GREEN CREATIVE DESIGN FOSTERING A SUSTAINABLE MENTAL MODEL

DESIGN CRIATIVO VERDE: IMPULSIONANDO UM MODELO MENTAL SUSTENTÁVEL

EL DISEÑO ECOLÓGICO CREATIVO PROMUEVE UN MODELO MENTAL SOSTENIBLE

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ABSTRACT

Green creativity has emerged as a vital field in sustainability research, emphasizing the integration of creative processes with environmental responsibility. Literature on green creativity highlights its role in generating eco-innovations and fostering awareness of sustainable practices through design. Engagement in sustainability initiatives often depends on such creativity-driven approaches, which encourage individuals to view sustainability as part of their core values and social identity. This study explores how a creative framework based on green creativity and design techniques can effectively promote sustainable engagement. The method involved adapting a Creative Framework for the "Cidades pelo Clima" project (CpC), to engage participants in sustainable issues. It helped establish shared values and collective goals, empowering participants to actively contribute to environmental solutions. Results demonstrate that green creativity not only enhances team cohesion and motivation but also embeds sustainability into participants' mental models, fostering long-term commitment to eco-conscious behaviors. The research contributes to the field of sustainable design by showcasing how creativity can serve as a catalyst for promoting long-term engagement and fostering sustainable mental models.

KEYWORDS

Creativity; Design Thinking; Green Creativity; Mental Models; Green Commitment.

RESUMO

A criatividade verde emergiu como um campo vital na pesquisa em sustentabilidade, enfatizando a integração de processos criativos com responsabilidade ambiental. A literatura sobre criatividade verde destaca seu papel na geração de eco-inovações e na promoção da conscientização sobre práticas sustentáveis por meio do design. O engajamento em iniciativas de sustentabilidade frequentemente depende de abordagens orientadas pela criatividade, que incentivam os indivíduos a enxergar a sustentabilidade como parte de seus valores centrais e de sua identidade social. Este estudo explora como um framework criativo baseado em criatividade verde e técnicas de design pode promover efetivamente o engajamento sustentável. O método envolveu a adaptação de um Framework Criativo para o projeto "Cidades pelo Clima" (CpC), com o objetivo de envolver os participantes em questões sustentáveis. Esse framework ajudou a estabelecer valores compartilhados e metas coletivas, capacitando os participantes a contribuir ativamente para soluções ambientais. Os resultados demonstram que a criatividade verde não apenas potencializa a coesão e a motivação das equipes, mas também incorpora a sustentabilidade nos modelos mentais dos participantes, promovendo um compromisso de longo prazo com comportamentos ecoconscientes. A pesquisa contribui para o campo do design sustentável ao mostrar como a criatividade pode servir de catalisador para fomentar o engajamento duradouro e o desenvolvimento de modelos mentais sustentáveis.

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PALAVRAS-CHAVE
Criatividade; Design Thinking; Criatividade Verde; Modelos Mentais; Compromisso Verde.

RESUMEN
La creatividad verde ha surgido como un campo vital en la investigación sobre sostenibilidad, que hace hincapié en la integración de los procesos creativos con la responsabilidad medioambiental. La literatura sobre creatividad verde hace hincapié en su papel a la hora de generar ecoinnovaciones y promover la concienciación sobre prácticas sostenibles a través del diseño. El compromiso con las iniciativas de sostenibilidad depende a menudo de enfoques basados en la creatividad que animen a los individuos a ver la sostenibilidad como parte de sus valores fundamentales y de su identidad social. Este estudio explora cómo un marco creativo basado en la creatividad verde y las técnicas de diseño puede promover eficazmente el compromiso sostenible. El método consistió en adaptar un Marco Creativo al proyecto «Ciudades por el Clima» (CpC), con el objetivo de implicar a los participantes en cuestiones sostenibles. Este marco ayudó a establecer valores compartidos y objetivos colectivos, capacitando a los participantes para contribuir activamente a soluciones medioambientales. Los resultados muestran que la creatividad verde no sólo mejora la cohesión y la motivación de los equipos, sino que también incorpora la sostenibilidad a los modelos mentales de los participantes, promoviendo un compromiso a largo plazo con comportamiento eco-consciente.

PALABRAS CLAVE
Creatividad, Design Thinking, Creatividad Verde, Modelos Mentales, Compromiso Verde.

1. INTRODUCTION

Creativity is a fundamental factor in developing innovative solutions; therefore, it is also crucial in facing global sustainability challenges. It is an important ally in building a sustainable mindset and engaging people in teamwork, allowing a new perspective and approach to sustainability challenges. In this context, creativity becomes essential, as it challenges us to perceive the world in different ways and thus promotes questioning of old beliefs and habits, opening up space for ideas that consider the common good and care for the environment (Amabile, 1983).

This creative and reflective process contributes to the formation of a more sustainable set of values (sustainable mental models), enabling individuals and their groups to see and understand the world with a more conscious approach as a direct result of this type of creative practice. According to Jodi Summers et al. (2021), these mental models shape the way we think and act. Thus, creativity oriented towards perceiving different angles of specific problems allows individuals to see new connections and understand the impacts of their decisions.

In this context, engagement becomes more than a response to goals and objectives; it becomes "flow," a state of total immersion where individuals are fully involved and motivated in the activity they are developing (Csikszentmihalyi, 1996). In teams that value sustainability and creative thinking, this engagement becomes natural, as each member understands their role as essential in the search for solutions that can make a real difference. This collective awareness creates a sense of belonging and purpose, strengthening connections among members and fostering a genuine commitment to the group's goals.

