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Gameful systems for corporate sustainability: systematic review, conceptual framework and research agenda on gamification and sustainable employee behavior in companies

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Abstract

Purpose – Given the urgency of corporate engagement in sustainable development, companies seek ways to involve their employees in sustainability efforts. In this regard, gamified systems have gained attention as a novel tool to promote sustainable employee behavior. However, as the research field matures, researchers and practitioners are confronted with a scattered academic landscape that makes it difficult to grasp how gamification can be designed to engage employees in sustainable behavior and to understand how gamification effects unfold at psychological, behavioral and corporate levels of sustainability.

Design/methodology/approach – This paper uses a systematic literature review to consolidate the existing knowledge on gamification designs and their effects on sustainable employee behavior.

Findings – Studies have explored a variety of utilitarian and achievement-, immersion- and social-related gameful affordances to promote positive behavior- and system-related psychological effects as a basis for employee engagement in sustainable behavior. However, the evidence regarding their impact on rational decision-making processes and overcoming the intention-action gap inherent in sustainability is still limited. Nevertheless, several studies in focused areas indicate the potential to elicit behavioral changes that drive sustainability outcomes at the corporate level as well.

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Originality/value – Our study provides three main contributions. First, we develop a conceptual framework that illustrates how gamification can drive sustainable behavior in the workplace. Second, we derive seven agenda points to guide future research on gamification for corporate sustainability. Third, we deduce three practical approaches to use gamification as a strategic intervention to promote sustainable behavior in organizations.

Keywords Gamification, Serious games, Sustainable employee behavior, Pro-environmental behavior, Green behavior, Green IS, Motivational IS, Digital sustainability, Corporate sustainability, Corporate social responsibility, Sustainable development

Paper type Literature review

1. Introduction

In 2020, the United Nations developed a global sustainable development agenda in the form of 17 Sustainable Development Goals (SDGs) to guide the coordination of individual, organizational, and governmental efforts toward sustainability (United Nations, 2020). Companies, in particular, are increasingly required to contribute to sustainable development (Aguilera *et al.*, 2021). In recent years, an increasing number of companies have recognized the need to adopt sustainability measures and implement voluntary environmental management standards (Delmas *et al.*, 2013), commit to sustainability (Whiteman *et al.*, 2013), and report on their contributions to sustainable development (Adams and Clark, 2014; Hahn *et al.*, 2015). Nevertheless, current corporate efforts to realize measures toward sustainable development have been criticized as insufficient (Ergene *et al.*, 2020; Whiteman *et al.*, 2013).

One of the main reasons for these difficulties could be the lack of employee participation in corporate sustainability efforts. Employee engagement is critical to the implementation of sustainability programs and projects in day-to-day operations (Kim *et al.*, 2017; Westman *et al.*, 2019). Previous research has shown that individual employees' behaviors significantly influence overall corporate sustainability (Chen *et al.*, 2015; Paillé *et al.*, 2014). Consequently, the subject of *sustainable employee behavior* – and how it can be supported by corporate interventions – has gained increasing attention.

Scholars have explored a range of measures to encourage sustainable behavior among employees. For example, companies can concentrate on recruiting employees with values and beliefs similar to those of the company, developing training programs, and implementing reward practices (Sabokro *et al.*, 2021). Informational posters and stickers may also help promote sustainable behaviors among employees (Chakravarty and Mishra, 2019; Manika *et al.*, 2021), and leadership practices that serve as role models for followers (Robertson and Barling, 2013) influence employee behaviors toward sustainable actions. Most importantly, information systems (IS) as digital approaches to promote sustainable employee behavior in organizations have received increasing attention and have been shown to encourage employees to engage in sustainable behaviors successfully (Singh and Sahu, 2020). Feedback systems on current energy use (Casado-Mansilla *et al.*, 2020) and ambient learning displays (Börner *et al.*, 2015), for example, raise employee awareness of energy use. Moreover, IS increasingly use motivational and social design features to offer their users not only informational benefits, such as feedback but also to afford additional emotional and social benefits (Hassan *et al.*, 2019). In this respect, introducing design elements and mechanics from games, so-called *gameful affordances*, into the design of digital and non-digital systems to enhance utilitarian benefits with positive hedonic experiences, conceptualized as *gamification* (Hamari *et al.*, 2014) holds great potential for enhancing positive emotional and social experiences in sustainable employee behavior (Koivisto and Hamari, 2019; Pasini *et al.*, 2017).

Accordingly, the research field of gamification for sustainable employee behavior has increased in recent years, and there is already considerable research effort on gamification as a means to promote sustainable behaviors related to specific aspects of sustainability at work, such as employee health (Lier and Breuer, 2019; Mamede *et al.*, 2021; Nagata *et al.*, 2022) and energy conservation (Iria *et al.*, 2020; Lou *et al.*, 2019; Oppong-Tawiah *et al.*, 2020). Despite a large number of promising findings, the increasingly divergent field of research has also

sometimes produced conflicting results regarding the impact of gamification to promote learning about sustainability in the workplace (Omiya and Kadobayashi, 2019; Pasini *et al.*, 2022; Willis *et al.*, 2024) and to drive motivation for sustainable behaviors among employees (Shahrestani *et al.*, 2017). Given the abundance of various gameful designs and different foci of investigation, it has become difficult for both researchers and practitioners to grasp how gamification can and should be designed and deployed to engage employees in sustainable behaviors to enhance their contribution to corporate sustainability and to understand how gamification effects unfold at psychological, behavioral and corporate levels. Therefore, this work seeks to synthesize previous research efforts on gamification for sustainable behavior in the corporate environment in order to systematically *consolidate existing knowledge on gameful design and its effects and outcomes on sustainable employee behavior* and derive *recommendations for future research efforts* as well as for the *practical application of gamification* as a strategic tool to promote sustainable employee behavior in companies.

Drawing on a descriptive systematic review of the academic literature, the main research question for this paper is:

RQ. What is the state of scientific knowledge on gamification and sustainable employee behavior in corporate environments?

Our systematic review and analysis of the current state of knowledge on gamification for sustainable employee behavior yield three main contributions to the research fields of gamification in particular and (digital) interventions for corporate sustainability in general, as well as to the practical application of gameful approaches to sustainability management. First, by synthesizing gameful design affordances and outcomes at the psychological, behavioral, and corporate levels, we develop a *conceptual framework* that illustrates how gamification can promote sustainable behavior in the workplace. Second, based on this framework and our observations, we identify research gaps and derive *seven valuable agenda points* to guide future research on gamification as an intervention approach for corporate sustainability. Finally, we infer *three practical approaches* from our findings to use gamification as a strategic measure to foster sustainable employee behavior in organizations.

2. Background

2.1 Sustainable employee behavior

Sustainable employee behavior has traditionally been defined based on sustainable behavior in general, with a specific application to the corporate context. As the research field has evolved, a variety of interchangeable terms mainly related to environmental sustainability have emerged, such as *organizational citizenship behavior toward the environment, green behavior, workplace environmentally-friendly behavior, employee pro-environmental behavior, ecological behavior, conservation behavior,* or *environmentally conscious behavior* (Ones and Dilchert, 2012). In an attempt to provide a comprehensive definition of sustainable employee behavior, Lülfs and Hahn (2014), following Bansal and Roth (2000), defined sustainable employee behavior as *"a set of effective, deliberate, and anticipated actions aimed at accepting responsibility for conservation and preservation of physical and cultural resources. These resources include integrity of animal and plant species, as well as individual and social wellbeing, and safety of present and future human generations"* (Lülfs and Hahn, 2014, pp. 44–45). These behaviors, according to a popular distinction by Bissing-Olson *et al.* (2013), can be both task-related (i.e. within the context of core employee tasks) and proactive (i.e. a more active and change-oriented approach to improving workplace sustainability beyond work tasks).

Previous research has examined a variety of corporate interventions to increase sustainable employee behavior. Green human resource practices, on the one hand, include considering sustainability in hiring, training, performance evaluation, compensation, and performance management (Chen and Wu, 2022). For example, companies can focus on recruiting

employees with similar environmental values and beliefs as the company, developing training programs to improve awareness and knowledge, and implementing reward practices (Sabokro *et al.*, 2021). On the other hand, marketing interventions use marketing materials, posters, and other internal marketing tools to promote awareness of behavior change within the company. For instance, informational posters and stickers as "green nudges" can help promote recycling, energy conservation, and physical activity among corporate employees (Manika *et al.*, 2021; Schubert, 2017). Furthermore, leadership practices that serve as role models for followers (Robertson and Barling, 2013) have been shown to influence employees' green behaviors, and goal-setting and feedback interventions can be individually targeted tools to support sustainable employee behavior. A study by Davis *et al.* (2020) showed that "eco-cards" containing a set of sustainable behaviors that could be completed and stamped by supervisors could support motivation for sustainable behaviors among employees.

Most importantly, *IS* to promote sustainable employee behavior can contribute to shaping beliefs about the environment (Melville, 2010) and facilitating changes in human behavior (Elliot and McGregor, 2001). Previous research has primarily focused on IS to educate individuals about sustainable behavior (El Idrissi and Corbett, 2016). For example, the e-Genie tool, which includes dashboards on energy usage and trend indicators, as well as hints and tips for energy conservation (Spence *et al.*, 2018), significantly reduced energy usage and increased energy awareness at work. Other studies that used feedback systems (Casado-Mansilla *et al.*, 2020) and learning displays with information on energy usage and tips for energy conservation (Börner *et al.*, 2015) have similarly shown to promote awareness of energy consumption among employees in companies. Beyond informational benefits, such as feedback, IS increasingly use hedonic design features to generate emotional and social benefits (Hassan *et al.*, 2019). For instance, drawing on the story of a garden that evolves based on employees' energy conservation, Oppong-Tawiah *et al.* (2020) demonstrated that narrative elements combined with tips can significantly reduce energy consumption. Hillebrand and Johannsen (2021), on the other hand, evaluated a climate chatbot and found that it encouraged a variety of environmentally friendly actions among employees. In this regard, gameful design elements represent a particularly promising design approach for IS to promote positive emotional and social experiences in sustainable employee behavior (Lehnhoff *et al.*, 2021).

2.2 Gamification

While the term gamification is still debated, two definitions of gamification have emerged as the most popular in academic research (Schöbel *et al.*, 2020; Tobon *et al.*, 2020). The one by Deterding *et al*. describes gamification as *"the use of game design elements in a non-game context"* (Deterding *et al.*, 2011, p. 10). Such game design elements include levels, points, badges, leaderboards, avatars, quests, or certificates. On the other hand, Hamari *et al*. defined gamification as *"a process of enhancing services with (motivational) affordances in order to invoke gameful experiences and further behavioral outcomes"* (Hamari *et al.*, 2014, p. 3026). As opposed to the definition of Deterding *et al*., Huotari and Hamari argued that their definition focuses on the *utilitarian goals* (value creation/behavioral outcomes) and *psychological outcomes* (gameful experiences) of gamification rather than on the presence of elements characteristics of games (Huotari and Hamari, 2017). In this regard, it is important to note that gamification constitutes a *design process* rather than an artifact, i.e. there is no technological boundary imposed by the definition of gamification, which encompasses both gamified digital or persuasive (information) systems, serious games, as well as gamified non-digital workshops, campaigns or other interventions (Schöbel *et al.*, 2020), even though digital approaches are most prevalent.

