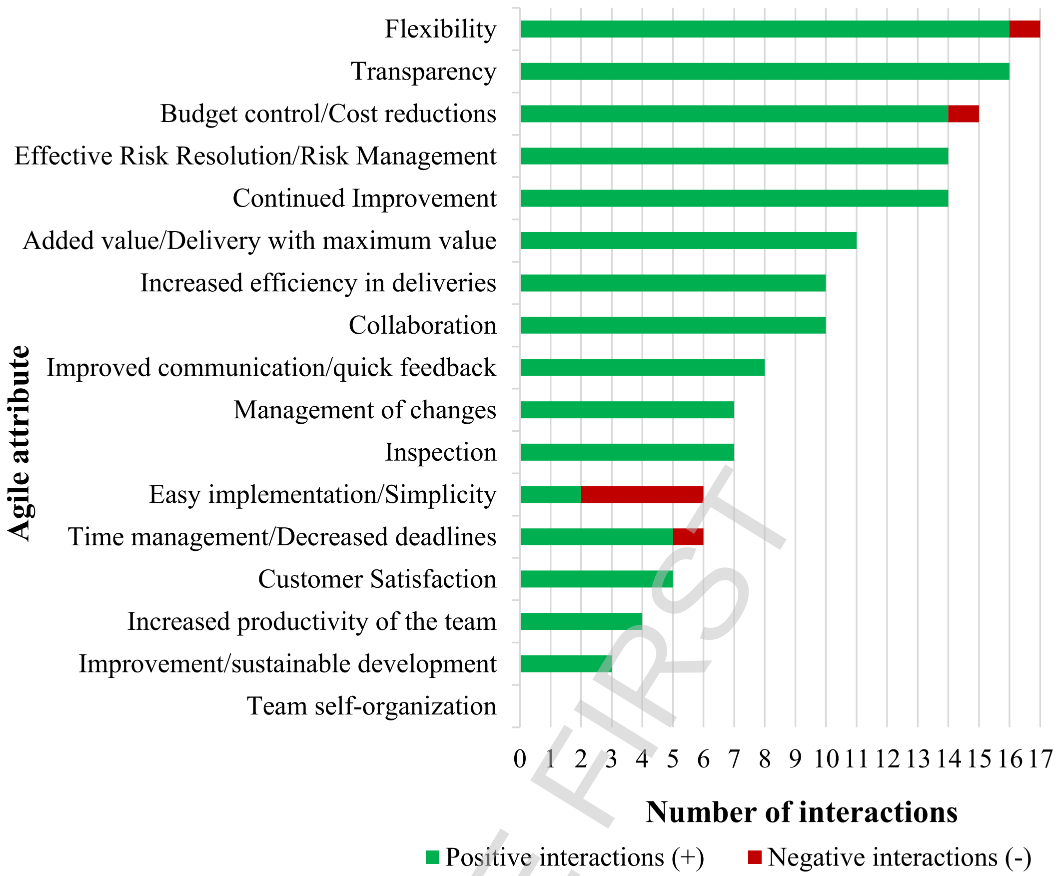

Figure 2. Incidence of interactions by agile attribute

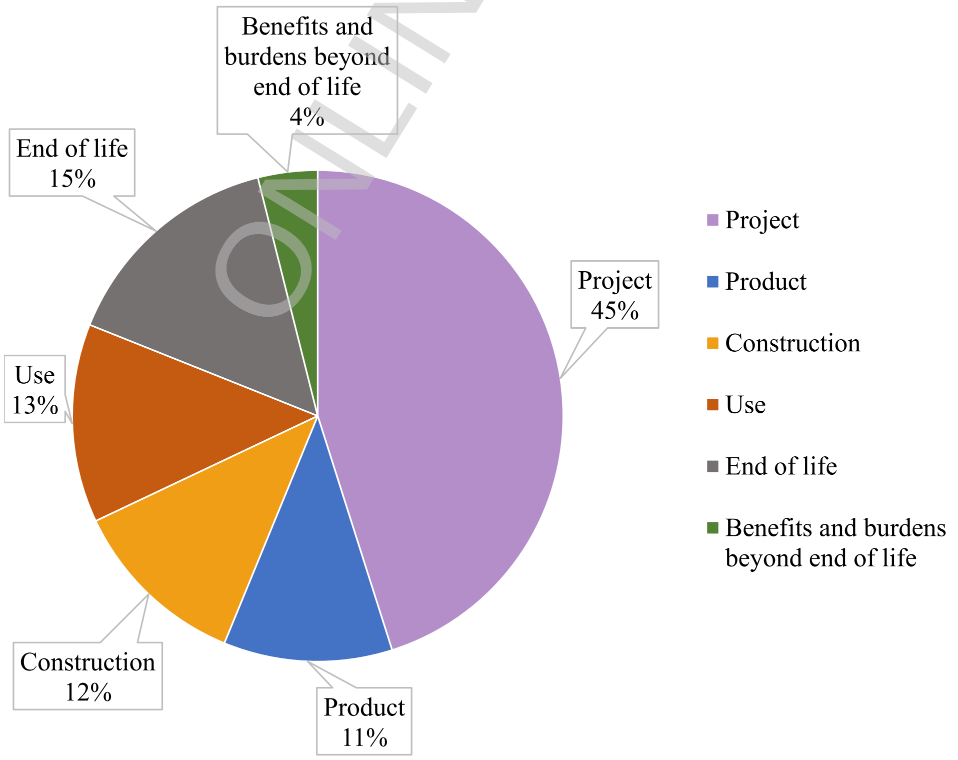

Figure 3. Incidence of interactions by life cycle stage

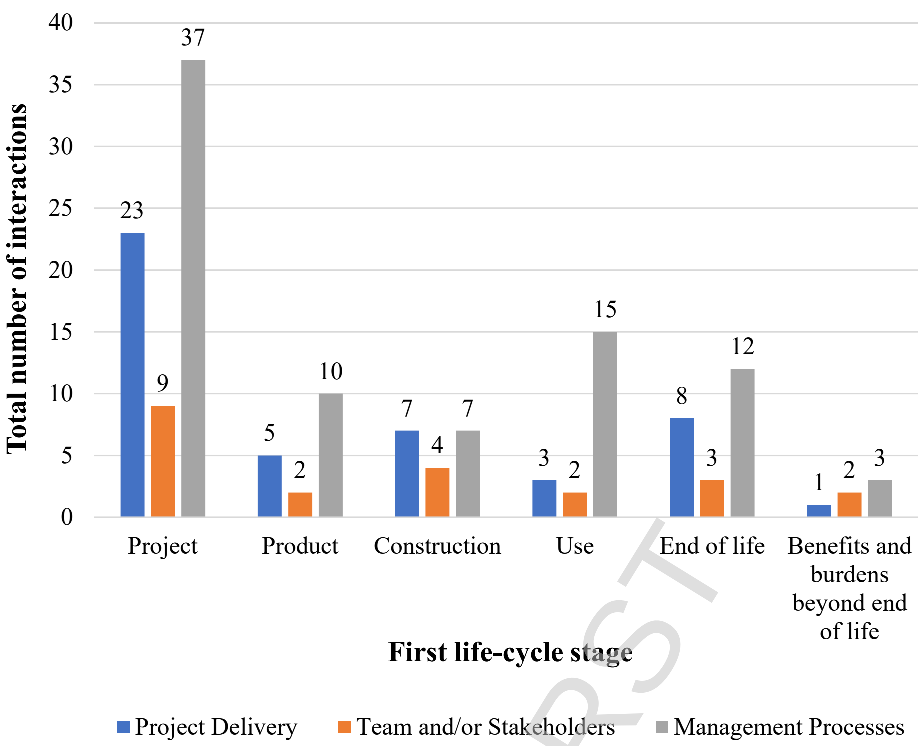

Figure 4. Incidence of interactions by stages of the life cycle and by categories of agile attributes

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Based on the results presented in this section, the discussions in the following section were based on the analyses carried out.