Thus, creativity is seen not only as a tool for problem-solving but as a starting point for individuals and teams to become more committed and engaged in sustainable projects. By expanding individual horizons, creativity unites individual and collective purposes around a shared vision where sustainability is the central value. In this way, beyond generating innovative solutions, creativity can also be used to strengthen team relationships and cohesion, providing a more connected environment oriented toward a more sustainable future. According to Brown (2010), methodologies such as design thinking foster this practice by promoting empathy and collaboration, which are essential for teams to not only share a sustainable vision but also unite around it.

In this sense, this work aims to analyze the efficacy of creativity and design tools as drivers to motivate environmental awareness, and then, promoting sustainable engagement of people. Bertella et al. (2021) shows examples of which frameworks were applied as a useful approach to promote innovation by a critical systemic thinking. Furthermore, this work sought to understand the follow issue: Can a creative design framework, exclusively developed to foster business models, guide creativity to play a crucial role to promote sustainable engagement of teams, raising confiança e espírito de equipe to support reliable decisions?

Our research sheds light on the creativity tools as an important approach to reach sustainable aims, as well as the impact of such tools on the development of espírito de equipe e identidade social among membros de equipes, serving as a guide force in sustainable projects to help managers. In the following sections, relevant work on creativity, green creatitivty, sustainable design, and design tools and engageent is reviewed and organized as follows. Section two, three and four we present a background on creativity and green creativity and their relationship with sustainable design, as well as creativity and design are taken into account to foster sustainable engagement. Section five we show the research method and approach of the case study. The section six we present the results and discussions, elaborating the implications sustainable projects. The paper ends with a presentation of conclusions and recommends future research.

2. CREATIVITY FOR SUSTAINABILITY

Creativity is a fundamental factor in the development of innovative solutions; therefore, it is also crucial in addressing the global challenges of sustainability, with its variables, dynamics, and complex interactions that make the sustainability problem even more challenging (Anderson et al., 2014; Martens, 2011). This chapter discusses the nature of creativity, its role in promoting and motivating sustainable practices, and, in particular, the importance of Green Creativity for generating ideas and developing solutions that focus on environmental responsibility in design and innovation processes.

2.1. GREEN CREATIVITY: fostering sustainable mental models

Creativity is a widely used term; however, its definition is quite broad throughout the specialized literature, reflecting the difficulty and ambiguity in defining a theory that provides an accurate conceptualization. This complexity is determined by a multitude of factors that can be analyzed from different perspectives (Sharma & Teper, 2008; Costa, 2006; Saleh & Brem, 2023). The difficulty in defining it makes creativity a topic studied by researchers from several fields.

Creativity is inherently subjective, making it challenging to study over time. Before the 17th century, creativity and creative actions were explained by genius or divine inspiration (Pinheiro & Cruz, 2009). Similarly, in Darwin's evolutionary perspective, creativity was also considered divine or a genetic evolution linked to genius (Pelaes, 2010; Wechsler, 2008). Guilford's pioneering research was among the first to treat creativity as a measurable and trainable skill. Today, research focuses more on understanding the components necessary to foster creativity (Mkhize & Ellis, 2020; Arslan et al., 2022).

Due to its multifaceted nature, many researchers approach creativity from different perspectives, defining it as the ability to produce original and useful ideas (Boden, 1994). From a neuroscience perspective, creativity is understood as an innate human response to problem-solving (Kandel et al., 2014; Sprugnoli et al., 2017). According to Csikszentmihalyi (1996), creativity is an idea or product that transforms existing knowledge, while for Plucker (2004), creativity is socially recognized for being not only new but also useful. Amabile (1983) views creativity as a process leading to creative outcomes. Many other definitions highlight its main characteristics as originality, flexibility, fluency, and elaboration (Torrance, 1972; Guilford, 1967). For Cropley (2000), its qualities are novelty, elegance, and applicability in different contexts. According to Gurteen (1998) and Lubart (2007), divergent thinking is at the core of creativity, generating new knowledge. For Newbigin (2010), creativity is the act of questioning paradigms, challenging existing beliefs and assumptions. Despite the wide variety of perspectives, there is a consensus to understand creativity as the generation of new ideas that, when useful, drive innovation (Bedani, 2012).

The development of creativity does not occur in isolation; rather, it is systemic and influenced by internal factors (e.g., intrinsic and extrinsic motivation) and external factors, such as work environments and/or organizational policies (Gerhart, 2015). In organizations, creativity can be encouraged by management practices that promote an environment of experimentation and innovation. Research highlights that creativity is not just an individual skill but is also perceived and fostered in groups and organizations through collaborative processes and learning (Csikszentmihalyi, 2001).

Face current challenges, in the context of sustainability, creativity is the way to find innovative ideas for environmental, social, and economic problems, with solutions that can be applied in the medium and long term. Furthermore, new concepts of sustainability-oriented creativity emerge as an effective approach to increase awareness and creative engagement in sustainable solutions, such as "mindfulness" (Rodrigo, 2016). In this sense, in recent years, many researchers have sought to understand the role of creativity in sustainability, and different studies have focused on applying creative thinking in developing solutions to maximize the transition to sustainability (Brem & Puente-Díaz, 2020a; Kagan et al., 2020; Przychodzen et al., 2016; Sovacool et al., 2018). In this context, Shrivastava (2014) points to ways of integrating cognition and emotion in his research on sustainability, while Hensley (2020) and Mróz & Ocetkiewicz (2021) aim to understand how to incorporate creativity in education for sustainability. Luu (2021), Li et al. (2020), and Jiang et al. (2021) research approaches to promoting green creativity among employees in organizations (Rabab Saleh, 2023).

In this context, the concept of Green Creativity emerges, based on the need to integrate innovation processes with sustainable environmental practices. According to Chen and Chang (2013), Green Creativity can be defined as "the development of new ideas about green products, services, processes, or practices that are original, useful, and environmentally responsible". Thus, green creativity appears in the discourse of environmental management and organizational innovation as the ability to generate new ideas that are sustainable and beneficial for organizations, aligning innovation with social and environmental responsibility (Chen & Chang, 2016). Creativity is linked to innovation and problem-solving, making it fundamentally useful in tackling urgent sustainability challenges by generating solutions that reduce environmental impact while maintaining the economic viability of the products and services created.

