sustainability

IMPACT FACTOR 3.9

CITESCORE 5.8

Article

Exploring the Use of Mobile Apps for Fostering Sustainability-Oriented Corporate Culture: A Qualitative Analysis

Carmen Isensee, Frank Teuteberg and Kai Michael Griese

MDPI

https://doi.org/10.3390/su14127380

sustainability

MDPI

Article

Exploring the Use of Mobile Apps for Fostering Sustainability-Oriented Corporate Culture: A Qualitative Analysis

Carmen Isensee [1,*], Frank Teuteberg [2] and Kai Michael Griese [1]

[1] School of Business Management and Social Sciences, University of Applied Sciences, 49009 Osnabrück, Germany; k-m.griese@hs-osnabrueck.de
[2] Department of Accounting and Information Systems, Osnabrück University, 49069 Osnabrück, Germany; frank.teuteberg@uni-osnabrueck.de
* Correspondence: carmen.isensee@hs-osnabrueck.de

Abstract: Information systems (IS) play a central role in promoting corporate sustainability and pro-environmental behavior. This study explores the use of mobile apps for fostering sustainability-oriented corporate culture. It accentuates issues relating to sustainability-oriented corporate culture (RQ1), app meta-requirements as a strategic approach to addressing these issues (RQ2), as well as design and implementation principles (RQ3). Referring to the literature on sustainability apps, gamification, and nudging, our qualitative research design combines an analysis of four corporate apps intending to promote sustainable behavior and expert interviews (Grounded Theory). The proposed framework supports the planning, realization, and monitoring of this targeted app use. Single cultural dimensions inform seven issues in culture development. Five meta-requirements address this multi-dimensionality, challenges provided by new digital working environments, and principles of Green IT. Four design principles support, extend, and integrate current knowledge on app features, nudging, and gamification. Five variables determine the app intervention and maturity level. We conclude that this targeted app use should intend to foster the sustainability orientation within all dimensions of corporate culture instead of being limited to promoting sustainable behavior.

Keywords: sustainability culture; apps; mobile work; corporate culture; nudging; gamification

Citation: Isensee, C.; Teuteberg, F.; Griese, K.M. Exploring the Use of Mobile Apps for Fostering Sustainability-Oriented Corporate Culture: A Qualitative Analysis. *Sustainability* **2022**, *14*, 7380. https://doi.org/10.3390/su14127380

Academic Editor: Sooksan Kantabutra

Received: 14 May 2022
Accepted: 13 June 2022
Published: 16 June 2022

1. Introduction

Information systems (IS) play a central role in promoting corporate sustainability and pro-environmental behavior [1–4]. This includes the management of corporate culture [5]. During the COVID-19 pandemic, businesses were all of a sudden challenged to reorganize their processes and manage the new digital work environment, for example, the increased share of remote work [6]. Thus, this paper explores the relation between two supportive assets in these challenging times: mobile technologies (herein: apps) [7,8] and corporate culture [9] (herein: sustainability-oriented corporate culture). For example, app installations in the business category increased by 105% in the first quarter of 2020 (global start of the pandemic) compared to the first quarter of 2019 [10].

In recent years, the promotion of pro-environmental behavior through digital nudging [11], gamification [2,3,12] or persuasive technologies [13] has received much attention. Subsequently, we assume that apps present a deliberately low entry point out of this wider IS context for exploiting the potential of IS in sustainability and management. Sustainability management includes corporate culture development [1,14,15]. The ubiquitous use of smartphones in private contexts [16] suggests corporate members' familiarity with app use. In comparison to other digital technologies, numerous apps intending to promote sustainable behavior, i.e., sustainability apps, already exist. In a few examples from Germany, where the study was conducted: nearly half (54%) of at least 18-year-olds had installed

13 or more apps on their smartphone [17]. A company survey among Google customers revealed numerous positive effects of app use with a high relevance for sustainability and corporate culture management, including more efficient communication (48%) and increased creativity among employees (30%), or better exploitation of innovation potential (29%) [18].

Despite this potential, we perceive a gap regarding the practical use and empirical investigation of apps intending to promote sustainability-oriented corporate culture. Most existing apps intend to change individual behavior in private contexts. For example, only 17 of the 262 apps analyzed by [19] were targeting businesses. Similarly, apart from a few exceptions [3,20,21], most studies focus on private areas such as buying motives [22], residential electricity consumption [23], or sustainability awareness and education [21,24–27]. This focus on behavior change causes a blind-spot regarding the use of apps for fostering sustainability-oriented corporate culture as the organizational context of sustainable behavior [28]. In fact, fostering sustainability-oriented corporate culture is an important, but highly complex endeavor. This is due to the existence of sub-cultures, as well as its multi-dimensionality and multi-layeredness [29,30].