Although points, badges, and levels have been prevalent in gamification research since its inception and still are (Schöbel *et al.*, 2020), gameful affordances encompass a much wider variety. A comprehensive review of gamification research by Koivisto and Hamari (2019) identified a variety of 45 different affordances explored in empirical studies of gamification,

distinguished into five different categories: achievement and progression (e.g. points, badges, leaderboards, levels, status bars, skill trees, and quizzes), social (e.g. social networks, teams, competitions, and voting), immersion (e.g. avatars, narratives, virtual worlds, and role-playing), non-digital elements (e.g. rewards, cards and die), and other miscellaneous elements (e.g. virtual helpers, reminders and penalties).

While education is the predominant application area for gamification (Hong *et al.*, 2024; Koivisto and Hamari, 2019), gamification has increasingly been used to promote desired behavioral outcomes in other areas (Koivisto and Hamari, 2019; Krath *et al.*, 2021; Seaborn and Fels, 2015). These include health (Johnson *et al.*, 2016), crowdsourcing (Morschheuser *et al.*, 2019), marketing and consumer retention (Zhang *et al.*, 2022, 2023), management (Wanick and Bui, 2019), and consumer sustainability (Mulcahy *et al.*, 2021). Specifically, in the context of sustainable behaviors, research has explored gamification as a means to promote energy savings in households (Morganti *et al.*, 2017), sustainable travel and commuting (Andersson *et al.*, 2018), water conservation (Koroleva and Novak, 2020), eco-friendly driving (Günther *et al.*, 2020), green nutrition (Berger, 2019), and recycling (Hoffmann and Pfeiffer, 2022). Regarding gamification to promote sustainable employee behavior in the workplace, previous research has focused specifically on how gamified approaches can support employees' physical activity (Dadaczynski *et al.*, 2017; Kouwenhoven-Pasmooij *et al.*, 2017) and well-being (Hungerbuehler *et al.*, 2021; Ladakis *et al.*, 2021) in the workplace. In addition, studies examined how gamification can foster innovation in organizations (Agogué *et al.*, 2015; Patricio *et al.*, 2021) and how gamified applications may promote pro-environmental behaviors among employees in offices (Iria *et al.*, 2020; Kotsopoulos *et al.*, 2020; Krath *et al.*, 2023b).

3. Analytical framework for the systematic review on gamification for sustainable employee behavior

In a seminal work on gamification research, Koivisto and Hamari (2019) put forth the general conceptualization of gamification as a process in which *gameful affordances* influence *psychological outcomes* that lead to intended *behavioral outcomes*. First, gameful affordances include both concrete game design elements, such as points and badges, as well as gameful mechanics, such as turns, time limits, and role-playing (Krath and von Korflesch, 2021). While there is a plethora of gameful affordances, they can be categorized into the main hedonic experiences they target to increase motivation (Koivisto and Hamari, 2019), such as feelings of achievement, social relatedness, and immersion (Yee, 2006). Second, psychological outcomes refer to psychological experiences that drive intrinsic motivation for behavior change, such as the satisfaction of the three basic psychological needs, i.e. autonomy, competence, and relatedness (Ryan and Deci, 2017). However, they can also include, for example, enjoyment, flow, and engagement (Krath *et al.*, 2021). Finally, behavioral outcomes refer to concrete behaviors and actions encouraged by the gamified system, which may be healthy behavior and exercise, participation in learning activities, or completion of purchase (Koivisto and Hamari, 2019).

In terms of the psychological outcomes particularly important for sustainable behaviors, goal framing theory (Lindenberg and Steg, 2013) has been put forth as a seminal theory in research on sustainable employee behavior that combines the view of rational choice theories, such as the theory of planned behavior (Ajzen, 1991) and the one of normative theories, such as the value belief norm theory (Stern *et al.*, 1995) to explain the transition from affective and cognitive states to the formation of sustainable behavior (do Canto *et al.*, 2023). Goal framing theory assumes that people's behavior is guided by three goal frames: gain goal frames, normative goal frames, and hedonic goal frames. *Gain goal frames* refer to people's self-interest, i.e. the perception that sustainable behavior is beneficial from a rational perspective, and include rational choice determinants of the theory of planned behavior, such as attitude, subjective norm, and perceived behavioral control (Lindenberg and Steg, 2013). *Normative*

goal frames, on the other hand, relate to the belief that sustainable behavior is "the right thing to do" (Steg *et al.*, 2014) and refer to the concept of personal norms established by the value belief norm theory of environmental values (Stern and Dietz, 1994; Stern *et al.*, 1995). In addition, *hedonic goal frames* concern affective states and the intention to feel good in the current moment (Lindenberg and Steg, 2013). Rather than behaving sustainably because of perceived benefits or moral obligations, people with an activated hedonic goal frame would seek to behave sustainably when it is enjoyable (Steg *et al.*, 2014). Although all goal frames are usually present to evaluate a particular behavior, in most cases, one goal is focal and most strongly influences the cognitive process of behavior formation (Lindenberg and Steg, 2013). The main challenge that arises from goal framing theory is that different goals often conflict with each other. Sustainable behavior is often the right thing to do (normative goal frame) but not pleasant (hedonic goal frame). Therefore, when attempting to encourage and support sustainable employee behaviors, it is essential to note that sustainable behaviors may compete with other behaviors or tasks that an employee may choose to engage in (Unsworth *et al.*, 2013) and that it is important to develop interventions that align hedonic and gain goals with normative goals (Steg *et al.*, 2014).

Together, these two seminal theories from gamification and sustainable employee behavior research provide an analytical lens for examining the psychological "pathway" to sustainable employee behavior that previous studies have focused on, specifically, which gameful affordances have been used, which goal frames have been most frequently targeted on the psychological level and in what ways these translated into outcomes on the behavioral level. Conclusively, the analytical framework presented in Figure 1 guides the analysis and discussion of this systematic review of the academic literature related to gamification for sustainable employee behavior.

4. Research method

To answer our research question, this systematic literature review presents a descriptive review (King and He, 2005; Paré *et al.*, 2015) of the literature in the area of gamification to support sustainable employee behavior. Generally, descriptive reviews focus on theories, factors, and outcomes of previous empirical studies to guide future research in a field, often building on a previously established model, such as our analytical framework (King and He, 2005). Accordingly, we decided to use a transparent, representative search strategy to collect all relevant studies in the field, with explicit study selection and quality assessment (Paré *et al.*, 2015), to ensure the reliability of the subsequent concept-centered (Webster and Watson, 2002) analysis guided by the analytical framework (Figure 1).

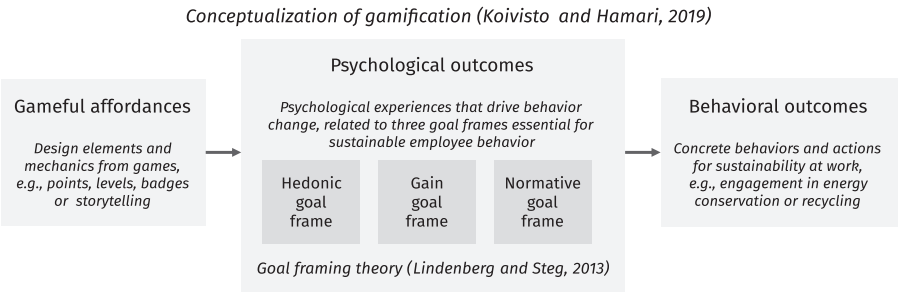

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Figure 1. Analytical framework for this systematic review

4.1 Search strategy

The updated PRISMA 2020 guidelines (Page *et al.*, 2021) provided detailed instructions on each step of the screening and selection process. The Scopus database was used as the primary source for searching relevant literature as it provides the most comprehensive indexing of journal publishers and conference proceedings in the field of management and computer science. To include as many relevant findings as possible, we used the broader term "gamif*," which includes verbs such as "gamified," to include studies that refer to related concepts such as game-based learning or serious games. We consciously decided not to limit our search or selection to particular artifacts, such as gamified digital systems and applications, to focus on the impact of gamification as a design approach for digital as well as non-digital interventions for sustainable employee behavior. In addition, drawing from the methodological recommendations of the AURORA-SDG queries (Kashnitsky *et al.*, 2024) and Elsevier's Scopus queries (Schmidt and Vanderfeesten, 2021), terms related to all 17 SDGs were added to include all relevant research related to sustainability. Finally, we added the terms "manag*," "employ*," "workplace," "HR," "human resource," "human resources," and "job*" to search for relevant articles specifically addressing sustainable employee behavior.

In this regard, the term "work*" was not included because it resulted in a large number of irrelevant studies in a previous pilot search that referred to "their work" in the abstracts. Searching for articles that included "work*" only in the title or keywords, we did not identify further relevant articles not covered by the former work-related terms. In addition, "compan*" was not included because it led to many studies that referred to gamification in marketing and social media or for sustainable consumer behavior (in combination with the term "social" from the SDG-related terms), but no relevant additions related to gamification for sustainable employee behavior (i.e. the internal corporate sustainability perspective). Therefore, the search was conducted in April 2024 using the following search term: *Search string: TITLE-ABS-KEY ("gamif*" AND (("manag*" OR "employ*" OR "workplace" OR "HR" OR "human resource" OR "human resources" OR "job*") AND ("SDG" OR "health" OR "well- being" OR "innovation" OR "gender" OR "water" OR "resilience" OR "sustainab*" OR "environ*" OR "green" OR "ecolog*" OR "energy" OR "social" OR "societ*" OR "consum*" OR "inclusi*" OR "equality" OR "climate" OR "justice" OR "poverty" OR "hunger" OR "crime" OR "nutrition" OR "growth" OR "infrastructure" OR "city" OR "cities" OR "transport" OR "marine" OR "pollution" OR "ocean" OR "sea" OR "terrestrial" OR "land" OR "biodivers*" OR "ecosystem*" OR "deforest*" OR "conflict" OR "peace")))*

4.2 Screening strategy and inclusion criteria

The first author carried out the screening in three steps: Title screening, abstract screening, and full-text screening. To ensure the quality of the research, only studies from peer-reviewed journal articles and peer-reviewed conference papers were included in the final sample. As a language criterion, only English-language articles were included. Further, since the review focuses on the theories, game design elements, and outcomes used and investigated in previous studies, only empirical articles (both qualitative and quantitative) were included, whereas review articles, conceptual articles, and editorial articles were excluded. After initial filtering for these criteria in Scopus and duplicate removal, 1,872 records remained for the manual screening process (see Figure 2). In terms of content, studies that were either not related to any of the SDGs (e.g. studies that referred to "organizational climate," "organizational environment," or "gamified environment" in the title or abstract) or the workplace context (e.g. studies in schools or private households or studies that described individual health treatments, such as diabetes treatment, in the title or abstract) were excluded. Specifically, we excluded 16 full texts in the full-text screening because they were not workplace-related but targeted individuals in households, tourists, crowd workers, or patients rather than employees. Moreover, eight full texts were excluded because they focused on improving corporate