According to (Shrivastava & Ivanova, 2015) Green creativity can transform prevailing mental models in society,

meaning it can alter current cognitive structures used by individuals to interpret and respond to the world around them. The current mental models in society prioritize financial gain based on intensive resource exploitation. However, these mental models are being replaced by models that prioritize sustainability, and in this sense, green creativity promotes the conditions necessary for this shift by incentivizing the generation and development of ideas and practices aligned with long-term sustainability rather than immediate economic returns.

For a long time, prevailing mental models have produced unsustainable behaviors, promoting growth without considering environmental impacts. Thus, green creativity challenges this mental mode, fostering new ways of thinking where social and environmental responsibility becomes the primary strategic objective of organizations (Kagan, 2011). The new mental models aim not only for innovation but also for behaviors and actions that reduce environmental impacts, relieving pressure on natural resources.

Green creativity acts simultaneously as a product and catalyst of sustainable mental models by generating cognitive structures that imply environmentally responsible behaviors, thus contributing to the development of responsible mental models. According to Shrivastava and Ivanova (2015), the transition to sustainable practices requires not only political changes or technological innovations but also a change in the mental models that guide decision-making. Therefore, green creativity provides the tools and processes necessary for society to reconsider its environmental impact, promoting sustainable approaches to problem-solving and thereby motivating more sustainable behaviors and transformation (Poldner, 2017).

Chen & Chang (2013) assigned that such sustainable changes require the courage to challenge conventional practices and adopt new, long-term sustainable mental models, implying systemic changes in organizations and their respective operational segments. An organization that adopts green creativity can trigger a ripple effect where green creativity becomes the norm rather than the exception, encouraging more innovation and sustainable mental models throughout the value chain (Renwick et al., 2013).

In sectors like fashion, architecture, and design, green creativity has already started to reshape the mental model (Jia. 2018). According to Poldner et al. (2016), the luxury brand Osklen has integrated sustainability into its business model, where green creativity enables the integration of a sustainable mental model into its design process. In this way, it reduces its environmental impact and, more importantly, establishes a model to be followed on how creativity can be used to drive a shift toward sustainable practices (Poldner, 2017). In this sense, the definition of creativity, where originality and effectiveness are highlighted as main characteristics (Runco, 2012), aligns with the goals of sustainable design. A sustainable design project can be considered creative not only for presenting a new solution but also for considering environmental issues as guiding principles of the project. This integration of Green Creativity into design development processes can lead to the generation of innovative and sustainable solutions.

2.2. Integrating green creativity into sustainable design processes

In the design process, there are divergent stages dedicated to discussion and creation, where creativity represents the expression of new ideas, as well as convergent phases of definition and materialization, in which innovation brings these ideas into reality (Thaler, 2016). Thus, the concepts used in design are closely linked to creativity, as design itself can be seen as a capability for problem-solving, developing, and implementing ideas (Farias, 2022). Like creativity, the design process is based on individual cognitive processes and takes place within a social context involving multiple actors (Zavadil, 2016). In design, creativity manifests in various forms, shaped by each designer's unique characteristics (Iervolino, 20XX). Consequently, when we think of designers, we envision creative individuals with knowledge of human attributes and behavior, as well as technical skills, which translate creativity into the development of objects and/or services (Iervolino, 20XX; Thaler, 2016).

In the sustainability context, sustainable design and green creativity form a strong alliance to address the environmental challenges. Sustainable design focuses on reducing environmental impact, increasing resource efficiency, and promoting social responsibility through the development of products and services. On the other hand, green creativity promotes awareness and innovation in ways that prioritize socio-environmental sustainability. These concepts work to generate products and services that not only meet functional needs but also actively contribute to socio-environmental preservation. When integrated, sustainable design and green

creativity enable designers to generate impactful and innovative solutions that respect both current and future environmental limitations (Bozkurt & Tan, 2021).

Traditionally, design projects have primarily focused on market demand, profitability, and user convenience. However, sustainability has necessitated a paradigm shift toward more environmentally responsible design approaches (Kagan, 2011). Green Creativity facilitates this shift by incorporating environmental factors into the design process and encouraging designers to think beyond aesthetics or functionality in their creations (Rabab Saleh, 2023; Ramsha, 2022). Sustainable Design includes various techniques, such as Design Thinking with its iterative and human-centered approach, serving as a catalyst for the integration of sustainability and creativity (Malene, 2010). Furthermore, sustainable design emphasizes empathy, ideation, and prototyping, creating a method through which it is possible to develop solutions that meet practical requirements and stringent environmental goals, encouraging life-cycle thinking that considers the entire impact of a product, from creation to disposal (Ahmed, 2023).

In sustainable design, maximizing green creativity means considering environmental factors throughout the creative process, from ideation to final production (Empson, 2019). Green creativity in sustainable design goes beyond aesthetics or functionality; it prioritizes these values and guides designers to develop sustainable solutions and innovations, where novelty and environmental responsibility coexist (Lozano, 2014). This holistic vision aligns with Amabile's (1996) components of creativity, which empower designers to go beyond conventional problem-solving, allowing them to reimagine existing practices to achieve sustainable results. In this context, creative thinking becomes an essential driver of sustainable solutions, with design developing various techniques and tools that use structured methods to drive innovative ideas (Alves et al., 2024), ensuring alignment with environmental priorities. Thus, green creativity is maximized, reinforcing the use of sustainable practices that are efficient and resilient to environmental changes.