The purpose of this study is to close these gaps through addressing the following questions:

RQ1. *What are relevant issues regarding the development of sustainability-oriented corporate culture?*

RQ2. *Which meta-requirements should apps as IS of high relevance in the new digital work environment* fulfil to foster sustainability-oriented corporate culture?

RQ3. *Which design and implementation principles can be derived for their technical realization and use in corporate contexts?*

This paper is the first to explore the use of apps for fostering sustainability-oriented corporate culture using a qualitative research design combining an app analysis, expert interviews, and references to the relevant literature. While previous systematic reviews identified relevant apps, the proposed framework on the use of apps for fostering sustainability-oriented corporate culture illuminates issues, meta-requirements, design principles, and intervention and maturity levels. As these findings are applicable to other IS, we provide a blueprint for IS developers. Among corporate decision-makers, we motivate and support this targeted app use as part of their sustainability strategy and organizational development (change management).

This paper is structured in six sections. After this introduction developing the research questions, we refer to the relevant literature in Section 2. In Section 3, we describe the qualitative research design. In Section 4, we present the main findings. In Section 5, we discuss the findings and their implications as well as the limitations of this research. Section 6 will close this research.

2. Theoretical Background

This study unites two determinants of corporate sustainability: Corporate culture [14,15,28,31] and IS [1,32].

2.1. Sustainability-Oriented Corporate Culture

2.1.1. Sustainability-Oriented Corporate Culture as the Context of Pro-Environmental Behavior

Currently, many apps intending to promote sustainability focus on changing individual behavior. In businesses, sustainability-oriented corporate culture provides the context that guides pro-environmental behavior [28]. In other words, there are various other elements besides pro-environmental behavior that constitute a sustainability-oriented corporate culture. Therefore, relying on behavior alone does not sufficiently reflect the corporate culture [29]. According to a systematic literature review performed by [1], eight frequently investigated dimensions in the context of corporate culture, sustainability and digitalization include attitudes, values, behavior, collaboration, internal capabilities, ethics/norms,

management/leadership, and the (strategic) orientation. According to these authors, these dimensions can be investigated on the micro level focusing on single corporate members (e.g., individual pro-environmental behavior or attitudes) and the macro level considering the corporation as a whole or smaller sub-groups (e.g., collective pro-environmental attitudes). Based on this, the present paper acknowledges sustainability-oriented corporate culture as a key element for the sustainable development of businesses [1,15,28,30,31]. Consequently, one objective is to widen the often-applied focus on the use of apps from promoting pro-environmental behavior (in individual contexts) to fostering sustainability-oriented corporate culture.

2.1.2. Fostering Sustainability-Oriented Corporate Culture

The literature on fostering sustainability-oriented corporate culture is in a nascent stage. Harris and Crane [33] identified seven factors determining the establishment of a sustainability-orientation within an organizational culture. While they emphasize the difficulty of the aspired culture development, they did not present specific approaches. Ketprapakorn and Kantabutra [34] propose six best practices: act as role model, promote from within, design value communication channels, use core values to recruit new employees, and avoid employee layoff. However, none of these practices address the manifestation of a pro-environmental orientation within single cultural dimensions.

Due to the COVID-19 pandemic, more attention is being paid to "Sustaining corporate culture in a world of hybrid work" [35]. However, the phenomenon of IS-supported culture development has not been addressed so far.

2.2. IS and Corporate Sustainability

2.2.1. The Role of IS in Corporate Sustainability and Promoting Pro-Environmental Behavior

In the overall context of corporate sustainability, the focus lies on different disruptive technologies, such as artificial intelligence or Blockchain technology [36]. Based on a systematic literature review, four key areas of digital transformation in the environmental sustainability domain are outlined in [37]: pollution control, waste management, sustainable production, and urban sustainability. The promotion of pro-environmental workplace behavior, for example through gamification [3], is not yet established as a research theme. Other issues include the digitization of sustainability management and the environmental impact of digital technologies.

While the current research focuses lies on issues that do not touch upon the underlying corporate culture, we argue that the purpose of IS, including apps, would be to strengthen all dimensions of sustainability-oriented corporate culture in alignment with the principles of corporate sustainability. To the best of our knowledge, there are no scholarly works investigating this complex relationship. Therefore, we present key works on app features, nudging, and gamification addressing pro-environmental behavior that we will refer to throughout this paper.

2.2.2. App Features

Previous works have suggested a multitude of app features for promoting pro-environmental behavior. We assume that these features could also influence other dimensions of sustainability-oriented corporate culture. Earlier, still quite recent works [13,16,19] have laid the foundation for a better understanding of sustainability apps in highlighting app features and a meta-perspective of app functions. Systematic searches in Google Play Store were used for this purpose [13,16,38]. It was shown in [16] that several apps for measuring climate change include interactive features to enhance user engagement (e.g., sharing to social media, gamification, goal setting, tips, visual comparisons). The app analysis framework by [19] for the public domain (private contexts) is not limited to one sustainability issue. Instead, it considers different sustainability domains (ecosystem, energy, food, lifestyle, mobility, pollution, recycling, waste, water, wildlife), normative sustainability goals (e.g., raising awareness, resource efficiency, pollution reduction), and

different compatibility approaches (e.g., donations, awards, rewards, ranks). The authors [19] propose five IS functions that could help fulfilling the respective goal: collaborate, informate, educate, gamify, transformate.