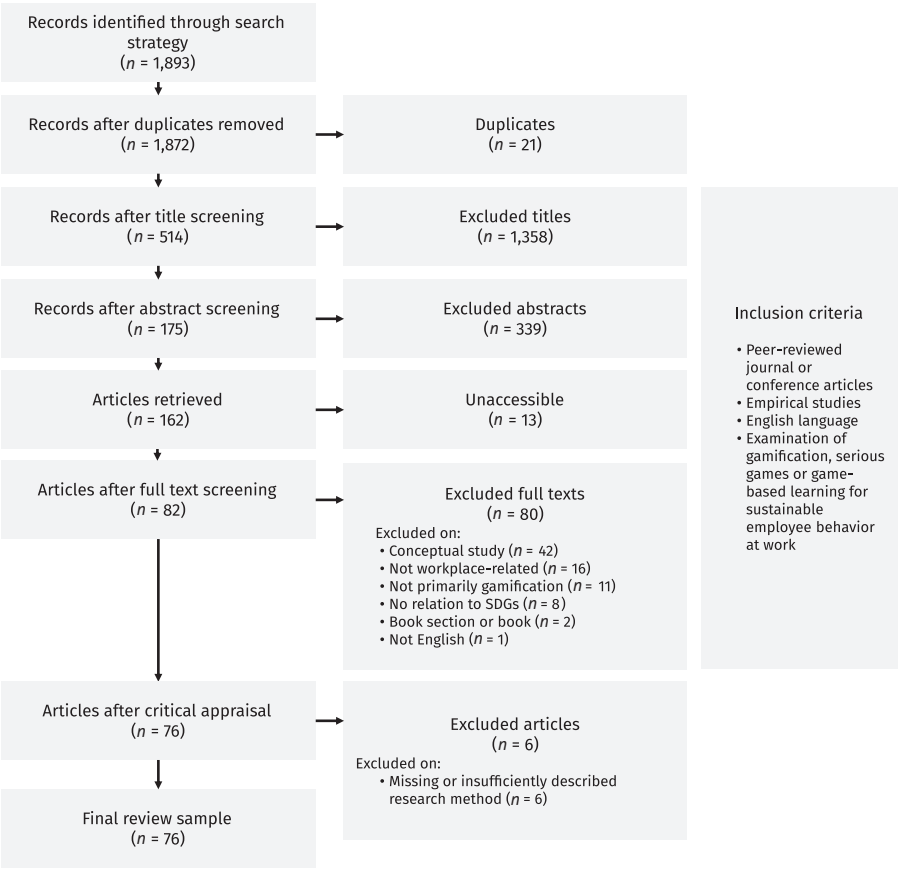

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Figure 2. Flow diagram for the selection of studies

performance with employee engagement but did not relate to corporate contributions to sustainable development. Finally, eleven studies that did not primarily deal with gamification as an intervention (e.g. studies that referred to video or leisure games in the title or abstract, referred to (non-gamified) tools to build knowledge on gamification, did not describe how or in which way the IS used was gamified, did preliminary work for a future gamification-related study or mentioned gamification as a potential future avenue in the abstract) were excluded.

The inclusion and exclusion criteria for the article screening are summarized in Table 1.

For the critical assessment of the quality of the reviewed articles, the following criteria were checked for each study: at least one clear research question or goal, clear research method, and proper answering of the research question(s)/goal(s).

Figure 2 illustrates the result of the search strategy and screening process. A total of 76 articles remained for data extraction and synthesis.

4.3 Data extraction strategy

Metadata such as title, year of publication, authors, publication type (journal or conference proceedings), and publication name of the articles were extracted using Mendeley Reference

Table 1. Inclusion and exclusion criteria

Criterion	Included	Excluded
Language	English	Other languages, e.g. Spanish, German, Russian, Korean, Chinese, Japanese
Publication type	Peer-reviewed journals, peer-reviewed conference papers	Book chapters, magazine articles, reports, these, other grey literature
Type of study	Empirical studies	Conceptual studies, systematic reviews, editorial articles
Study topic	Gamification, serious games, game-based learning	Video games, gamification only mentioned in outlook or discussion
Study context	Workplace	Schools, private households, individuals
Study goal	Sustainability (in relation to the SDGs)	Marketing, service, productivity, optimization

Source(s): Authors' own work

Manager and manually checked during import. Following the guidelines of Webster and Watson (2002), author-centered qualitative data extraction coded the topic, associated SDGs, and methodological approach of the study. Furthermore, the theories employed, the gameful affordances used in the study, and the psychological and behavioral outcomes were coded inductively. In the subsequent concept-centric phase, the coded results were analyzed and organized into frequency matrices guided by the analytical model (Figure 1).

5. Results

5.1 Bibliometric data, research topics, and methods

The first two empirical studies on gamification for sustainable employee behavior were published in 2014 (see Figure 3). They primarily addressed how gamification can be used ethically in work environments to support and not disrupt employee well-being (Shahri *et al.*, 2014) and how gamification can support impaired workers in industrial settings (Korn *et al.*, 2014). In 2015 and 2016, the topics of gamification to reduce inequalities, e.g. in assessing the abilities of impaired job applicants (Korn *et al.*, 2016), and to support workplace well-being (Jent and Janneck, 2016), gained traction, but it was not until 2017 that research publications on gamification as a tool to promote environmental sustainability in organizations, e.g. to promote energy conservation among employees, increased. Furthermore, individual studies have explored how gamification

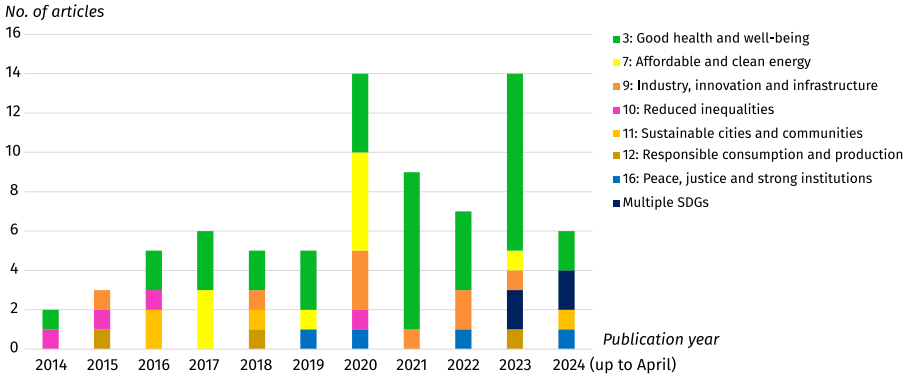

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Figure 3. Distribution of studies on gamification for sustainable employee behavior over the years

could support sustainable commuting (Wunsch *et al.*, 2016) and emergency management (Heldal, 2016). In the same vein, research studies on gamification to promote physical activity and, thus, employee physical health also emerged. In 2018, gamification research streams arose at a larger enterprise level, e.g. to support innovation processes (Janocha *et al.*, 2018) and sustainability in supply chain management (Putz and Treiblmaier, 2018). The years 2019–2020 were marked by an increasing number of studies in the field of energy conservation, well-being, and quality of care in the healthcare sector and open innovation.

It is noteworthy that in 2021 and 2022, studies related to gamification for environmentally friendly behaviors have declined, while gamification for the physical and mental health of employees and improvement of healthcare work has received steady interest. In the most recent studies, the topic of responsible consumption and production has gained attention, e.g. concerning employees' contributions to sustainable product development (Villamil *et al.*, 2023). Finally, since 2023, there have also been the first studies that took a more holistic perspective and investigated the potential of gamification to support multiple dimensions of sustainable development in the workplace (Berglund *et al.*, 2023; Kirchner-Krath *et al.*, 2024b; Ligorio *et al.*, 2023). Table A1 in the appendix summarizes the specific research topics identified in the articles analyzed according to the SDGs. Collectively, there is a large dominance of research on gamification for health and well-being at work as well as improvement of healthcare, accompanied by a medium level of interest in gamification for innovation and energy conservation, while most of the 17 SDGs remain unexplored as dimensions of sustainable behavior that could be motivated by gamification at work.

In terms of research methods, the majority of studies used quantitative methods to examine the effects and outcomes of gamification for sustainable employee behavior. These methods include quantitative field experiments, either controlled ($n = 7$) or without a control group ($n = 26$); quantitative laboratory experiments, either controlled ($n = 3$) or without a control group ($n = 3$); and quantitative surveys ($n = 9$). In addition, twelve studies used mixed methods, including mixed-method field experiments ($n = 7$), mixed-method controlled experiments ($n = 1$), mixed-method design studies ($n = 2$), as well as mixed-method expert studies ($n = 1$), and mixed-method case studies ($n = 1$). Finally, 16 articles used qualitative research methods, such as exploratory case studies ($n = 9$), qualitative interviews ($n = 6$), and field observation ($n = 1$).

5.2 Theoretical foundations

Concerning the theories used to design and study gamification for sustainable employee behavior, it is noteworthy that the majority (42 of 76) of the studies did not invoke any theory or framework for their study. Beyond that, the studies analyzed used a variety of 42 theoretical frameworks, with most theories used in only one study.

Clustering the theoretical foundations used in line with previous categorizations of the objectives of gamification and game-based learning (motivation and affect, behavior, and learning, see Table A2 in the appendix) (Bloom *et al.*, 1956; Plass *et al.*, 2015), it becomes evident that most of the theoretical foundations in studies on gamification for sustainable employee behavior are theories related to affect and motivation, followed by a significant number of behavioral theories while learning theories were less used. In addition, nearly one-sixth of all studies relied on design frameworks or models to guide the design of gamification.

Of the theories used as the basis for empirical studies, self-determination theory, a theory related to *affect and motivation* (which includes cognitive evaluation theory and organismic integration theory) that focuses on the basic psychological needs of autonomy, competence, and relatedness, the role of extrinsic incentives, and the processes of introjection for intrinsic motivation (Ryan and Deci, 2017), was most commonly used to guide the design of gamified artifacts that address the three basic needs (e.g. Kotsopoulos *et al.*, 2020; McKeown *et al.*, 2016; Shahrestani *et al.*, 2017) and various forms of intrinsic as well as extrinsic motivation (McKeown *et al.*, 2016; Nuijten *et al.*, 2022; Oppong-Tawiah *et al.*, 2020).

In addition, regarding theories related to *behavior*, studies majorly drew on the theory of planned behavior, which describes individual attitudes, social norms, and perceived behavioral control as antecedents of behavioral intention and behavior (Ajzen, 1991), and its predecessor, the theory of reasoned action, to guide the design (Brown *et al.*, 2020; Lou *et al.*, 2019; Nuijten *et al.*, 2022) and evaluation (Dadaczynski *et al.*, 2017; Putz and Treiblmaier, 2018) of gamified applications.

Theories related to *learning* were mainly used to design rather than evaluate gamification for sustainable employee behavior. From social psychology, social cognitive theory (Bandura, 2001) was used to explain the intended social learning effects of social gamification elements (Nivedhitha and Manzoor, 2020) and motivate design elements that promote self-efficacy (Dadaczynski *et al.*, 2017; Gremaud *et al.*, 2018; Mamede *et al.*, 2021; Nuijten *et al.*, 2022).

In addition, studies relied on gamification *design frameworks*, such as Werbach and Hunter's 6D framework (Werbach and Hunter, 2012) and the Meaningful Gamification Framework (Nicholson, 2012), to design their gamified intervention.

5.3 Gamification design and gameful affordances

In terms of gameful affordances, previous studies have used various design elements and mechanics from games, often in complementary ways, to elicit positive psychological experiences and lead to intended behavioral outcomes. Moreover, it becomes evident that most of the approaches used in the studies did not only contain elements related to emotional or social experiences but combined them with design elements that are more informative and educational in nature and can, therefore, be mainly characterized as *utilitarian*. Such utilitarian affordances often emphasized in theories of technology acceptance from IS research (Hamari and Koivisto, 2015) include elements that enhance the perceived usefulness of the system, i.e. the perception of the extent to which it supports the performance of a task (Davis, 1989), and the perceived ease of use, which describes the perception of the effort required to use a system (Davis, 1989).