Among several techniques and tools, (Guaman-Quintanilla et al., 2023) indicates that incorporating design thinking into sustainable design practices encourages creative problem-solving, promoting innovative approaches that go beyond traditional product development. Ivano and Louis (2021) note that one of the strengths of design thinking is its ability to bring together different perspectives, thus fostering a comprehensive understanding of the needs of both users and the environment. Furthermore, design thinking is aligned with sustainability due to its focus on empathy with users, which allows it to extend empathy to environmental impacts through techniques that promote a deeper understanding of the user's role within environmental systems (Xia, 2021). As design thinking gains popularity, its role as a guide for sustainable innovation also increases, allowing a generation of designers to address sustainability challenges with heightened creativity and purpose (Ivano and Louis, 2021).

The design thinking collaborates to achieve a balance between divergent and convergent thinking, essential for creating innovative solutions. Divergent thinking supports the generation of a wide range of creative ideas, promoting an open approach that is crucial for exploring new concepts and challenging assumptions. Convergent thinking, on the other hand, plays a critical role in refining these ideas, evaluating their feasibility, and selecting the most viable solutions (Xia 2021). This balance ensures that the creative processes in sustainable design result in innovative and implementable solutions. Alves (2024) points out that the duality between divergent and convergent thinking is fundamental to guiding designers in structured creative processes. Additionally, ideation techniques in sustainable design rely on both logical and intuitive approaches to problem-solving. Methods such as TRIZ (Theory of Inventive Problem Solving) and SCAMPER (Substitute, Combine, Adapt, Modify, Put to another use, Eliminate, and Reverse) provide systematic approaches that allow for both the expansion of ideas and the critical evaluation needed to ensure sustainability (Alves, 2024).

Integrated within the green creativity framework, divergent and convergent thinking provide designers with the necessary flexibility to develop solutions for complex sustainability challenges while also meeting traditional project requirements (Bertella et al., 2021). Thus, Green creativity serves as a guide for designers to push the boundaries of conventional solutions. Finally, through approaches such as Design Thinking, it is possible to raise awareness among different stakeholders about sustainability challenges, fostering strong engagement with environmental issues.

3. DESIGN TOOLS AND CREATIVITY PROMOTING GREEN ENGAGEMENT

Faced with various environmental challenges, the concept of sustainability has been integrated into global discourse.

In this context, green creativity and design tools emerge as fundamental approaches to encourage individuals and communities toward sustainable behaviors, transforming abstract environmental principles into real-life activities (Charlie Wilson, 2018; Elina et al., 2018). By enabling people's emotional connection to sustainability, green creativity fosters a cultural shift oriented toward environmental responsibility (Sandile Mkhize & Ellis, 2020; Hussain et al., 2019). Meanwhile, design tools provide a structured framework, helping people develop sustainable solutions in a tangible and practical way (Phillips et al., 2020; Leon Cruickshanka et al., 2017). Together, green creativity and design tools foster awareness and action, motivating people to contribute to socio-environmental well-being (Saima Hussain et al., 2019; Anke Buhl et al., 2019).

Studies indicate that sustainability initiatives are successful when aligned with personal values, making environmental responsibility part of individual and social identity (Sophia Becker et al., 2021; Elisabeth van de Grift et al., 2020), encouraging people to view sustainable behavior as inherent to their identity and community (Charlie Wilson, 2018; Najla Mouchrek, 2017). In this sense, green creativity combines sustainability with creative processes to promote pro-environmental behaviors in a personal and engaging way (Elisabeth van de Grift et al., 2020; Sandile Mkhize & Ellis, 2020). Through methods that simplify complex topics, green creativity seeks to make tangible environmental issues, promoting long-term socio-environmental commitments (Elina Narvanen et al., 2018; Charlie Wilson, 2018).

According to Sandile Mkhize & Ellis (2020) and Elina Narvanen et al. (2018), when based on playful and community activities, green creativity makes sustainability enjoyable. Gamified initiatives thus engage people by reducing potential inconveniences associated with a sustainable lifestyle. This more pleasant approach generates a sense of shared sustainable purpose (Saima et al., 2019; Leon Cruickshanka et al., 2017). On the other hand, design tools act as instruments to translate sustainability concepts into concrete actions. Through organized structures like workshops, participants can perceive sustainability from multiple perspectives, gaining systemic understanding and practical experience (Bertella et al., 2021; Phillips et al., 2020). Workshops incorporating design tools encourage participants to co-create solutions, making the learning process dynamic and meaningful (Anke Buhl et al., 2019; Augsten & Marzavan, 2017).

According to Najla Mouchrek (2017) and Bertella et al. (2021) the workshop approach effectively bridges the "value-action gap," where pro-sustainability values don't always align with individuals' actions, providing opportunities for practical and experiential learning and helping participants incorporate sustainable practices into their lives (Phillips et al., 2020; Anke Buhl et al., 2019). This holistic approach promotes sustainable awareness, motivating individuals to take responsibility for their sustainability journey and reinforcing their confidence to experiment with new ideas (Augsten & Marzavan, 2017; Leon Cruickshanka et al., 2017).

Design tools make sustainability concepts accessible and tangible, for example, through eco-mapping and user journeys, enabling participants to create visual representations of sustainability goals, helping them see the impact of their actions (Phillips et al., 2019; Anke Buhl et al., 2019). Meanwhile, prototyping tools allow people to transform abstract ideas into physical models, breaking down complex environmental challenges into manageable and actionable steps (Leon Cruickshanka et al., 2017; Phillips et al., 2019). These techniques, followed by feedback cycles, empower participants to experiment and refine sustainable practices based on new environmental insights, reinforcing a dynamic environmental mindset (Phillips et al., 2020; Augsten & Marzavan, 2017). Other techniques, such as personas and empathy mapping, promote sustainable engagement by encouraging empathy, inclusion, and adaptability. They encourage people to consider the needs of different stakeholders, leading to inclusive and people-centered solutions (Mouchrek, 2017; Leon Cruickshanka et al., 2017). User-centered approaches ensure that sustainable practices align with participants' values, making sustainability personally relevant for engagement (Cruickshank et al., 2017; Phillips et al., 2020).