More recent works focus on gamification and persuasive technologies [2,3,20,38] and started to address corporate contexts. Using a systematic review of apps for sustainable waste management, the authors of [38] identified seven persuasive strategies and 16 categories based on the purpose and target behavior intended by the app. The study [3] used a design research approach to develop a guideline for gamification that would promote pro-environmental workplace behavior (energy use). Drawing on gamification and persuasive design principles, they developed an app in five iterative steps. During the two-week intervention period, they tracked employees' individual computer-related energy consumption and provided feedback in the app using a visualization of a fictional flourishing garden.

2.2.3. Gamification

Gamification uses game elements in non-gaming contexts to change user behavior [39]. For this paper, the recently presented gamification prototype by [20] aiming to motivate pro-environmental behavior at the workplace presents a key work. Video conferencing instead of travel activity and online learning offer examples for the role of IS in promoting pro-environmental behavior at the workplace. We adapt the gamification elements these authors proposed as app features for corporate contexts that could foster sustainability-oriented corporate culture. These include points (sustainability scores), level, badges, rankings, quests (pre-defined challenges), avatars, social network graphs, and teams. A specific combination of gamification elements (action–points–motivation) can create engagement loops [20]. These can cause a constant repetition of pro-environmental actions, which could influence other dimensions of the corporate culture.

2.2.4. Organizational Nudging

> "By definition, digital nudging focuses on guiding the behavior of individuals, but the effects of digitally nudging individuals can extend to organizational or societal levels." [40] (p. 434)

This extension to organizational levels serves our interest in fostering sustainability-oriented corporate culture beyond individual behavior. Yet, in contrast to gamification, the reviewed literature does not explicitly refer to nudging as an approach to changing behavior. However, some interventions are centered around nudging principles. For example, the gamification study by [41] focuses on "giving feedback". The process model for the design of digital nudges by [42] provides a good introduction to this topic in suggesting nudging elements (anchoring, customized information, decision staging, default setting, framing, informing, limited time window, priming, reminders, simplification, social influence, warning). Like previous works on nudging in the sustainability context (green nudging: [43]), we address organizational nudging as a source for good. However, nudging in work environments can also have negative effects, such as a feeling that one's own privacy is threatened [44]. Within the scope of this paper, we address nudging as the technical realization of nudge principles in app features to nudge organizational members towards pro-environmental behavior (micro level) with the aim of fostering sustainability-oriented corporate culture (macro level).

3. Methods

Our research design combines established qualitative methods (expert interviews, app analysis, literature analysis) (Figure 1). These allow for enough flexibility for both the validation of existing knowledge and the exploration of new themes in the specific context of corporate culture development. We relied on thematic analysis for the analysis and identification of themes within our empirical qualitative data [45]. This flexible analysis method allows for the engagement with relevant previous literature where appropriate (theoretical analysis).