5.3.1 Utilitarian affordances. Among these utilitarian elements, studies primarily used informational content, summary dashboards, sensor tracking, direct feedback, and goal setting to support users in changing their behavior toward desired goals (see Table A3 in the appendix).

Informational content can take many forms, such as instructional videos for healthy lifestyles (Lowensteyn *et al.*, 2019) and workouts (Lier and Breuer, 2019) or detailed text-based mental health information provided on demand (Hungerbuehler *et al.*, 2021). In addition, serious games provided informational content in the form of text-based information about the relevance of the context and behaviors in the simulation (Jackson *et al.*, 2020; Tuti *et al.*, 2020). Informational content and *direct feedback* are often intertwined. For example, in serious games with primarily educational purposes, information was also conveyed in the form of direct feedback messages with explanations about whether a choice made in the game was right or wrong (e.g. Hart *et al.*, 2020; Jackson *et al.*, 2020; Omiya and Kadobayashi, 2019). In this context, *tips* also represent a particular form of informational content. In the form of information "nuggets," tips convey small bits of information and were particularly used in mobile applications to save energy (e.g. Iria *et al.*, 2020; Kotsopoulos *et al.*, 2023; Lou *et al.*, 2019; Oppong-Tawiah *et al.*, 2020) as they often rely on push notifications to employees' devices.

Sensor tracking is a utilitarian element often used to automate the input of user behavior into the gamified system. In the context of employee health, fitness trackers such as Fitbit were used in studies to automatically monitor employee physical activity (e.g. Lier and Breuer, 2019; Lowensteyn *et al.*, 2019; Nuijten *et al.*, 2022; Wentz and Wilhelm Stanis, 2024). On the other hand, smart plugs and sensors that measure the energy consumption of electronic devices were used to capture the energy-saving behavior of employees (Iria *et al.*, 2020; Kotsopoulos *et al.*, 2020, 2023; Oppong-Tawiah *et al.*, 2020). Other sensors used in the studies analyzed

include sleep sensors (Waddell *et al.*, 2021) and stress sensors that measure arousal in stress reduction applications (Ladakis *et al.*, 2021). In cases where sensors were not present, employees were asked to *manually track their activities* as input to the gamified application. For example, some studies used manual input for recording physical activities (Mamede *et al.*, 2021; Nuijten *et al.*, 2022), cycling routes (Wunsch *et al.*, 2016), or pro-environmental actions at work (Kirchner-Krath *et al.*, 2024b; Krath *et al.*, 2023a).

Goal setting is a particular element used in studies to individualize behavioral goals (as opposed to, for example, challenges, which are defined uniformly for all employees). It was most commonly used for physical activity (Dadaczynski *et al.*, 2017; Jent and Janneck, 2016; Mamede *et al.*, 2021) and healthy lifestyle (Nuijten *et al.*, 2022), and in some cases, accompanied by professional guidance from a physician or therapist (Kouwenhoven-Pasmooij *et al.*, 2017; Zhang *et al.*, 2021). In other studies, *assessment questionnaires* were used to set goals at the beginning of the intervention and track progress over time, assessing employee health (Hungerbuehler *et al.*, 2021; Lowensteyn *et al.*, 2019), current physical activity (Nuijten *et al.*, 2022), or level of technostress (Pasini *et al.*, 2022).

In order to accomplish goals, studies employed elements of *action planning*, i.e. which activities to perform and in what order. For example, employees collaborated on plans for future workplace stress management (Cheng and Chau, 2022) and the implementation of developed innovation ideas (Pasini *et al.*, 2022). In addition, gamified applications were accompanied by instructional features, instructional workshops, and individual coaching sessions. *Instructional workshops* and *coaching sessions* take place outside the application, while *instructional modules* that tell employees what to do next were included in serious games (Ladakis *et al.*, 2021; Omiya and Kadobayashi, 2019) or augmented workplaces (Korn *et al.*, 2014, 2015). Predefined *checklists* (Kaselofsky *et al.*, 2020) or *tasks* (Raflesia *et al.*, 2022) represent another form of goal guidance used in the analyzed studies. Especially in accompanying workshops, *suggestive questions* (Hart *et al.*, 2020; Patricio *et al.*, 2021; Villamil *et al.*, 2023) (in the form of "How would you decide?") by cards or *game coaches* (Patricio *et al.*, 2022) were another way to define actions to meet goals in specific situations, e. g. to defend against cybersecurity attacks (Hart *et al.*, 2020).

To monitor users' progress toward their goals, studies used summary dashboards and feedback graphs. *Summary dashboards* primarily aggregate employee performance, such as how much energy (in kWh) they saved (Hafer *et al.*, 2017; Iria *et al.*, 2020; Kirchner-Krath *et al.*, 2024b; Lou *et al.*, 2019) or how many steps they took (Gremaud *et al.*, 2018; Mamede *et al.*, 2021). *Feedback graphs* resemble summary dashboards (and in most cases, are displayed on these dashboards), but some studies also employed standalone feedback graphs, e.g. in the form of a spiderweb graph of performance on various health-related dimensions (Nagata *et al.*, 2022) or the display of Fitbit data (Lowensteyn *et al.*, 2019).

Email newsletters with information about achievements are another means of monitoring progress, but unlike summary dashboards or feedback graphs, newsletters are typically sent outside the gamified system. For example, studies have used newsletters to inform participants about what has generally been achieved by all participants (Kaselofsky *et al.*, 2020; McKeown *et al.*, 2016; Respati *et al.*, 2018).

Finally, to increase topic awareness and ongoing engagement in behavior change, studies employed posters and stickers in the workplace, as well as reminders. *Posters* were most commonly used to promote gamified campaigns offline in the work environment, whether for energy conservation (Kaselofsky *et al.*, 2020), care work (McKeown *et al.*, 2016; Newcomb *et al.*, 2019), physical activity (Nagata *et al.*, 2022), or waste reduction (Respati *et al.*, 2018). On the other hand, *reminders* not intended to be informative (such as tips) but to be small "nudges" to behave or interact with the application were mostly used in gamification apps (either for smartphones (Kotsopoulos *et al.*, 2023; Oppong-Tawiah *et al.*, 2020) or web apps (Brown *et al.*, 2020; Dadaczynski *et al.*, 2017; Gremaud *et al.*, 2018; Iria *et al.*, 2020) in the form of push notifications.

5.3.2 Gameful affordances. Besides the utilitarian elements, studies employed a variety of design elements and mechanics from games related to feelings of achievement, social experiences, and immersion (Yee, 2006) (see Table A4 in the appendix).

Achievement-related elements. Among the achievement-related elements, *points* were the most commonly used design element. Hardly any gamified application did not use points, whereas points were uncommon in serious games. As a virtual currency earned through desired behavior, points can express progress without concrete metrics (e.g. energy savings or steps). Points were often used in combination with *leaderboards* (e.g. Barna and Fodor, 2018; Viberg *et al.*, 2020), a social design element, as a primary measure for comparing peer performance. In addition to points, *badges* were often introduced as virtual rewards for achievements in the gamified application and could be earned on an individual and team basis (Mamede *et al.*, 2021). In some studies, achievements were also expressed as *certificates* awarded to employees outside the application (Barna and Fodor, 2018; Newcomb *et al.*, 2019). Furthermore, *motivational messages* were used to elicit positive achievement experiences (e.g. "You did great!"), mainly to encourage continued involvement in physical activity (e.g. Gremaud *et al.*, 2018; Nagata *et al.*, 2022). It is noteworthy that nearly one-third of the studies also used *real-world rewards* as extrinsic incentives for participation and engagement in the gamified intervention. The extent of rewards varied widely across studies, ranging from free meals (Iria *et al.*, 2020) to material gifts (Kouwenhoven-Pasmooij *et al.*, 2017) and lottery tickets (Kotsopoulos *et al.*, 2020) to an increase in annual compensation (Newcomb *et al.*, 2019) and other monetary rewards (Respati *et al.*, 2018). In contrast, only three studies introduced punishments for bad decisions, but these were limited to virtual punishments, e.g. an accumulation of viruses in a serious game for COVID-19 protection (Suppan *et al.*, 2021), and did not translate to the real world. In addition, *levels* represent an element of game design to express progress in behavior change by dividing advancement into milestones that can be achieved. They were sometimes coupled with *adaptive difficulty*, such that the difficulty of the task increases as a new level is reached (Korn *et al.*, 2016). As another element of progress tracking, *progress bars* are a hedonic way of representing progress on a particular task or process, e.g. submitting an idea (Viberg *et al.*, 2020), assembling a tool (Korn *et al.*, 2014, 2015), or completing a challenge (Nuijten *et al.*, 2022). For learning purposes, *quizzes* represent an additional hedonic way of imparting information, e.g. on energy conservation (Hafer *et al.*, 2017; Kaselofsky *et al.*, 2020) or reactions in medical emergencies (Pensieri *et al.*, 2023; Tuti *et al.*, 2020). Finally, several achievement-related mechanisms were mostly used in serious game interventions. *Time limit* describes a mechanic that challenges employees to complete a task in a certain amount of time. For example, employees must assemble a tool within a certain time frame, with a color-changing circle or a stackable Tetris board indicating the time left (Korn *et al.*, 2014, 2015).

Immersion-related elements. On the other hand, hedonic design elements are used in studies to evoke *immersion* and emotional attachment. *Storytelling* was very prevalent in the topic of sustainability and was predominantly used in serious games where the learner is placed in different *scenarios*, such as emergency situations (Heldal, 2016; Tuti *et al.*, 2020) and care situations (Jackson *et al.*, 2020; Seymour *et al.*, 2023; Suppan *et al.*, 2021). However, storytelling was also implemented in the form of narratives, e.g. in the form of a garden or tree that evolves by saving energy (Kotsopoulos *et al.*, 2020; Oppong-Tawiah *et al.*, 2020) or virtual cities visited through physical activity (Dadaczynski *et al.*, 2017). Combined with VR technology, employees can also be taken to a completely *virtual environment* separate from the real workplace, such as a virtual forest, to relieve stress (Ladakis *et al.*, 2021). *Roleplay* was often combined with storytelling and scenarios and used in serious games to convey different perspectives in a given situation, e.g. about attackers and defenders in cybersecurity (Hart *et al.*, 2020) or different tasks in healthcare (Jackson *et al.*, 2020). Moreover, *avatars* are a design element used in studies to represent employees in virtual space. For example, one study used facial recognition technology to display an avatar that looks like the employee currently

using the application in an energy-saving application (Lou *et al.*, 2019). Yet avatars can also represent non-player characters, such as a virtual counselor (Hungerbuehler *et al.*, 2021).

In order to promote continuous engagement with the gamified intervention, some studies used elements of personalization and unlockable content, e.g. *personalized* difficulty and feedback based on employees' individual knowledge (Tuti *et al.*, 2020) and fitness levels (Nuijten *et al.*, 2022). In eight studies, employees could also *unlock* new (and more difficult) tasks or challenges that were not available from the beginning by progressing in the application or attaining certain achievements (e.g. Jent and Janneck, 2016; Newcomb *et al.*, 2019). In this regard, *puzzles* and escape room mechanics have gained attention as they divide overall goals into unlockable, sequential episodes (Gue *et al.*, 2023; Seymour *et al.*, 2023; Willis *et al.*, 2024). Last, *turns* and *shuffling or chance* are mechanisms used in tabletop and card games in which workers draw cards in sequence (Hart *et al.*, 2020) or roll dice (Janocha *et al.*, 2018; Patricio *et al.*, 2020) that steer the game in unpredictable directions.