Buhl et al. (2019) and Bertella et al. (2021) highlight that these tools create a deep connection between people and the environment, transforming sustainability from an abstract concept into a lived and personal experience. Sophia Becker et al. (2021) and Elisabeth van de Grift et al. (2020) affirm that design tools strengthen sustainable commitment, inviting individuals to collaborate in the creation and development of solutions, enabling participants to embrace sustainability as an integral part of their social identity. Together, green creativity and design tools cultivate a shared and resilient responsibility, encouraging collective sustainable actions (Bertella et al., 2021; Anke Buhl et al., 2019). Facing urgent environmental challenges, the integration of green creativity and design tools offers a path to a sustainable future.

4. METHOD

Based on the background outlined previously, it is essential to understand whether and how creativity and design tools can contribute to fostering strong engagement with sustainable and environmental issues. In this sense, this work aims to analyze the efficacy of creativity and design tools as drivers to motivate environmental awareness and, consequently, to promote sustainable engagement. The theory and practice of Design Thinking illustrate examples of frameworks that have been applied as effective approaches to foster innovation through critical systemic thinking (Bertella et al., 2021). Furthermore, this study sought to address the following question: Can a creative design framework, exclusively developed to foster business models, be capable of guiding creativity to play a crucial role in promoting sustainable team engagement, enhancing trust and team spirit to support reliable decision-making?

To achieve the aim of the work, after extensive theoretical research on the following themes — Creativity and Green Creativity, Creative Design Tools, and Engagement — a Creative Framework (Alves, 2024) was applied in the Portuguese project "Cidades pelo Clima" (CpC). This project is a network of 20 Portuguese cities aiming to achieve climate neutrality by 2030. Thus, in this research, the first stage of the Creative Framework was adapted and conducted with a group of 20 participants who were appointed by their respective cities to represent them in the CpC project. The participants were divided in 4 teams.

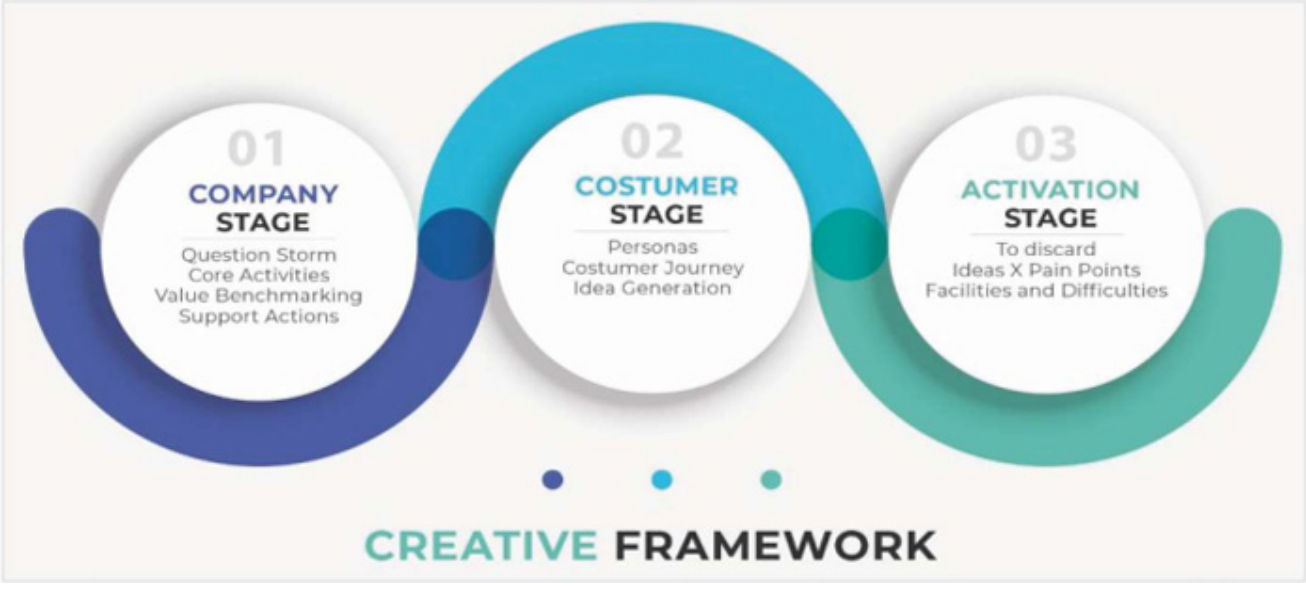

Figure 01: Creative Framework stages.
Source: The authors.

According to Alves et al. (2024), the Creative Framework (Figure 1) includes the following stages: Company Stage, Customers Stage and Activation Stage. For the purposes of this study, based on the literature review conducted, the Company Stage was adapted to create a sense of team and/or community, thereby enhancing participant engagement in the CpC.

5. RESULTS AND DISCUSSIONS

The main aim of this study is to examine if the structure of the Creative Framework can mitivate a new mental model in individuals, thereby fostering their engagement in sustainable projects. In this sense, by analyzing all ideas, propositions, and the collected data generated through the framework, it became possible to assess the results from each activity. This approach make possible to get a clearer understanding of the relationship between the activities analyzed and their performance, based on the prior theoretical review.

5.1. ICEBREAKER

Focusing on the individual, the objective of this activity is to bring people closer by introducing them to one another in a way that allows them to get to know each

other beyond their technical and/or professional skills, getting to know each other's personal characteristics, feelings, and emotions as well. This approach helps participants feel more confident and comfortable with each other, fostering a sense of ease and commitment in group activities (Megan, 2020).