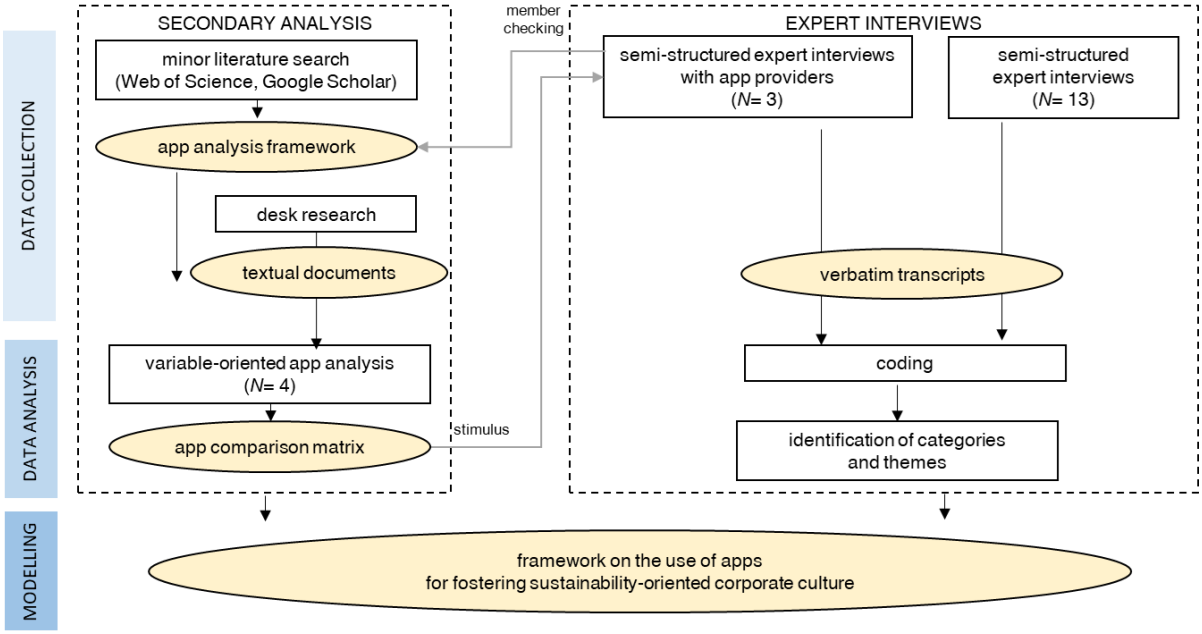

Figure 1. Qualitative research framework.

3.1. Data Collection

For the initial literature search in the online databases Google Scholar and Web of Science, we used different combinations of key words such as mobile app*, gamification, sustainability apps, or sustainability in both German and English. Additionally, we performed forward and backward searching. The data collection process for the app analysis and the interviews described in the following was performed by the lead researcher and a group of student assistants trained in qualitative methods.

3.1.1. App Analysis

As the works discussed in Section 2.2.1 suggest numerous app features, we adapt the following understanding of sustainability apps in corporate contexts (hereafter: apps) as the central subject of investigation in the present study: *Interactive applications with multiple features running on mobile devices, such as smartphones and tablets, that support the institutionalization of environmental sustainability within a corporation* [3,13,38]. In analyzing four apps available in the German language falling within the scope of this definition (Table 1), we demonstrate the topicality of our research interest and enhance its empirical contribution. The early development stages of all apps except Changers underline the practical relevance. Furthermore, two of the analyzed apps explicitly refer to corporate culture development (Sustayn: "Corporate Culture Transformation"; Klimakarl: "CO_2 saving with Klima Karl in a team for the (organizational) climate"). All of them at least present the pro-environmental behavior change of corporate members as their main purpose. Desk-research, relying on the company and Google Play Store websites, forms the primary data collection method. Furthermore, we conducted interviews with three app providers and a user of one of the apps.

Table 1. Apps considered in app analysis.

App	Target Group	Sustainability Focus	Development Phase & Statistics *
Changers	organizations	climate protection	available in Google Play Store since November 2014
		operational health management	Downloads: 10,000+
			Rating: 3.0 (441 reviews)

Table 1. *Cont.*

App	Target Group	Sustainability Focus	Development Phase & Statistics *
Codyo	organizations	climate protection (CO_2 emission reduction)	available in Google Play Store since September 2020
	private individuals		Downloads: >1000
			Rating: 3.0 (12 reviews)
KlimaKarl	organizations	climate protection (CO_2 emission reduction)	Co-creation phase (piloting until May 2021)
		Sustainable decision making	
Sustayn	organizations	promotion of sustainable employee behavior in accordance with the Sustainable Development Goals (employee sensitization and engagement)	Rollout planned in May 2021

* retrieved 14 June 2021.

3.1.2. Expert Interviews

Grounded Theory [46] presents an inductive method for theory building from qualitative empirical evidence. It thus suits the explorative character of this research and the objective to develop a framework on the use of apps for fostering sustainability-oriented corporate culture. Starting from our research questions, we followed the prescribed process of theoretical sampling, data collection, coding, constant interplay between data collection and analysis, and modelling [46,47]. First, we conducted 16 semi-structured expert interviews (in German) between May and July 2021 and prepared verbatim transcripts for further analysis.

On average, the interviews lasted 42 min. Experts included scholars, consultants in the field of sustainable or digital transformation, IS providers for corporations (E1–E13), as well as app providers (AE1–AE3) (Table 2). In considering different perspectives, we accounted for the interdisciplinarity of this research endeavor, which touches upon the fields of sustainability science, information systems, and organizational and occupational psychology. All participants received the data protection agreement upfront and confirmed their consent to the recording, analysis, and anonymized report of the results. They were informed that there were no right or false answers and received the transcripts for member-checking after the interview.

Table 2. Experts.