Social experience-related elements. Third, the studies used a variety of *social* design elements to encourage social interaction among employees. Notably, most social design elements were competitive rather than collaborative, with the most commonly used social design elements being challenges and leaderboards. *Challenges* are a playful way to present goals that employees are expected to achieve in a given period, competing against each other to be the first to complete the challenge. Challenges were the main element of gamified campaigns (Kaselofsky *et al.*, 2020; Respati *et al.*, 2018), but were also commonly used in gamification applications for web browsers (Barna and Fodor, 2018; Dadaczynski *et al.*, 2017) and smartphones (Mamede *et al.*, 2021; Zhang *et al.*, 2021). *Leaderboards*, unlike challenges, represent a form of social comparison based on the overall progress of the user rather than a specific goal. Leaderboards show individual users and their earned points (e.g. Waddell *et al.*, 2021; Zhang *et al.*, 2021) or their key metrics (e.g. Iria *et al.*, 2020). They were used in almost every gamified application, while they were uncommon in serious games. Other forms of social comparison used in the studies include *status ranks* displayed on peer profiles (Kotsopoulos *et al.*, 2020) or employee identification cards (Newcomb *et al.*, 2019) and opportunities for *direct comparison*, e.g. in competitive quizzes (Jent and Janneck, 2016).

Among the collaboration-oriented elements, *teams* of employees were often used as a cooperative form of play to achieve common goals in a cooperative-competitive manner. For example, teams competed against each other to overcome physical challenges (Mamede *et al.*, 2021), or different companies formed teams to compete in a ranking in terms of cycling kilometers driven (Wunsch *et al.*, 2016). On the other hand, teams were also used in gamified workshops (Patricio *et al.*, 2022; Putz and Treiblmaier, 2018) to promote collaborative work on ideas. In this context, employees often *discussed ideas* and possible behaviors (Cheng and Chau, 2022; Janocha *et al.*, 2018; Villamil *et al.*, 2023) and, in some studies, also *voted* on the results of the discussion, e.g. on the best idea (Agogué *et al.*, 2015) or the best response to cybersecurity issues (Omiya and Kadobayashi, 2019).

Finally, social and knowledge-sharing features are elements designed to enable mutual support among employees. *Social sharing* features strongly resemble the design of commonly known social networks such as Facebook and LinkedIn and thus include social feeds of peer activities where employees post their pictures and like or comment on the actions of others (e.g. Barna and Fodor, 2018; Shahrestani *et al.*, 2017; Viberg *et al.*, 2020). On the other hand, *forums* (Kouwenhoven-Pasmooij *et al.*, 2017; Nivedhitha and Manzoor, 2020) and *chats* (Shahrestani *et al.*, 2017) were presented as tools for social and knowledge exchange on the topic.

5.4 Psychological outcomes

Psychological outcomes in the studies analyzed are cognitive or affective states induced by the utilitarian and gameful affordances analyzed in the previous section. Following goal framing theory (Lindenberg and Steg, 2013), we identified 31 different psychological outcomes

examined in studies of gamification for sustainable employee behavior (see Table A5 in the appendix for an overview), most of which can be related to the hedonic goal frame, i.e. positive emotional experiences during participation in the gamified intervention (Lindenberg and Steg, 2013).

5.4.1 Hedonic goal frame. For the hedonic goal frame, several studies examined the effects of gamification on motivation and fun during the behavior change intervention. Regarding *fun*, the results seem to be unanimously positive in both quantitative (Barna and Fodor, 2018; Gremaud *et al.*, 2018; Lou *et al.*, 2019; Omiya and Kadobayashi, 2019) and qualitative (Hammedi *et al.*, 2021; Patricio *et al.*, 2022) studies. However, the effects of gamification on *motivation* are fairly mixed. Studies in the areas of energy conservation (Kaselofsky *et al.*, 2020; Lou *et al.*, 2019), physical activity (Gremaud *et al.*, 2018), and cybersecurity (Omiya and Kadobayashi, 2019) have found positive effects on motivation. However, Shahrestani *et al.* (2017) noted that half of their participants rated the gamified application as highly motivating for physical activity behavior, while the other half disagreed. Jent and Janneck (2016) observed that some gamification elements, such as progress bars, were found to be motivating by employees, while others, such as tips of the day or badges, did not have the same effect. In a similar vein, Willis *et al.* (2024) found that puzzles and escape room mechanics were fun for some participants, whereas others perceived them as confusing or frustrating. Studies have also shown that gamification can elicit a variety of positive affective experiences, supporting, for example, *enjoyment* in energy-saving behaviors (Oppong-Tawiah *et al.*, 2020), the experience of *surprise* in idea workshops (Agogué *et al.*, 2015; Patricio *et al.*, 2022), and *immersion* in system use (Viberg *et al.*, 2020), and fostering *feelings of support* (Gremaud *et al.*, 2018) and *challenge* (Omiya and Kadobayashi, 2019). However, other studies also pointed to potentially negative side effects of gamification in work environments. For example, performance transparency in gamified systems can put *pressure* on employees (Shahri *et al.*, 2014), reduce *job satisfaction* (Hammedi *et al.*, 2021), and negatively impact a *trustworthy* workplace atmosphere (Stroud *et al.*, 2020). Finally, there are conflicting studies on the psychological outcomes that can be associated with *flow* experience (Csikszentmihalyi, 1975). While Nivedhitha and Manzoor (2020) observed a positive effect of gamification on *transcendent experience*, Viberg *et al.* (2020) identified negative effects on the *perception of time*, which argues against flow.

5.4.2 Gain goal frame. Although several studies drew on the theory of planned behavior, theory of reasoned action, or self-efficacy theory to design their gamified interventions, surprisingly, few studies assessed the impact of gamification on related gain goal-oriented psychological and behavioral determinants that precede behavioral intention to change. Three studies identified positive effects on *attitude* toward sustainable supply chain management (Putz and Treiblmaier, 2018) and attitude or *interest* in energy conservation (Kaselofsky *et al.*, 2020; Kotsopoulos *et al.*, 2023), while seven studies examined the effect of gamification on concepts related to perceptions of behavioral control, i.e. *self-efficacy* (Dadaczynski *et al.*, 2017; Nuijten *et al.*, 2022; Seymour *et al.*, 2023), *self-confidence* (Gue *et al.*, 2023; Seymour *et al.*, 2023; Stanich *et al.*, 2023) and *self-regulation* (Zhang *et al.*, 2021).

5.4.3 Normative goal frame. In comparison, cognitive outcomes related to awareness and knowledge of sustainable behaviors, thus supporting the normative goal frame (Lindenberg and Steg, 2013), have been examined in several studies. In terms of *awareness*, studies have found positive effects of gamification on awareness of the importance of energy conservation (Lou *et al.*, 2019; Oppong-Tawiah *et al.*, 2020), resilient health care (Jackson *et al.*, 2020), mental and physical health (Shahrestani *et al.*, 2017; Zhang *et al.*, 2021), and addressing malnutrition (Agogué *et al.*, 2015). It has also been shown that serious games and gamified applications can promote *reflection* (Jackson *et al.*, 2020; Stanich *et al.*, 2023; Villamil *et al.*, 2023; Yu *et al.*, 2023), *intellectual experiences* (Nivedhitha and Manzoor, 2020), and *discriminative thinking* (Cheng and Chau, 2022). On the other hand, while the majority of studies reported positive outcomes related to *learning* healthy lifestyles (Dadaczynski *et al.*, 2017), health practices (Strong *et al.*, 2021; Tuti *et al.*, 2020), cybersecurity (Hart *et al.*, 2020),

and energy conservation (Hafer *et al.*, 2017), others have found only mixed (Omiya and Kadobayashi, 2019; Pasini *et al.*, 2022; Willis *et al.*, 2024) or no effects (Agogué *et al.*, 2015; Jackson *et al.*, 2020).

5.4.4 Behavioral intention. Finally, in addition to goal framing-related psychological outcomes, seven studies investigated whether the gamified intervention influences *behavioral intention* to engage in further behavior change, with coherently positive results on intention to exercise (Dadaczynski *et al.*, 2017; Shahrestani *et al.*, 2017), save energy (Kotsopoulos *et al.*, 2023; Oppong-Tawiah *et al.*, 2020), apply COVID-19 protection measures (Suppan *et al.*, 2021), adopt cybersecurity measures (Hart *et al.*, 2020) and use sustainable transportation in supply chain management (Putz and Treiblmaier, 2018).

5.4.5 System-related psychological outcomes. During coding, *system-related* psychological outcomes (see Table A6 in the appendix), which do not primarily relate to intended behavior but rather to perceptions of the gamified system itself, emerged as an additional category of psychological outcomes most often examined in design studies. These outcomes invariably relate to the *usefulness* (Heldal, 2016; Oppong-Tawiah *et al.*, 2020; Shahrestani *et al.*, 2017), *ease of use* (Gremaud *et al.*, 2018; Hart *et al.*, 2020; Viberg *et al.*, 2020), or *usability* (Pasini *et al.*, 2022; Shahrestani *et al.*, 2017) of a particular system, therefore, it is difficult to draw generalizable conclusions. Overall, the perception of gamification in the analyzed studies seems to be fairly mixed, which is also reflected in the mostly mixed results regarding *user experience* (e.g. Ladakis *et al.*, 2021; Nguyen *et al.*, 2020; Omiya and Kadobayashi, 2019).

5.5 Behavioral outcomes

When it comes to behavioral outcomes of studies on gamification for sustainable employee behavior, three categories of behavioral effects can be distinguished: individual behavior outcomes, social behavior outcomes, and psychophysiological outcomes of behavior change (see Tables A7 to A9 in the appendix).

5.5.1 Individual behavior outcomes. Several studies have examined the effects of gamification on *individual behavior*. Specifically, a number of studies found positive effects of gamified interventions on *engagement* in behavior change, for example, in energy-saving behaviors (Lou *et al.*, 2019), improved health practices (Jackson *et al.*, 2020; Newcomb *et al.*, 2019), and healthy behaviors (Hungerbuehler *et al.*, 2021; Respati *et al.*, 2018). Similarly, studies observed positive effects on *perceived behavior change* (Kaselofsky *et al.*, 2020; Shahrestani *et al.*, 2017). However, there are also studies indicating a lack of (Lou *et al.*, 2019; Mamede *et al.*, 2021; Nuijten *et al.*, 2022) or mixed effects (Dadaczynski *et al.*, 2017; Hammedi *et al.*, 2021; Korn *et al.*, 2015; Nuijten *et al.*, 2022) on engagement and perceived behavior change.

Regarding the specific behaviors studied, studies provided good evidence of positive effects of gamified applications on employees' *physical activity* (e.g. Lowensteyn *et al.*, 2019; Mamede *et al.*, 2021; Wentz and Wilhelm Stanis, 2024), including *fitness tracker wear* (Gremaud *et al.*, 2018), *creativity* (Agogué *et al.*, 2015; Nivedhitha and Manzoor, 2020; Patricio *et al.*, 2022), and *coping flexibility* (Cheng and Chau, 2022). The *time required for task completion* was also reduced at augmented gamified workplaces (Korn *et al.*, 2014, 2015). On the other hand, gamification appears to have mixed (Hammedi *et al.*, 2021) or even negative effects (Korn *et al.*, 2014, 2015) on *job performance*. In addition, there were no measurable improvements in healthcare *sepsis management* (McKeown *et al.*, 2016) and *COVID-19 protective measures* (Suppan *et al.*, 2021), which is particularly interesting given that the study by McKeown *et al.* (2016) reported a variety of positive effects at the corporate level that were hypothesized to result from behavior change.