Activities		Tasks
Icebreaker	**Company Stage (Business)**	**Team Stage (Engagement)**
	1- Name the Group	1- Name the Group
	2- Introduce yourself (general information)	2- Introduce yourself (general information)
	3- Talk about a chosen personal object	3- Talk about a chosen personal object
	4- Share a personal failure	4- Share a personal failure
		5- Share what you expect from the project

Table 1: Business and Engagement: Icebreak activity and tasks.
Source: The authors.

Table 01 presents the tasks carried out in this activity, both in their original business-oriented configuration (Company Stage) and in the adapted version focused on engagement and team building (Team Stage). It is possible to see that in both versions, the first four tasks, which make up this activity, are identical and aim to develop creative confidence within the group (Kelley and Kelley, 2013). However, in its adapted version, task 5 was added with the goal of promoting the sharing of participants' expectations regarding the CpC as a sustainable project. Figure 02 shows the participants during the activity.

Figure 02: Icebreake activiy section.
Source: The authors.

The participants were invited to individually express, through a word and/or a phrase, their expectation regarding the CpC. The technique used was Brainwriting because it is more anonymous than brainstorming, preventing participants from influencing each other and allowing everyone to be productive simultaneously (Thompson, 2003). After a 5 minute period for individual input, participants shared their expectations with the other members of their respective teams, enabling them to identify the first similarity within the team. The results show that, despite using different words and, primarily, representing various contexts and realities from their respective cities, all participants across the four teams have expectations that can be classified as shown in Figure 03.-

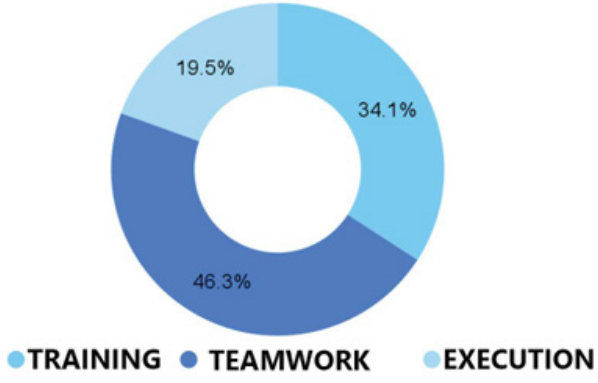

Figure 03: Expectations of participants about the project.
Source: The authors.

It is noticeable that nearly half of the participants (46.3%) indicate that their main expectation is teamwork, followed by training (34.1%) and execution (19.5%). Thus, it can be inferred that the participants hope to engage in a project that primarily promotes the opportunity to work as a team, along with the possibility of learning and acquiring new knowledge

with that team, and, finally, participants expect to see practical and tangible results being achieved. Figure 04 presents the pointed expectations that led to the main classification.

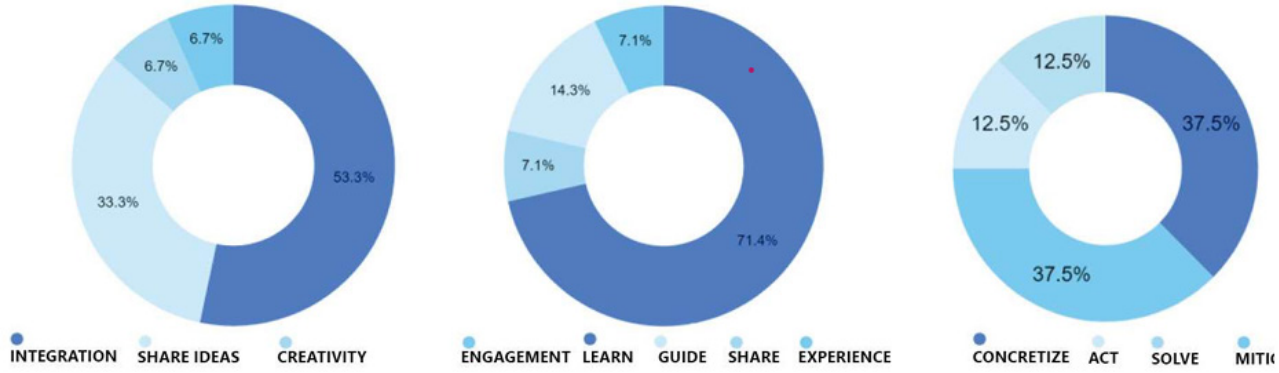

Figure 04: Raw words for main participants' expectations.
Source: The authors.

5.2. Questions Storm

In the original version of the Creative Framework, this activity aims to create (at least) three questions to better understand companies and their problems (Cralves, 2024), while in its engagement version the focus is to obtain and understand, in a more in-depth way, the beliefs and biases that participants hold about sustainable projects and/or initiatives similar to CpC (Table 02).

Activity	Tasks	
	Company Stage (Business)	**Team Stage (Engagement)**
Question Storm	Creation of questions that enable viewing the company's problem from different perspectives	Identification of possible causes for failures in similar projects Understanding the causes and motivations that may have led such projects to failure

Table 2: Beliefs and Biases about Sustainable Projects.
Source: The authors.

In this activity, participants were encouraged to think about sustainable projects they had been involved in or were aware of that, for some reason, failed to achieve their objectives. In its engagement version, this activity takes place in two stages. In the first, similar to the previous activity, participants were invited to identify possible causes of these sustainable project failures through a word and/or a sentence (Brainwriting). To facilitate the reasoning process and identification of these causes, the following questions were presented to participants: Why did the projects not succeed? What prevented their success? What were the possible causes of their failure?