4 Discussion

This section addresses the main discussions about the theoretical relationships between CE practices and agile attributes in construction projects found in the literature. Additionally, it highlights the main research gaps for future studies.

From Figure 1, it was observed that Practice 1 ("use of digital technologies to support the promotion of the circular economy") had the highest number of interactions, totaling 12 positive responses. Overall, Industry 4.0 technologies such as the Internet of Things (IoT), robotics, BIM, Artificial Intelligence (AI), blockchain, and augmented reality (AR) have the potential to bring benefits to the CE in the construction industry throughout the project lifecycle [17]. These digital technologies are essential for transitioning from a linear economy to a CE. The recurring association between Practice 1 and agile management stems from the benefits these technologies can bring to project management.

These benefits include innovation; greater efficiency and quality in delivery; optimization of CE practices; flexibility to incorporate circular measures; tracking and monitoring of information; identification of improvements; centralization of information and agility in communication among stakeholders; sustainable development; collaboration in risk management; and increased transparency and visibility in data management [18]. Additionally, the theory is associated with the origin of the agile methodology, which emerged in the information technology (IT) and software development fields, bringing the values established in the Agile Manifesto [19] into the practice of using technologies to promote the CE.

The design and use of modular buildings (Practice 5) was the second most interactive practice. The construction and utilization of buildings offer an efficient, high-quality construction solution with greater process control [20]. Prefabrication of components improves quality control and delivery efficiency, reducing costs and minimizing waste. Additionally, the modular approach allows for adaptations, promotes transparency in the process, and enables continuous improvements, making it a flexible and satisfying solution for clients. A similarity was identified with the research by Benachio et al. (2021) [20], as the authors also mapped this practice as the second most interactive with the principles of Lean. Based on this analogy, similarities between the principles of Lean and Agile are observed, such as simplicity, continuous improvement, flexibility, and transparency.

The practices with the fewest positive interactions were Practice 15 (use of local materials) and Practice 18 (reusing secondary materials in the production of building materials). Both practices are alternatives for material substitution and make it difficult to correlate them with agile management characteristics. These practices are present in decisions to be made at the beginning of the project, whose benefits for the subsequent phases are not associated with managerial terms.

When examining negative interactions, it was found that only six distinct practices showed unfavorable associations with agile characteristics. The practices of "off-site construction" and "deconstruction of structures and building materials" had two negative interactions. Off-site construction conflicts with simplicity because it involves complexities in transporting large and heavy parts and in planning [20]. Additionally, the lack of flexibility to make changes during assembly is a limitation resulting from this construction approach. Regarding deconstruction, compared to conventional demolition, it requires more complex planning, additional steps at the end of the structure's lifespan, and is a more time-consuming and meticulous process [21].

Based on Figure 2, an analysis was conducted on the recurrence of the theoretical relationships of each agile attribute. The attributes with the most positive interactions were flexibility and transparency. Flexibility is essential for applying CE practices, especially in transitioning from linear to circular models. Additionally, having flexible scenarios throughout the product lifecycle is necessary to achieve more sustainable projects. Transparency is fundamental for decision-making during the project, establishing visibility and trust among stakeholders. Therefore, transparency becomes indispensable for most CE practices to ensure successful implementation.

The team's self-organization attribute did not interact with any mapped CE practices. Although it is an attribute that can offer advantages in the transition to a CE, there were no interactions because the practices do not establish specific management guidelines, unlike this agile characteristic. However, it is evident that the self-management of the involved professionals provides competitive advantages to the project, and future studies may identify hypotheses about relationships with the CE. The agile attribute "easy implementation/simplicity" had the highest number of negative interactions. This stems from complexities attributed to the related practices, which require additional challenges for successful implementation, such as robust planning, detailed analysis, and specific techniques.