5.5.2 Social behavior outcomes. In general, few studies have examined the effects of gamification on *social behavior*, but those that have done so report predominantly positive results. While the evidence on *word of mouth* for behavior change (Berglund *et al.*, 2023; Hafer

et al., 2017; Jackson *et al.*, 2020; Shahrestani *et al.*, 2017), successful *knowledge transfer* (Agogué *et al.*, 2015) and *challenging ideas* (Agogué *et al.*, 2015) is ambiguous, there appears to be a variety of positive effects related to colleague interaction. To this end, studies have found that gamification has a positive impact on *social interaction* (Omiya and Kadobayashi, 2019; Patricio *et al.*, 2021), *communication* (Agogué *et al.*, 2015; Patricio *et al.*, 2020, 2021; Seymour *et al.*, 2023), *networking* (Barna and Fodor, 2018), and *social sharing* (Respati *et al.*, 2018). At the team level, gamified interventions also promote *team building* (Agogué *et al.*, 2015; Patricio *et al.*, 2022), *team dynamics* (Janocha *et al.*, 2018), especially group cohesion (Berglund *et al.*, 2023; Cheng and Chau, 2022) and consensus building (Patricio *et al.*, 2022), and *team effectiveness* (Cheng and Chau, 2022). Furthermore, gamification can support *knowledge sharing* (Agogué *et al.*, 2015; Patricio *et al.*, 2022) in ideation contexts.

5.5.3 Psychophysiological outcomes of behavior change. Finally, studies in the area of employee health and well-being examined intervention outcomes on *psychophysiological measures* influenced by behavior change. At the psychological level, studies found positive effects of gamified interventions on *well-being* (Berger and Koch, 2024; Brown *et al.*, 2020) and *mental health* (Shahrestani *et al.*, 2017) and negative effects on *stress* (Ladakis *et al.*, 2021). No effects were found for clinical mental health issues, such as *depression* (Brown *et al.*, 2020; Lowensteyn *et al.*, 2019). At the physiological level, studies reported improvements in *physical health* (Berglund *et al.*, 2023; Shahrestani *et al.*, 2017), particularly *blood pressure* (Gimenez *et al.*, 2024; Lowensteyn *et al.*, 2019; Nagata *et al.*, 2022), *cardiovascular age gap* (Lowensteyn *et al.*, 2019), and *fatigue* (Lowensteyn *et al.*, 2019). Regarding *sleep* (Lowensteyn *et al.*, 2019; Waddell *et al.*, 2021) and *cholesterol ratio* (Lowensteyn *et al.*, 2019; Nagata *et al.*, 2022), the evidence remains mixed.

5.6 Corporate outcomes

Finally, while studies have examined fewer of them than psychological or behavioral outcomes, scholars have also discovered a variety of *corporate-level outcomes*, i.e. effects of cumulative individual and social behavioral changes. Another notable observation is that the psychological and behavioral outcomes are not unanimously positive, and the studies also often reported mixed or no effects, while all of the corporate outcomes examined are essentially positive (except some culture and social interaction level outcomes; see the overview in Table A10 in the appendix).

A total of seven studies examined the outcome of a gamified intervention on corporate energy consumption (*SDG 7*). In particular, they found positive effects on *electricity conservation* in buildings and electronic devices (Berger and Koch, 2024; Hafer *et al.*, 2017; Iria *et al.*, 2020; Kaselofsky *et al.*, 2020; Kotsopoulos *et al.*, 2023; Lou *et al.*, 2019; Oppong-Tawiah *et al.*, 2020) and some positive to mixed effects on *heat conservation* in buildings (Berger and Koch, 2024; Kaselofsky *et al.*, 2020). In addition, five studies (three of which originate from the same gamified workshop) investigated how gamification can affect innovation processes in companies (*SDG 9*). The mostly qualitative studies reported positive effects on the generation of new ideas *(ideation)* (Patricio *et al.*, 2020, 2021, 2022), *structuring of ideas* (Patricio *et al.*, 2020, 2022), *decisions for ideas* (Patricio *et al.*, 2021), *time to action* (Patricio *et al.*, 2022), as well as the perception of an *innovation culture* (Schmidt *et al.*, 2023). A quantitative study by Colabi *et al.* (2022) also found positive relationships between gamification in innovation processes and *digital transformation, value co-creation*, and *open innovation*. In relation to *SDG 3*, good health and well-being, a study by McKeown *et al.* (2016) examined how a gamified campaign among healthcare professionals affected several key metrics indicating the quality of care. They found negative effects of gamification on *patient mortality, patient revisits*, and *length of patient stay*, all of which indicate an increase in quality of care. Regarding *SDG 12*, responsible consumption and production, as well as *SDG 11*, sustainable cities and communities, a notable study by Berger and Koch (2024) that

holistically targeted multiple pro-environmental behaviors of employees identified positive effects of gamification on *repairing*, *eco-friendly nutrition*, and *green commute* to work.

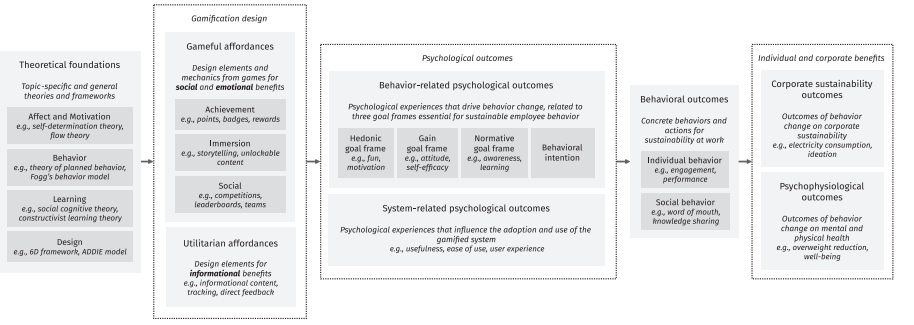
During coding, *workplace culture and social interaction* emerged as another category of corporate outcomes from gamification interventions. Similar to certain negative impacts of gamification on trust at the psychological level (Stroud *et al.*, 2020), some studies suggested mixed (Hammedi *et al.*, 2021) or even negative (Shahri *et al.*, 2014; Stroud *et al.*, 2020) impacts on *colleague relationships*, *privacy*, and *workplace atmosphere*. In particular, gamification may even pose the risk of employee *exploitation* (Shahri *et al.*, 2014). However, consistent with several positive social behavioral outcomes, other studies found rather positive effects on colleague relationships, workplace atmosphere (Barna and Fodor, 2018), *supervisor support* (Kaselofsky *et al.*, 2020), *employee retention* (Newcomb *et al.*, 2019), and *hierarchy reduction* (Janocha *et al.*, 2018). Therefore, the impact of gamification on culture and social interaction seems to depend on the design of the intervention and the pre-existing workplace culture.

Finally, two studies also considered the economic perspective of companies. The studies by Strong *et al.* (2021) and McKeown *et al.* (2016) in the healthcare sector found that improved care through gamification can lead to *economic savings* as well as lower *pharmacy* and *risk-adjusted costs*.

6. Discussion

In carefully analyzing the prevailing research topics, research approaches, theoretical foundations used, utilitarian and gameful affordances, and the outcomes of previous studies, this review synthesizes the current state of scientific knowledge on gamification as a tool for promoting sustainable employee behavior in the workplace. By bringing together theories from gamification and sustainable employee behavior research, we developed an analytical model to analyze gameful approaches and their outcomes for sustainability at the psychological and behavioral levels. Our findings substantially extend this analytical framework to derive a conceptual framework of how gamification, as an innovative approach to design interventions for sustainable employee behavior in organizational environments, can drive employee- engagement and improve corporate sustainability (shown in Figure 4).

First, the analysis reveals that different affordances, *utilitarian* as well as *gameful*, are essential to drive psychological and behavioral outcomes in the context of sustainable behaviors at work. In contrast to systems with the sole purpose of fun, where utilitarian aspects are of less importance (van der Heijden, 2004), the success of gamified systems also depends on utilitarian design so that the social and emotional experiences intended to be induced by the



Source(s): Authors' own work

Figure 4. Conceptual framework of gamification to support sustainable employee behavior based on the findings of the systematic literature review

gameful (hedonic) affordances (Koivisto and Hamari, 2019) are directed toward the intended behavioral or broader utilitarian outcomes. While this is a finding inherent to the definition of gamification as a design approach that enriches – but not replaces – utilitarian goals with hedonic experiences (Huotari and Hamari, 2017), it should nevertheless be emphasized to illustrate how important both design aspects are to motivate sustainable behaviors in the workplace successfully. In a sense, playing a strategy game like Anno 2070 to build a green future (an example of storytelling) is not enough to influence players' sustainable behavior in the real world; the gamified system must also provide utilitarian elements that provide informational benefits and guide users to change their behavior, such as direct feedback on their behavior in the real world or informational cues. Gameful affordances, on the other hand, induce positive social and emotional experiences of *achievement*, *immersion*, and *social relatedness* (Hamari *et al.*, 2014), which are essential mediators for achieving behavior change. For example, while an application that serves as a coach for sustainable behavior by providing information about sustainable behavior may serve the utilitarian aspect of usefulness, it will not unleash positive hedonic experiences unless it includes gameful elements such as quizzes with playful animations or a virtual avatar that provides emotional, motivational messages to engage in behavior change.

Moreover, the use and application of *theoretical foundations* related to *motivation*, *behavior*, and *learning*, as well as *system design*, demonstrates that multiple perspectives can be beneficial in deciding how to design gamification and select gameful affordances for IS to encourage sustainable employee behavior. While motivational theories, such as self-determination theory (Ryan and Deci, 2017), can help in deciding which gameful affordances to choose to meet employees' basic psychological needs and thus generate intrinsic motivation for sustainable behavior, behavioral theories, such as the theory of planned behavior (Ajzen, 1991), can guide the selection of utilitarian and gameful affordances to promote self-efficacy and positive attitudes toward sustainable behavior as a prerequisite for developing intentions for individual behavior change. The perspective of learning theories, such as social cognitive theory (Bandura, 2001), can assist in choosing utilitarian affordances to promote cognitive outcomes such as awareness and knowledge. Finally, system design-related theories and frameworks, such as the 6D framework (Werbach and Hunter, 2012), can guide the gamification design process and ensure that target audience expectations are met in the final design to create a positive user experience.

Related to the previous point, the results show that gameful affordances can influence both *behavior-related* (i.e. sustainability-related) and *system-related* psychological outcomes. While the focus of the evaluations centered on psychological outcomes related to the *hedonic* goal frame (Lindenberg and Steg, 2013), such as fostering motivation and enjoyment in sustainable behaviors, the findings also demonstrate that gameful affordances combined with utilitarian elements can promote learning and awareness of sustainable behavior among employees, activating the *normative* goal frame. While *gain* goal frame-related outcomes such as attitude toward sustainability and self-efficacy in sustainable behaviors have not been similarly studied, initial studies suggest that gamification yields promising results in this regard as well, potentially presenting a novel and promising alternative to existing corporate sustainability interventions that mainly focus on the rational choice or normative perspective (El Idrissi and Corbett, 2016; Manika *et al.*, 2021; Sabokro *et al.*, 2021), but disregard aligning the rational choice process with hedonic goals (Steg *et al.*, 2014). It is noteworthy that the cognitive outcomes of goal framing theory do not seem to translate directly into sustainable behavior. Instead, in line with meta-analyses on sustainable employee behavior research (Katz *et al.*, 2022; Morren and Grinstein, 2016), *behavioral intention* must be considered on the psychological path to sustainable behavior. Furthermore, especially in the context of digital gamified approaches and gameful IS, it is important to assess not only the psychological outcomes related to sustainable behavior but also the psychological outcomes related to the experience of adopting and using the gamified system. Research on the adoption and use of IS for sustainability has emphasized the importance of technology adoption factors, such as

perceived ease of use and usefulness (Davis, 1989; Wunderlich *et al.*, 2012), for the successful use of IS in organizational contexts (Singh and Sahu, 2020). In particular, studies have even highlighted the comparative importance of aesthetic experiences versus flow experiences for gamified systems used in workplace contexts (Suh and Wagner, 2017). Thus, it is vital that gamification not only *can* lead to positive behavior-related and system-related psychological outcomes but that these outcomes *must both* be considered for the successful implementation of gamification to promote sustainable employee behavior.