After a 10 minute for individual input, participants shared their beliefs withthe other members of their respective teams, once again allowing them to identify similarities among everyone. Then, as a team, participants identified the top three main causes of failure. Thus, each team presented their chosen causes, and, once again, participants were surprised to see that the teams had identified similar beliefs. Finally, all teams discussed as a large group and defined the top three causes they believe led to the failure of previous sustainable projects: lack of participant engagement, lack of dedicated time for the project, and lack of objective and pragmatic actions to support the projects. Figure 05 shows a word cloud generated from individual inputs; it is possible to see that the words appearing most frequently indeed represent the three main causes defined by the entire participant group.

Figure 5: Word cloud from all inputs.
Source: The authors.

According to Berger, W. (2014), it is essential to value questioning, and among the important questions to be asked, "why?" is the one that allows the perception of a new reality. In this sense, in the second part of the activity, participants were guided to think: Why did these defined causes occur? Why did a lack of participant engagement, dedicated time, and objective and concrete actions occur? What were their motivations?

Figure 6: Presentation of the teams' main motivations.
Source: The authors.

The participants, individually, identified their beliefs about the reasons that led to the causes of project failures and why. After 10 minutes, the participants shared their possible motivations with their teams, which then defined the top three motivations. Finally, each team shared their top three motivations that led to the emergence of the causes of sustainable project failures (Figure 06). Once again, participants were surprised to discover that the teams defined similar motivations, and finally, all teams engaged in a large group discussion to better understand their beliefs, biases, and challenges they would face in the CpC. Table X presents the words and/or phrases identified by the teams.

Similarities are observed among the teams (Table 03), and the recurring identification of these similarities fosters a sense of group/team among participants, allowing them to perceive connections with one another. This perception initiates a process of collective identity (Sophia Becker, 2021), bringing people closer together through the realization that they share the same problems, beliefs, and goals. In this way, an intrinsic motivation spontaneously arises (Amabile, 1997), leading to individual engagement that enhances participants' interest in being part of the whole to solve their problems.

Team	Main motivations/Reasons
01	Lack of technical and political domain definition Lack of priority criteria definition Lack of involvement and accountability
02	Different priorities No involvement because it does not generate votes Disorganized HR and organizational policies
03	Political objectives are usually short-term Lack of funding opportunities Different cultures/opinions involved
04	Cultural level misaligned with actual needs Lack of awareness of the importance of the theme Lack of funding and bureaucracy

Table 3: Main motivations of Project failures.
Source: The authors.

At the end of these activities, participants were able to get to know each other (both technically and emotionally) and, most importantly, realize that despite all their contextual differences, since they come from diferent cities and regions of Portugal, they share the same concerns and beliefs about sustainability-related projects and initiatives. Finally, participants were invited to share their perceptions of these two activities, and all of them assigned that it was highly valuable to share their expectations regarding the CpC and their beliefs about what could lead the CpC to failure, thus seeking common solutions for the whole group, given their shared opinions. This result aligns with Gaertner and Dovidio (2011), which states that situational context emphasizes the significance of categorical distinctions between groups, where contexts impact social identity, as the latter is a concept that spans both social and individual experience (Upham et al., 2019). Individuals who share group beliefs and feelings tend to have a stronger intention to act consistently with those groups (Fielding et al., 2008).

5.3. Core activities and Value Benchmarking

Once the similarities that enable participants and their respective cities to work in harmony towards common goals are recognized and established, thus allowing for the formation of a group identity and behavior, this activity and those that follow focus on establishing rules that allow for group recognition. In other words, they aim at developing concepts that represent CpC—and

its participants—as a network of cities striving for climate neutrality. In this way, this activity aims to think about the concepts that represent the core of CpC as a sustainable project (Table 04), in which each participant identifies the main words or sentences that represent essential values for CpC.

Activity	Tasks	
	Company Stage (Business)	Team Stage (Engagement)
Core activities	It aims to think about the core of the company, activities carried out by the company, those that add essential value to the business.	It aims to think about the concepts of the sustainable project that represent essential value of the project

Table 4: Business and Engagement: Core activities activity and tasks.
Source: The authors.

This activity is also performed through Brainwriting, writing ideas instead of speaking them eliminates the issue of productivity blocking, as participants do not need to wait for their turn to produce ideas (Thompson, 2003). In this divergent thinking activity, convergent thinking emerges in the analysis and selection of the best concept obtained. Each participant lists at least 20 essential concepts that could represent CpC within 20 minutes. After that each team must select, in 30 minutes, four concepts from the total obtained, considering what is essential to represent the core value and what truly contributes to the social identity of CpC. Then, each team posts their defined concepts on a central board, and finally, everyone agrees on the four concepts they believe best represent CpC as a project focused on sustainability and climate neutrality for Portuguese cities. Figure 07 shows the moment of discussion and final concept selection.

Figure 7: Concepts discussion and definition.
Source: The authors.

As a result of the co-creation process involved in this activity, four concepts were defined that best represent CpC: Capacity Building, Sharing, Realization, and Credibility. It is noticeable that, except for the concept of Credibility, all other concepts reflect the expectations previously defined (Capacity Building, Teamwork, and Execution). This result can be explained by the fundamental role that expectations play in cortical conceptual processing, thus exerting significant influence on conceptual categorizations (Lane, P. 2019; Schubotz, R., I. 2015).

In line with the Value Benchmarking task outlined by the CoCreative Framework, participants conduct a web search to explore how the four core concepts have been addressed across various market sectors, whether through products or services. Through this analogical process, participants broaden their perspective on these concepts, engaging in discussions on how those market solutions might be adapted for the CpC context (Table 05).

Activity	Tasks	
	Company Stage (Business)	Team Stage (Engagement)
Value Benchmarking	The participants carry out a search to find and understand better the 4 core activities.	The participants carry out a search to find and understand better the 4 core.

Table 5: Business and Engagement: Value benchmarking activity and tasks.
Source: The authors.