Regarding the analysis of the categories, it was observed that the interaction between CE practices and agile attributes, especially those related to management processes, plays a significant role in the early stages of the building's lifecycle, namely the design phase. Emphasizing the importance of adopting sustainable planning from the initial conception stage of a building. This can involve, for example, incorporating circular design from the CE and integrating construction project processes to incorporate innovations. By combining the concept of the circular economy with project management processes early in the project's initial phase, the substantial interaction between this stage and the mentioned approaches is addressed.

A low frequency of interactions was observed in the "team and/or stakeholders" category, which is related to the weak presence of solid management guidelines in CE models. The CE has not yet reached a level of maturity that enables adequate characterization of the essential qualities of a team and the development of strategies to improve communication with stakeholders. In this context, this study is relevant because it proposes a synergy between agile project management and the CE, allowing them to complement each other and fill gaps.

Regarding the "Benefits and loads beyond the end of life" phase, the low incidence of interaction with the "project delivery" category occurs because the practices related to this stage aim to go beyond the client-focused deliverable by considering what happens after the end of life. The fact that this stage was the least related to agile practices is also due to the characteristics of agile methodologies, which typically consider project management only until the completion of the active phase. This limited interaction arises from post-project issues, such as the need for extended planning and changes in stakeholders and end users. The reduced connection between agile project management and this specific phase highlights the importance of adapting management approaches according to the nature and distinct characteristics of each life-cycle stage. This situation may also indicate the need to develop specific strategies to address the challenges and benefits that emerge after a project's formal completion. Due to the complexities involved in implementing practices in this stage, the agile approach stands out as an alternative for managing such complex issues, given its flexible and adaptive capabilities.

In summary, the results indicated that there is synergy between the CE and agile project management. Based on the interactions found, which were mostly positive, it was observed that the combination of both concepts has the potential to bring benefits to construction projects. Therefore, a proposed application, to corroborate and validate this synergy in real-world scenarios, is to adapt an agile framework for managing the implementation of one or more CE practices in the construction project.

To promote the transition from a linear economy to a CE in the construction industry, it is suggested to do so gradually and in a well-coordinated manner. Therefore, the agile approach can contribute with its iterative and incremental methodology, just as the construction industry needs to become familiar with agile methodology to expand its use in an increasing number of projects. For this, it is proposed to create a circular innovation project within the company for each building project, and these projects will be managed according to the agile methodology. Authors such as Lalmi, Fernandes, and Souad (2021) mention that the most used agile framework in the civil construction landscape is Scrum. Due to this, the present research recommends the Scrum framework for developing a management model aimed at implementing CE practices in construction projects. To exemplify agile management of CE practices through a parallel innovation project related to a specific construction, an adapted framework is proposed, considering the roles, ceremonies, and artifacts of Scrum as described in the Scrum guide [22]. This allows for adaptation regarding the daily meeting proposed by Scrum, which can be changed to weekly meetings, as there are phases in which the process of a construction project proceeds more slowly than software development in its original form. It is recommended to start the circular innovation project simultaneously with the conception of the construction project. For this, a Scrum team is established with a multidisciplinary team to handle activities related to the innovation project, including a Product Owner (suggestion: design engineer) and a Scrum Master (a professional trained in Scrum). It is also necessary to identify the main stakeholders of the project, such as the business owner, company management, engineering and architecture professionals, among others. The proposed approach is supported by recent studies indicating that agile methodologies enhance collaboration, adaptability, and sustainability performance in construction project environments [23].

It is important to emphasize that a framework provides guidelines for project management, but it is not a rigid process, allowing for flexibility depending on the type and phase of the project. It is also important to highlight the role of the Scrum Team in adjusting the sprint duration in accordance with the phase of the product development cycle. For example, extending the sprint time during the construction phase proportionally to the duration of the selected activities. The goal of the adapted framework is to practically demonstrate the synergy between the CE and agile methodologies, presenting agile as a driver for implementing CE business models in the construction industry.