In addition, the findings show that gamification can drive behavioral outcomes on both *individual* and *social* levels. While individual engagement in behavior change, as evidenced in several of the studies analyzed in relation to various dimensions of sustainability, is inevitably essential for cumulative outcomes in corporate sustainability (Norton *et al.*, 2015; Ones and Dilchert, 2012), our results re-emphasize that social dynamics may also play a critical role in the organizational setting. Studies point to word of mouth, knowledge sharing, and communication about sustainability among colleagues elicited by gamification, and insights from research on sustainable behavior support that collective rather than individual engagement is critical to achieving substantial outcomes (Lozano, 2007).

Finally, initial studies indicate that gamification can generate positive outcomes not only at the behavioral level but also in terms of measurable *psychophysiological benefits* for individuals and *corporate sustainability benefits*. Psychophysiological benefits that primarily result from healthy behaviors, such as reducing obesity, not only serve the individual employee but also contribute to corporate sustainability on a *social* plane, e.g. in terms of employees' physical and mental health and well-being (SDG 3) (United Nations, 2020). Similarly, positive outcomes at the level of culture and social interaction, such as workplace atmosphere, advance corporate sustainability in the social dimension. On the other hand, cumulative employee engagement in behavior change motivated by gamification promises to advance corporate sustainability at the *environmental* (e.g. energy savings (SDG 7) and responsible consumption (SDG 12)) and *economic* (e.g. innovation (SDG 9) and economic benefits) levels as well. Overall, therefore, the psychological and behavioral outcomes induced by gamification hold the potential to drive corporate sustainability on all dimensions of the triple bottom line (Norman and MacDonald, 2004).

6.1 Implications for theory

Based on the conceptual framework presented before, this study contributes to shaping future research efforts in gamification for sustainable employee behavior. In particular, we see significant research gaps that deserve further attention to improve the design and understanding of gamification for sustainable employee behavior and to unleash its full potential in the organizational setting.

In terms of the thematic focus of existing studies, it becomes apparent that research efforts have largely focused on a relatively narrow understanding of sustainable behaviors. Critically juxtaposing the topics of previous studies with the SDGs, it is evident that half of all studies addressed SDG 3 by focusing on how gamified approaches can support employees' physical activity, well-being, and healthy lifestyles in the workplace, thus taking a rather individually oriented perspective on employees' contributions to (social) corporate sustainability. A particular subtopic that has gained attention in this context in recent years is how gamified campaigns and applications can improve the quality of health care. In addition, SDG 9 and SDG 7 were targeted by studies examining how gamification, specifically gamified ideation workshops, can support innovation in organizations and how gamified applications can promote energy-saving behaviors among employees in the workplace. In contrast, few studies focused on the potential contribution of gamification to reducing inequalities (SDG 10) in the work environment, supporting strong institutions and addressing unlawful acts (SDG 16), promoting sustainable commuting, transportation, or supply chain management (SDG 11), and promoting responsible consumption of natural resources, including eco-friendly nutrition and

waste management, in the workplace (SDG 12). In addition, there are no empirical studies to date that have examined the potential effects of gamification on sustainable behaviors in other dimensions that may be performed by employees in the workplace, such as water conservation (SDG 6), gender equality (SDG 5), or climate change mitigation (SDG 13). Finally, only in recent years have a few studies considered addressing more than one specific sustainability issue, and thus, they have ceased to take a holistic perspective on sustainable behavior in the workplace. However, as multiple sustainability goals can conflict with each other in the corporate environment (Unsworth *et al.*, 2013), even though they are equally important to drive the company's efforts toward comprehensive, i.e. environmental, social and economic sustainability, there is merit in exploring how gameful approaches can help balance and synergize employees' contributions to multiple SGDs simultaneously. Therefore, we propose the following initial thematic agenda item for future research in the area of gamification for sustainable employee behavior:

> *Agenda point 1:* Future research should explore the potential of gamification to support sustainable employee behaviors at work more holistically, particularly focusing on the balance and interplay of multiple dimensions of sustainability in corporate environments.

Regarding the use of gameful affordances, it is encouraging that previous research has developed a variety of different gamification designs, ranging from web and smartphone applications to serious games, simulations, board games, and campaigns. Similarly, most studies incorporated utilitarian and hedonic aspects in the design of gamification to generate both informational and social and emotional benefits. In this context, it can be noted that research on gamification for sustainable employee behavior has successfully moved beyond the point-badges-level notion of gamification (Schöbel *et al.*, 2020) to consider immersive elements such as storytelling, scenarios, and role-playing in the design of gamification. However, research is still deficient when it comes to the use of a variety of game elements that offer great potential for ongoing behavior change, such as unlockable content, motivational messages, and adaptive difficulty levels, an observation that is consistent with previous reviews of gamified applications for sustainable consumption (Guillén *et al.*, 2022). Similarly, most studies addressed the short-term effects of gamified systems on sustainable employee behaviors (i.e. over a period of several weeks to a few months) and provided evidence of some promising short-term effects in terms of organizational sustainability but lacked the critical consideration of how these short-term gamification effects, which may result from the positive psychological experiences, translate into lasting habit formation and behavior change. However, this perspective is crucial, as gamification suffers from a well-known novelty effect (Koivisto and Hamari, 2019; Rodrigues *et al.*, 2022), and lasting habit formation is particularly critical for sustainable behaviors (Linder *et al.*, 2022). Thus, future research is warranted that focuses on how such elements can support ongoing engagement in sustainable behaviors at work:

> *Agenda point 2:* Future research should focus on the design and evaluation of gamification to promote long-term engagement and habit formation for sustainable behaviors at work.

Moreover, with respect to socially oriented design elements, studies have mostly focused on competitive or collaborative-competitive paradigms rather than collaborative designs (i.e. teams were primarily used in combination with competitions). Previous research suggests that collective rather than individual efforts are required for sustainability in particular (Lozano, 2007) and that collaborative approaches potentially outperform competitive designs in terms of user engagement (Morschheuser *et al.*, 2018). In addition, studies have shown that cooperative game design features can evoke altruism, which is particularly important in developing we-intentions for further joint behavior changes (Riar *et al.*, 2023). Thus, we call for future research explicitly targeting collaborative gamification designs to support sustainable employee behavior:

Agenda point 3: Future research should develop and explore approaches that focus on fostering collaboration and altruism rather than competition to achieve sustainable employee behavior.

From a methodological perspective, it becomes clear that few studies have examined the individual effects of various design elements on psychological and behavioral outcomes. In particular, two studies have compared personalized versus non-personalized gamification designs (Nuijten *et al.*, 2022; Tuti *et al.*, 2020) and found that adaptive gamification performed better than one-size-fits-all designs. Yet, there are only two studies on gamification for sustainable behavior (Kotsopoulos *et al.*, 2017; Krath *et al.*, 2023a) that draw on the extensive research stream of personalized gamification (Kirchner-Krath *et al.*, 2024a; Klock *et al.*, 2020) and design gamification in line with different motivations for sustainable behavior. In this regard, there is great research potential to transcend the current mostly static gamified systems, whose perception and impact, as our findings indicate, may suffer from inter-individual differences (e.g. some employees see them as fun and enjoyable, while others express frustration and confusion (Willis *et al.*, 2024)) and resort to novel, dynamically adapting approaches enabled by artificial intelligence (Bezzina and Dingli, 2023) to motivate sustainable behaviors in organizations:

Agenda point 4: Future research should examine the potential of personalized gamification to support sustainable employee behavior, with particular attention to dynamic adaption enabled by novel technological advances, for greater and lasting effects across individuals.

Regarding the theoretical lenses used in the studies to date, it is noteworthy that only a minority of the studies even considered theoretical foundations in their work, which reinforces the call for more theory-driven research (Nacke and Deterding, 2017) in the area of sustainable employee behavior as well. Of these, most relied on general motivational theories, such as self-determination theory (Ryan and Deci, 2017), flow theory (Csikszentmihalyi, 1975), goal-setting theory (Locke, 1968), or the attention, relevance, confidence, satisfaction model (Keller, 1979), or behavioral theories, such as the theory of planned behavior (Ajzen, 1991), Fogg's behavioral model (Fogg, 2009), or the transtheoretical model of behavior change (Prochaska and Diclemente, 1982), which reflects the focus on general theories observed in a recent theoretical review of gamification research by Krath *et al.* (2021). In contrast, few studies drew on theoretical foundations specific to the topic of inquiry, such as the health belief model (Becker *et al.*, 1974) for health-related interventions (Brown *et al.*, 2020; Dadaczynski *et al.*, 2017). This is particularly concerning when considering that sustainable behavior, especially in the corporate context, is based on an interplay of rational decision-making processes, normative influences, and intangible or ambiguous individual outcomes (Bamberg, 2013; Sabbir and Taufique, 2022), which is why merely individual motivational and behavioral theories may not be sufficient to guide the design of interventions for sustainable behavior in the workplace. Therefore, future theory-driven research that draws on topic-specific sustainable behavior theories to design gamification for sustainable employee behavior is warranted:

Agenda point 5: Future research should shift away from focusing on general motivational and behavioral theories and draw on topic-specific theories to advance theory-driven gamification design for sustainable employee behavior.

Furthermore, theoretical foundations are predominantly used to guide gamification design rather than evaluation. In terms of psychological outcomes, while several studies have found positive hedonic and learning effects of gamification, little is known about how gamification supports the rational decision-making process toward sustainable behavior, i.e. the gain goal frame (Lindenberg and Steg, 2013). Furthermore, although some studies have observed positive effects on behavioral intention to change behavior, there is still a lack of knowledge about how the various psychological outcomes related to hedonic, gain, and normative goal

frames translate into behavioral outcomes. This is particularly relevant in the context of sustainable behaviors, where research has repeatedly highlighted a critical intention-behavior gap (Carrington *et al.*, 2014; ElHaffar *et al.*, 2020; Rausch and Kopplin, 2021), i.e. psychological outcomes do not automatically yield behavior change, suggesting that eliciting positive psychological experiences with gamification alone may not be sufficient to achieve the desired effects on organizational sustainability. Therefore, the following avenue is suggested for future research:

> *Agenda point 6:* Future research should expand understanding of the psychological mechanisms of gamification for sustainable employee behavior by examining how gamification can overcome the intention-behavior gap and translate different psychological effects into behavioral outcomes.