5.4. Support actions and ideas generation

It is widely known that ideation processes and techniques are fundamental for generating innovative solutions (Ju Hyun Lee, 2022). Thus, utilizing all inputs generated in previous activities and through team-building and social identity development, enhanced by recognizing various similarities among participants and their different contexts, the final activities in this engagement-focused version are directed toward ideating solutions. In its business version, these activities are conducted separately; however, in the engagement version, they have been combined to foster a better understanding of the objectives to be achieved. In this version, the objective of this activity is to guide participants to think about actions that can be implemented in the CpC to ensure that the defined concepts are effectively delivered, and mainly to develop action plans that prevent causes and motivations like those that led previous projects to failure (Table 06).

Activity	Tasks	
Support Actions	It aims to guide participants to think about actions that support the 4 defined core activities.	It aims to guide participants to think and generate ideas about actions that support the 4 defined core concepts.
Ideas Generation	It aims to generate a huge quantity and diversity of ideas based on all repertoire achieved from previous activities.	

Table 6: Business and Engagement: Suport Actions and Ideas Generation activity and tasks.
Source: The authors.

Support Actions aims to guide participants to think about actions that enable the implementation of the four defined core concepts, identifying actions that the project carries out and/or can implement. Meanwhile, Ideas Generation by Method 635 aims to generate a large quantity and diversity of ideas based on all the knowledge gained from previous activities oriented by CpC, its concepts, expectations, problems, and beliefs shared by participants. This method takes a total of 30 minutes, and once 635 is complete, all ideas must be analyzed and discussed among participants, selecting three ideas with the most potential to, in their activation, prevent and/or reduce the likelihood of failure due to the same causes and motivations encountered in other projects.

By the end of the activity, approximately 300 ideas were generated regarding preventive actions or procedures that could be implemented in the CpC to enhance its success. This outcome proved highly valuable and essential for the coordination of the CpC project, as it resulted in a substantial repository of actions that when analyzed and assessed for activation feasibility, these ideas, from collective teamwork, have significant potential for acceptance by the team. This collaborative generation of ideas supports the empowerment of participants, shifting them from passive actors subject to coordination decisions to active contributors in creating value and ensuring project success. Finally, participants were invited to share their experiences with all activities developed in this work.

Positive	Negative
The dynamics of the activities were very interesting; I really enjoyed them.	Nothing to point out
The team was very friendly, with accessible and clear language.	Very generic
Exceeded my expectations	Unclear conclusions
Excellent work session	Revision of some tasks
Important interaction with colleagues from municipalities and communities	Low participation from municipalities
Thank you very much to the whole team for the rich experience.	Using too much paper
I liked the dynamic, the sharing, and the teams	We didn't introduce ourselves individually
Good organization and work method	
I liked the dynamic and the shared information	
I really enjoyed this session; I learned new concepts	
I really liked the various methodologies used	
I enjoyed the informal and relaxed atmosphere of the session	
I appreciated the promotion of dialogue created between municipalities	
I liked the knowledge exchange and the interaction	
Different ways of thinking and working methods	
Informality in sharing ideas and experiences	
Communication, organization, teamwork, and sharing	
Dynamic activity, out-of-the-box, and multidisciplinary	
Motivation with clear and accessible speech	
Knowledge sharing with colleagues	
I liked the dynamic used	
Conversations among participants	
I enjoyed the methodology adopted for a future perspective of a network for sharing and implementing solutions to combat climate change	
Very positive session with a dynamic and creative model which created an ideal environment of comfort and relaxation for sharing ideas	
Relaxed and practical meeting atmosphere	
Moderator with high professionalism	
Good organization in the sequence of activities	
Sharing challenges from different municipalities	
New ideas to improve the CpC network	
Idea of sharing implemented projects on the CpC website	
Good discussion and positive attitude	
Interesting sharing and common/shared willingness	

Table 7: Partipants' feedback.

Source: The authors.

The results (Table 7) show that the vast majority of participants rated all activities positively, highlighting the importance of this work in dynamically, engagingly, and uniquely fostering teamwork and allowing them to learn from the realities of other participants from various cities. It is important to note that the statements poist out a perception of a social sense of team, in which the participants assigned a significant experience of sharing their knowledge, seeing a common goal towards sustainability, fostering a new mental models about sustainable projects. Thus, it can be said that the engagement-adapted structure of the Creative Framework points its effectiveness in using creativity-related techniques and approaches to introduce a new way of perceiving sustainability. It also fostered a sense of unity and team cohesion, with participants working toward similar problem-solving goals, ultimately becoming facilitators and supporters of the project at hand.

6. CONCLUSIONS

The conclusion of this research highlights how a creative framework can effectively engage participants in sustainable projects. By integrating design techniques and green creativity, this approach nurtures sustainable mental models and fosters meaningful engagement. Activities such as Icebreakers, Question Storming, Core Activities, and Value Benchmarking revealed that when creativity is used to connect personal expectations, social values, and shared objectives, participants develop a deeper sense of community and commitment to sustainability goals.

This research demonstrates that a creative framework tailored for sustainability projects promotes a shift in participants' mental models, encouraging them to adopt long-term, environmentally responsible mindsets. Through structured creative exercises, participants not only shared common beliefs and concerns but also collectively generated actionable ideas. This collective ideation serves as a foundation for sustainable design, reinforcing each participant's role in achieving practical, eco-friendly solutions.

Furthermore, by making sustainability principles tangible and action-oriented, this study showcases the value of green creativity in sustainable design practices. It underlines that green creativity is not merely an abstract concept but a practical approach that fosters team cohesion, empathy, and a proactive stance on sustainability. Consequently, the research provides valuable insights into how creative frameworks can serve as powerful tools in shaping sustainable behaviors, thereby contributing to the broader field of sustainable design and environmental responsibility.

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