ID	Gender	Position	Expert Group	Expertise
E1	m	principal consultant	consulting	digitization management, digital culture
E2	f	CEO	consulting	previous occupation: Head of Digital Culture (stock company of the banking sector)
E3	f	divisional manager	sector association (ICT)	digital workplace
E4	m	CEO	consulting, academia	digitization management (focus: finance and accounting)
E5	m	advisor	sector association (ICT)	digitization and sustainability
E6	m	CEO	consulting/agency	full-service agency for digital workplace, digital culture, digital workplace IT (e.g, social intranet, mobile Apps for staff)
E7	m	CEO	consulting	digital business models, digitization management (focus: business processes), regional competence center for the digitization of medium-sized companies (funded by German federal ministry for economic affairs and energy)

Table 2. *Cont.*

ID	Gender	Position	Expert Group	Expertise
E8	f	professorship	academia	occupational and organizational psychology, influence of digitization on corporate culture
E9	f	project manager	consulting/agency	green nudging, climate protection and employee retention for businesses, business networks
E10	f	CEO	consulting/agency	sustainability management and communication, value-based corporate governance
E11	m	professorship	academia	occupational and health psychology, digitalization of work, culture- and organizational development
E12	m	CEO	consulting/agency	digital Leadership, virtual team collaboration, sustainable transformation of culture
E13	m	CEO	consulting/agency	consultant in the accounting sector with a focus on sustainability
AE1	m	divisional manager	app provider	business development & sales manager for a sustainability-oriented mobile app
AE2	f	CEO	app provider	Co-founder of a sustainability-oriented mobile app
AE3	f	CEO	app provider	Co-founder of a sustainability-oriented mobile app

The aim of the interviews E1–E13 was to collect initial ideas from different perspectives about issues in the development of sustainability-oriented corporate culture (RQ1) and the potential of apps and specific app features to address these issues (RQ2–3). As this targeted app use presents a rather new topic, we chose expert groups with a future-oriented perspective on sectoral developments. The semi-structured interview guide consisting of four sections is displayed in Table A1 (Appendix A).

The aim of the interviews AE1–AE3 was to understand app providers' intention to support their customers' corporate culture development, gain deeper insights on the (planned) app design, and validate the literature-based app analysis matrix (cf. Section 3.2). Drawing from the thinking-aloud method [48], we asked participants to comment on the anonymized app comparison matrix. This increased the trustworthiness (credibility) of our literature analysis in terms of completeness, relevance, and categorization/labelling [49].

3.2. Data Analysis

Our analysis was characterized by a strong engagement with the literature and relied on two empirical data sets [45]: textual documents on the analyzed apps and verbatim transcripts of the interviews.

For the app analysis, we prepared an app analysis matrix, providing one row for each app and one column for each app feature identified in the literature (cf. Section 2). To complete the matrix, we screened the documents compiling information from the desk-research for these app features. Then, we calculated frequency measures. Furthermore, we extended the initial literature-based list of app features through features newly identified in the app analysis.

In the coding process of the transcripts, the use of QDA Miner as a standard software for qualitative analysis, regular discussions on the intermediate results and memos on these discussions ensured a deep engagement with the transcript data. First, the lead author and one other member of the research team assigned initial codes to each transcript through line-by-line examination. This codebook (Table A2 in Appendix A) was constantly reviewed and adapted, and new codes were assigned to previously coded transcripts where appropriate. Then, a revision of the coded text passages (quotes) within each code allowed for the identification of themes and variables with different manifestations.

The report of the results is organized along the main findings relating to our RQs. We use quotes and references to the literature, as well as summary tables and graphical models to integrate the analysis results.

4. Results

Figure 2 provides a summary of the analysis results, distinguishing between the literature and empirical analysis. Sections 4.1–4.3 integrate the empirical evidence with knowledge from the literature in a discursive manner. At the end of Section 4.3, we present our framework integrating the issues relating to sustainability-oriented culture development (RQ1), the meta-requirements for apps (RQ2), and the derived design principles (RQ3). Section 4.4. presents the variables on the app intervention and maturity levels (RQ3) inductively derived from the expert interviews.