Finally, it is noteworthy that few of the studies examined corporate outcomes. While initial results point to potential in the dimensions of health and well-being (SDG 3), energy conservation (SDG 7), and innovation (SDG 9), it is worthwhile to explore further the impact of gamification at the corporate level to more holistically assess the value of gamification interventions from a management perspective. While sustainable employee behavior has been highlighted as crucial to corporate sustainability efforts (Paillé *et al.*, 2014; Westman *et al.*, 2019), it is inevitable to remark that individual behaviors motivated by gamification are tied to organizational structures, strategies, and processes. In this context, initial studies have begun to focus not only on gamification for sustainable employee behavior in terms of individual decision-making in everyday work but also on gamified approaches to promote strategic sustainable product development (Villamil *et al.*, 2023) or green supply chain management (Behl *et al.*, 2024; Putz and Treiblmaier, 2018). It is thus beneficial to shift the focus of gamification research beyond individual considerations to the organizational level of corporate sustainability:

> *Agenda point 7:* Future research should focus on the impact of gamification beyond the individual level and explore how gamification can influence corporate-level outcomes in various dimensions of sustainability.

6.2 Implications for practice

Based on our conceptual model of gamification for sustainable employee behavior, we assume three potential design approaches for practice in designing gamification for sustainable employee behavior, summarized in Table 2.

First, the *cost-benefit approach* might be particularly appropriate when employees in a company tend to be primarily egoistically motivated to behave sustainably, i.e. they care mainly about the consequences for themselves and their children (Stern and Dietz, 1994) and question the cost-benefit ratio of sustainable behavior in the workplace, which is often the case because sustainable behavior is an additional duty for employees that conflicts with other goals (Unsworth *et al.*, 2013). This approach is about communicating the core message that sustainable behavior is beneficial to employees from a rational choice perspective. Consistent with this, the goal is to influence gain goal-related psychological outcomes (Lindenberg and Steg, 2013), such as attitude, self-efficacy, and knowledge, and individual behavior outcomes. For this, designers can draw on utilitarian and achievement-related hedonic design elements that support learning and self-efficacy. For example, companies might consider using informational content, direct feedback, goal setting, tips, or action planning in IS, coupled with badges, rewards, points, and levels. The introduction of sensor or system tracking, which automates the tracking of behavior change and thus reduces the effort required for employees to participate, is also a particularly suitable approach in this context. However, because elements to elicit extrinsic motivation in particular, such as rewards and badges, are used to influence the perceived cost-benefit ratio of sustainable behavior in the workplace in favor of

Table 2. Summary of design approaches for gamification to support sustainable employee behavior

Design approach	Cost-benefit approach	Hedonic approach	Normative approach
Core message (based on goal framing theory)	Sustainable behavior is beneficial	Sustainable behavior is fun	Sustainable behavior is the right thing to do
Possible guiding theories	Theories related to behavior	Theories related to affect, motivation, and learning	Theories related to learning
Focused psychological outcomes	Attitude toward sustainable behavior Self-efficacy in behaving sustainably Knowledge of sustainable behavior and behavioral consequences	Motivation to behave sustainably Fun in sustainable behavior Enjoyment in sustainable behavior Immersion	Awareness of the need for sustainable behavior Knowledge of sustainable behavior and behavioral consequences Reflection on current behavior
Focused behavioral outcomes	Individual behavior	Individual behavior	Social behavior
Possible affordances	Focus on utilitarian elements for self-efficacy and achievement-related gameful elements, e.g. Informational content Direct feedback Goal-setting Tips Action planning Sensor tracking Badges Rewards Points Levels	Focus on immersion-related gameful elements that promote curiosity and social experience-related gameful elements that evoke playful challenge, e.g. Storytelling Unlockable content Quiz Shuffling/chance Challenge Leaderboard	Focus on utilitarian elements for learning and social experience-related gameful elements that exhibit social pressure, e.g. Informational content Instruction Self-evaluation Suggestive questions Teams Social sharing Forum
Particularly suitable if . . .	. . . employees are primarily egoistically motivated, are not yet very engaged in sustainable behavior, and question the cost-benefit ratio of sustainable behavior at work	. . . sustainable behavior interventions should be implemented in short-term forms with a focus on a specific topic	. . . there are strong relationships among employees and a corporate culture where we-intentions are deeply anchored
Potential pitfalls	Potentially undermining effects of extrinsic motivation on intrinsic motivation for sustainable behavior	Potential lack of translation into behavior change\newline Potential novelty effect	Potentially negative effects on workplace atmosphere and colleague relationships

Source(s): Authors' own work

sustainability, there may be potentially adverse effects on intrinsic motivation (Deci *et al.*, 1999).

Second, the *hedonic approach* can be best used when companies opt for short-term, topic-specific behavior change interventions. This approach focuses on conveying the message that sustainable behavior is fun and appeals to hedonic goals (Lindenberg and Steg, 2013). Thus, the aim is to elicit hedonic psychological effects such as motivation, fun, enjoyment, and immersion in sustainable behavior that then lead to individual behavioral outcomes. Several gameful elements used in previous studies that promote immersion and curiosity could potentially be used in the hedonic approach, such as storytelling, unlockable content,

scenarios, quizzes, and chance. Social elements that evoke a sense of playful challenge, such as interindividual challenges, leaderboards, and trading, could also support the hedonic enjoyment of sustainable behavior. It should be noted, however, that the hedonic approach, especially when based on full-fledged serious games with no direct connection to the work environment, may not translate learning outcomes into behavior change. Furthermore, gameful elements may suffer from a novelty effect (Koivisto and Hamari, 2019) and lose their motivational impact over time, making this approach particularly suitable for implementing multiple topic-specific short-term interventions.

Third, the *normative approach* is best suited when strong relationships exist among employees, and we-intentions are deeply embedded in the organizational culture, as the main message to be communicated is that sustainable behavior is the right thing to do, which works especially through learning and social pressure. Therefore, it is important to activate the psychological outcomes related to the normative goal frame (Lindenberg and Steg, 2013), e.g. awareness, learning, reflection, and motivation, the latter especially by satisfying the need for relatedness (Ryan and Deci, 2017) and target social behavioral outcomes. To achieve this, organizations might draw on utilitarian and social elements that promote a combination of learning and social pressure. For example, design elements used in previous studies include informational content, instruction and instructional workshops, self-evaluation and suggestive questions, teams, social sharing, and forums. It is important to elevate sustainable behavior from an individual to a collective level to implement the normative approach. However, studies show that a balance must be struck between healthy social pressure and potentially negative effects on the workplace atmosphere and colleague relationships.

6.3 Implications for society

Although our study is primarily concerned with the potential of gamification to foster sustainable employee behaviors within the corporate environment, the findings and knowledge gained about the use of gamification in organizational settings also have the potential to yield valuable societal contributions.

At the individual level, we synthesize knowledge on the various design opportunities that gamification offers to support social sustainability in the corporate environment, specifically with regard to employee health and well-being. In this respect, gameful interventions can produce measurable psychophysiological benefits for the individual employee (Berger and Koch, 2024; Berglund *et al.*, 2023; Brown *et al.*, 2020; Gimenez *et al.*, 2024; Lowensteyn *et al.*, 2019). Given that a significant portion of an employee's life is spent in the workplace, we firmly believe that the implementation of gamification by companies to encourage physical activity and mental well-being during the course of daily work can have a profound and enduring impact on the promotion of a healthy society. Our synthesis may serve as a foundation for companies to recognize and realize this potential in practice.

At the organizational level, our conceptual framework provides managerial decision-makers and other practitioners in organizations, including businesses, governments, and public institutions, with an understanding of how gamification can be designed and used to promote organizational sustainability from the bottom up and anchor it in the corporate culture. Thus, we present a novel, innovative and creative intervention approach that can drive employee engagement in corporate sustainability efforts (Kim *et al.*, 2017; Westman *et al.*, 2019) and promises to support organizational transitions toward sustainability, particularly in the environmental domain. Furthermore, the activation of normative, gain, and hedonic goal frames and subsequent employee behavior change toward sustainability during work might result in spillover effects to the private life context (Zhang *et al.*, 2024), which would serve to amplify the impact of gamification for sustainability on the societal plane. Therefore, we believe that our work can serve as a catalyst for practitioners to leverage the power of gamification to contribute to sustainable development and thereby drive the transformation toward a sustainable society (Aguilera *et al.*, 2021).

7. Limitations

We acknowledge that our study entails several limitations. First, although the search terms were designed and tested to include all relevant studies on gamification for sustainable employee behavior, it is possible that some relevant studies that do not use one of the search terms in the title, abstract, or keywords were not included in this review. In particular, we observe a large dominance of positive effects reported across psychological, behavioral, and organizational outcomes in our sample of papers, suggesting a potential reporting bias. Other papers that may not have found the hypothesized effects of their studies may have framed their contribution differently. In this regard, we strongly encourage further research to examine this potential bias critically and to analyze findings on counterproductive effects of gamification to shed light on whether research has also pointed to adverse or unexpected effects in the context of gamification for corporate sustainability.

Second, because the focus of this study was primarily set on examining the outcomes of gamification in order to gain critical insight into the process of how gamification can impact sustainable employee behavior, both at the psychological and behavioral levels, only empirical studies were included, and design suggestions and proposals from a variety of conceptual studies on sustainability at work were disregarded. Future research should expand the review of design approaches to gamification in this context to include such conceptual studies, particularly to improve recommendations for practice in designing successful gamification for sustainability in workplace environments.

Third, while this work aimed to provide critical analysis of the current state of academic knowledge on gamification for sustainable employee behavior, it neglected practitioner experiences that could also be considered valuable in understanding pathways to sustainable behavior in organizations. Further work is encouraged to expand the review with books, reports, and other sources from practitioners to incorporate practitioner perspectives into the conceptual model.

Finally, while our conceptual framework is based on a thorough examination of the existing knowledge on gamification for sustainable employee behavior in workplace settings, our analysis did not include a meta-analysis of the proposed pathways in our framework, which means that we cannot draw definitive causal conclusions about our hypothesized processes. It would be very insightful for future research to explore causal relationships between different gameful affordances, diverse psychological outcomes pertaining to the three goal frames, and individual and social behavioral outcomes. This would further refine and deepen our conceptual understanding derived in this paper with empirical evidence on the trajectory from gamification design to organizational-level outcomes for corporate sustainability.

8. Conclusion

In recent years, research on gamification has gained increasing attention as a potential tool to support sustainable employee behavior in the workplace. This systematic review, based on an analytical framework grounded in gamification and sustainable employee behavior theory, has analyzed and discussed the design and psychological, behavioral, and corporate outcomes of previous studies on gamification for sustainable behavior in the workplace. In doing so, the findings reveal a conceptual framework of how gamification works to support employee engagement in corporate sustainability. This framework demonstrates that different affordances, both utilitarian and gameful, are essential to shaping psychological and behavioral outcomes related to sustainable workplace behaviors and that their selection is best guided by solid theoretical foundations related to motivation, behavior, learning, and system design. The choice of gameful affordances drives behavior-related and system-related psychological outcomes, both of which must be considered to implement gamification to promote sustainable employee behavior successfully. In this regard, gameful affordances can activate not only hedonic goal frames but also gain and normative goal frames for workplace sustainability. In doing so, gamification promotes individual and social behavioral outcomes.

The former can generate valuable psychophysiological benefits for employees in the workplace, while the latter is particularly important in the organizational setting because, cumulatively, behavioral outcomes can drive measurable corporate sustainability benefits across all three dimensions of sustainability – social, environmental, and economic. Based on these findings, our results point to exciting avenues for advancing future research in this area and lead to the identification of three practical approaches to designing gamification for sustainable employee behavior in organizational environments: the cost-benefit approach, the hedonic approach, and the normative approach.

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Supplementary material
The supplementary material for this article can be found online.

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