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5 Conclusions

The research adopted the content analysis and relationship method proposed by Bardin (1977) [11] to answer the question, "What are the theoretical relationships between the Agile approach and the CE in projects within the Architecture, Engineering, and Construction (AEC) sector?" Through a literature review, practices of the CE and agile attributes for construction projects were mapped. Content analysis identified 146 positive interactions and seven negative interactions between CE practices and agile attributes. The results indicated a synergy between the two concepts, highlighting the use of digital technologies to promote the CE and the design of modular buildings.

The agile attributes with the highest incidence of positive interactions were flexibility and transparency. On the other hand, the attribute “easy implementation/simplicity” had the highest number of negative interactions. The analysis of the results indicated that the combination of the agile approach and the CE can bring benefits to construction projects, due to the synergy between the concepts.

Agile characteristics such as flexibility, transparency, budget control, risk management, and continuous improvement are synergistically related to the practices of the CE, as detailed:

- Flexibility allows for the quick adaptation needed for CE strategies, responding to changes in the market and customer needs;
- Transparency promotes the dissemination and sharing of information to optimize sustainable practices;
- Budget control comes from the efficient allocation of resources, reduction of waste, and the reintegration of materials into the economy after their end of life through circular solutions;
- Risk management enables the identification and mitigation of environmental, social, and economic impacts associated with the circular model; and
- Continuous improvement supports the ongoing pursuit of innovations that make processes more sustainable and contribute to a circular cycle with the maximum value of materials.

It has been found that the combination of agility and the CE promotes the adoption of circular practices in the construction industry, as well as being a way to introduce agile methodology into the sector.

The analysis of the categories revealed the importance of the interaction between CE practices and agile attributes, especially concerning management processes during the early phases of a building's lifecycle, with a focus on the design phase, highlighting the need to adopt sustainable planning from conception. A limited interaction was observed in the “team and/or stakeholders” category due to the nascent presence of management guidelines in CE. In the “Benefits and burdens beyond the end of life” phase, the low connection with project delivery suggests a broader approach. The “Benefits and burdens beyond the end of life” phase shows less interaction with agility, reflecting the distinct characteristics of this stage and emphasizing the essential adaptation of management approaches. This finding underscores the need for specific strategies to address post-project challenges, highlighting the importance of considering the nuances of different lifecycle phases in the pursuit of more effective and sustainable practices. In this context, the agile approach stands out for its flexible and adaptive capacity, gaining relevance.

Based on the results, the adaptation of the Scrum agile framework is proposed for managing circular innovation projects in parallel with construction, aiming to promote the transition from a linear economy to a circular one in the construction industry. The proposed association between agile and the CE in a company’s innovation project intends to familiarize AEC professionals with both topics without causing a sudden change in the entire management process. This approach allows for the gradual and coordinated implementation of CE practices in construction projects, with agile management providing an iterative and incremental approach to achieve more sustainable projects. In this way, it is possible to overcome resistance to change and invest in innovation, which are crucial steps toward achieving more sustainable and efficient construction industry projects.

Finally, the synergy between the CE and agility presents an opportunity to promote the adoption of sustainable practices in the construction industry, fostering innovation and continuous improvement. It is emphasized that the establishment of these interactions was made through inferences and interpretations between the categories, identifying the theoretical relationships between the themes of CE and agile methodology in the construction industry based on the current state of the literature. Therefore, the scope of this research did not include proving or providing practical evidence through case studies about the theoretical interactions identified. For this reason, it is recommended that future studies explore this practical approach to validate its actual effectiveness and further enhance the integration between the CE and agile management in construction projects.

Furthermore, during the analysis of the interactions, a close relationship between Agile and Circular Economy construction was observed, as both approaches share principles and characteristics. Therefore, the relationship between Agile and Circular Economy construction is identified as a promising topic for further research, providing insights for improving project management in the construction industry.

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