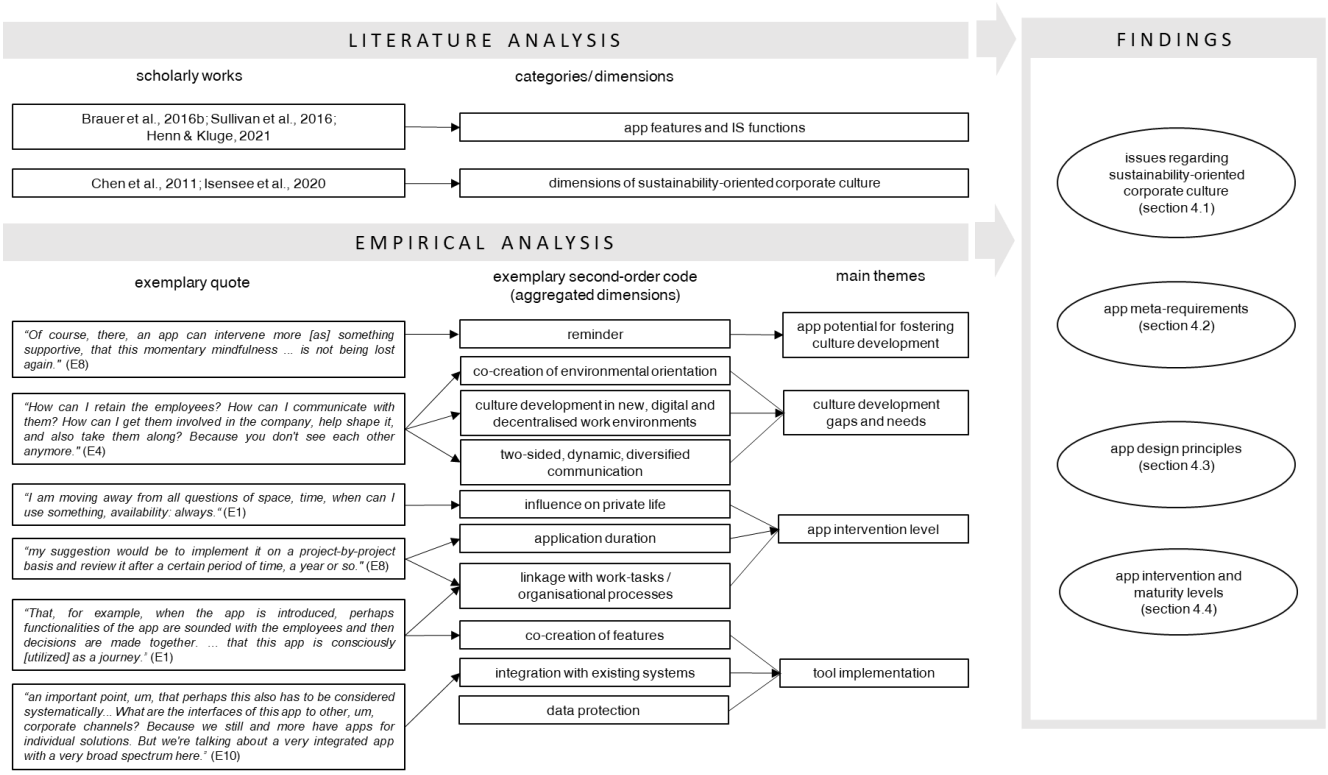

Figure 2. Summary of analysis results and main findings [1,16,19,20,28].

4.1. Issues in Sustainability-Oriented Corporate Culture Development

We organize the issues (I) discussed in the interviews along the eight cultural dimensions by [1,50]. For example, the participants highlighted a need for new people to "bring other value concepts into the company" (E6) and the necessity to operationalize values to expose unethical practices:

> "And I would find that quite exciting . . . , whether you can work . . . app-supported there, uhm, to say: 'Okay, the core values in the company, how do we actually operationalize them in everyday life? [. . .] And where can we show: 'This is exactly where there is no respectful interaction!?' . . . Because culture is like some kind of invisible force that either holds everything together or creates centrifugal forces within the company. . . . And if there were apps that managed to make this cultural aspect of values within the organization discussable, measurable, and thus also changeable, I would find that very exciting." (E12)

This addresses the concern that sustainability-oriented values remain unconscious or are lacking in many corporations. This makes the anchoring of sustainability-oriented

ethics and norms more difficult (I1). Similarly, the focus of consultants to change "mindset and attitude issues" (E2) reveals a lack of sustainable attitudes, through which a behavior-guiding effect remains absent (I2). The statement below demands a purpose coordinate system oriented towards shaping a sustainable future along the different corporate functions. This points towards the lack of a long-term perspective in the strategic orientation, through which continuous sustainability improvements are barely considered (I3).

> "If we now really dream that we will grow into an economy where . . . sustainability means more for companies than becoming less bad, but really: Where can we positively . . . help shape a future worth living? Then an app like this could be something like a purpose coordinate system for the employees that constantly asks questions: Are we still on course? Are we making the right decisions? And it could map this in such a way that it applies to all areas of the company." (E10)

The previous statement also indicates that the insufficient establishment of sustainable leadership structures and competencies limits companies' abilities to change (I4). This is further exemplified by the following statement, which discusses the increase of remote work as a new leadership challenge in change management [6], including sustainability management.

> "How can I retain the employees? How can I communicate with them? How can I get them involved in the company, help shape it, and also take them along? Because you don't see each other anymore." (E4)

More specifically, the statement above addresses employee involvement (collaboration) as a leadership task. The necessity to "develop this will [for more sustainability] together with the employees" (E4) points towards often too little exchange (collaboration & co-creation) about sustainability issues between company members. Through this, unused potential from within the company is not fully exploited (I6). Similarly, in expressing the wish for a digital exchange platform, the following statement reflects the lack of sustainability-relevant internal capabilities, such as knowledge of sustainable solutions. Through this, awareness about the company's sustainability performance can only increase to a limited extend (I5).

> "If we could create a platform like, even with a mobile app, where you can permanently post successes, permanently read: 'Oh yes, that's right. That's really great, I hadn't even thought of that yet'. That would perhaps be a very central point for me, because this is where it often fails." (E13)

Ultimately, the insufficient standardization of sustainable behavior in all processes and the toleration of unsustainable behavior (I7) remains a major issue, as E10 explained:

> "So, if I may really dream now, this app would help to close the schizophrenia of employees between private individuals and how I am in my role at work. Because we still have that so very strongly, um, that we make completely different decisions as private individuals than employees in the company, even at the CEO level. As I said, the CEO who really only takes organic wholemeal pasta for his toddler at home, but then invests in coal-fired power plants in the company because the returns are somehow so tempting. That we create this gap in terms of values, that I am an integrated personality, so to speak, no matter what context I'm in. At home as well as on the job. I don't leave my values at the company door, so to speak." (E10)

4.2. Meta-Requirements

In the following, we formulate five meta-requirements for apps that reflect a strategic approach to addressing the issues discussed in Section 4.1. Additionally, they explicitly consider challenges provided by the new digital working environment [6,51].

4.2.1. Raise Awareness

Strengthening sustainability awareness [21] appears as central approach for overcoming the lack of internal capabilities (A5) and has quite recently been subject of different scholarly works [21,24–26]. The code "awareness" under the category "corporate culture" points towards awareness raising regarding the collective sustainability definition of the organization and the organizational values (E10), enhanced resource consumption through increased digitalization (E6), available sustainable solutions in the nearby environment (E10), or the consequences and potential impact of individual actions within the organizational system (E10). For example, the realization of personalization and self-monitoring strategies in waste management apps [38] invites reflections on the own behavior. This can increase awareness about the consequences of individual actions. Accordingly, reflection should become a part of the corporate culture itself:

> "In such agile forms of work, it is actually always part of the process that you reflect on the way you work. . . . I mean, you also have this in every QM approach. Yes. If you implement it correctly, it is of course compatible to always reflect on how you do things. And ultimately, of course, this is also a form of corporate culture." (E11)

> "Whose responsibility is it to raise awareness of these issues, to put these issues on the table? For this, you don't need epaulettes, you don't need a mandate. That's everybody's responsibility." (E2)

We conclude that apps should raise awareness of sustainability issues to promote reflection and enable self-optimization (MR1).

4.2.2. Provide Diversified Access

Beyond awareness raising, activation plays a central role.

> "We activate the potentials and try to bundle them. To get ideas out of the organization and into the light of day. To motivate people not only to take an interest in their job." (E1)

> "When we talk about corporate culture, we're talking about activation, yes. That means we talk about activating people so that they would contribute." (E10)

The question remains how awareness raising and activation can succeed. The authors of [19] suggest five strategic approaches (IS functions) for introducing a sustainability-orientation. For example, the IS function "gamify" can support sustainability-oriented leadership (A4) that would "take [up] apps as an additional element to approach [the sustainability strategy] in a playful way" (AE2). In addition to these approaches, the assumed influence of employees' private app use behavior on corporate contexts draws attention towards another strategy. That is, the acceleration and reinforcement of the spill-over of private interest in sustainability and self-optimization to the working environment.

> "I'll start with the private, because from my point of view it has a direct influence on this business field. And I am convinced that this type of optimization app, as we know it in the area of nutrition or fitness, that the demand for it is so large that a significant proportion of the population will want to use something like this for themselves in the near future." (AE1)

We conclude that apps should provide diversified access points to sustainability issues to activate and strengthen the potential of all corporate members to engage in sustainable behavior beyond their work task (MR2).

4.2.3. Promote Co-Creation

Beyond self-optimization of individual sustainable behavior, one IS provider intends to promote crowd innovation via platforms, which relies on a diffusion of knowledge and ideas (I5):

> "We provide a platform . . . where you can make your ideas available . . . [to] slowly [start] the topic of crowd innovation." (E1)

In this vein, with a frequency of 163 coded text passages, the code "collaborate, communicate" underlines the relevance of the IS function "collaborate" [19]. As outlined in the description of I5, platforms can be a source of inspiration for sustainability solutions and provide points of contact and spaces where co-creation (I6) can happen. From these insights, we conclude that as platforms, apps should promote co-creation to achieve diffusion and anchoring of sustainability orientation in all cultural dimensions (MR3).

4.2.4. Bridge Physical and Temporal Distances

The codes "COVID-19 pandemic" and "HomeOffice" emphasize that the disruptions of the working world cause an increasing physical distance of company members. This hampers the manifestation of sustainable behavior patterns through observation, comparison, and imitation (I7).

> " . . . now, when people work mobile, the direct role model is no longer there because I can't observe how someone else does something." (E11)

In contrast to these (leadership) challenges to ensure role modeling despite physical distance, the participants pointed towards deep reflections stimulated by the pandemic. The reduced environmental impact through diminished travel activity [7,52] is a frequently addressed example. The participants postulated that many of the disruptions caused by the pandemic will stay and define the post-pandemic working world [51]. In summary, apps should bridge temporal and spatial distances between company members to anchor reflections on the sustainable digital working world or business models stimulated by the COVID-19 pandemic in corporate culture (MR4).

4.2.5. Ensure Meaningfulness

The code "motivation for use" addresses a few explicit motivators for app use, such as regular push-notifications with information as a call for pro-environmental behavior (E10). In turn, the participants mentioned various imminent (acceptance) problems, such as suspicion of greenwashing or paternalism (on the dangers of organizational nudging, see [44]) (E10), additional work (E6, E12) through media gaps or unreflected IS implementation (E2), rebound effects (E5, E11, E13) or an increase in user-related problems (digitization fatigue, unhealthy behaviors in the use of digital technologies) (E3, E4, E10, E11, E12). Furthermore, one participant raised the question of

> "How you can, uh, use something like (. . .) the mechanisms of Instagram, so that it remains ethically correct." (E10)

In answer to this, the code "support measures" subsumes different approaches intending to prevent acceptance and ethical problems. One approach is to integrate the app with the intranet or other corporate social media channels. More generally, the app use could also be linked with corporate health management [16,53]. E7 referred to an app fostering healthy behavior when reflecting on the use of apps for promoting pro-environmental behavior. In summary, apps should link to existing systems, policies, and processes, ensure privacy, data protection and voluntariness, and underly a sustainable and ethical use to be accepted as a meaningful tool (MR5).

4.3. Design Principles

The empirical evidence suggests that corporate sustainability apps as defined in this paper have not been widely established in corporate sustainability management practice. All app providers (AE1–AE3) reported on their ongoing research for the best app design and challenges in realizing features. Participants E1–E13 widely struggled to develop an initial, more or less concrete idea of apps intended to promote sustainability-oriented corporate culture. Instead, they often referred to apps as IS with one specific purpose, covering only one issue of sustainability-oriented corporate culture development. Communication

apps like Zoom, Microsoft Teams, or WhatsApp were frequently mentioned. Nonetheless, despite some critical voices, the participants widely reflected upon the app potential.

> "If I saw it right in front of me, so to speak, I would probably have like a one million dollar job right now." (E7)

To clarify and support the exploitation of this potential, the following four design principles strongly engage with central topics discussed in the literature, especially app features, gamification, nudging, and Green IT.

4.3.1. App Features

Our results allowed us to distinguish 24 app features that would cover considerably more key functionalities. The empirical evidence extends app features identified in the literature [3,16,19,20,38]. For nearly all app features, we were able to identify new key functionalities with a potential relevance for the intention of fostering sustainability-oriented corporate culture. For example, the findings specify opportunities for visualization. Besides diagrams or a live-ticker [20], a fictional planet (Sustayn), pet (AE1), or garden [3], which wither or flourish based on individual behavior, or (website) dashboards for team leaders could indicate the sustainability performance. Furthermore, we distinguish four new app features:

- Chat & Chatbot: So far, only KlimaKarl uses a chatbot (based on artificial intelligence) as a personal assistant for users and a moderator for the competition.
- Co-determination: Codyo enables company members to invest points in corporate sustainability projects or to vote for sustainability champions.
- Survey/feedback: With KlimaKarl, employees can make improvement suggestions to the company or point out environmentally harmful behaviors via app.
- Wiki: E4, E10 and E13 address the integration of an area in the app where users can access and add information at any time.

As a first approach towards postulating an influence of single app features on sustainability-oriented corporate culture, Table 3 presents exemplary key functionalities, reveals the number of expert interviews each feature was mentioned in intuitively (considering E1–E13), and indicates their realization in the analyzed apps (in integrating the results of the app comparison matrix). On average, 15.75 out of 24 app features are realized in the analyzed apps. An exploration of potential effects arising from specific app feature combinations is beyond the scope of this paper. However, the creation of engagement loops through gamification features [20] presents an example for potential synergy effects. These insights lead to DP1: *Combine app features associated with fostering sustainability-oriented corporate culture.*

Table 3. App features with a potential influence on sustainability-oriented corporate culture.

App Feature	Key Functionalities [1]	Source	Mentions (E1–E13)	Realization (App Analysis Results) [2]			
				Changers	Codyo	KlimaKarl	Sustayn
user profile/ (dynamic) avatar	• creation of an individual profile, incl. profile picture, personal information, information on performance in the app • creation of an avatar that can move through the app and thus also meet and interact with other avatars in virtual space (e.g., virtual meeting rooms)	[20]	1	x	x	x	x

Table 3. *Cont.*

App Feature	Key Functionalities [1]	Source	Mentions (E1–E13)	Realization (App Analysis Results) [2]			
				Changers	Codyo	KlimaKarl	Sustayn
community/social network	• connection of user profiles ("follow") • social network graphs • exchange within networks (e.g., pictures, chats)	[20]	5	x	x	x	
social sharing	• open interfaces compatible with internal and external systems or applications (e.g., intranet, social media) enables direct postings on app-related information (e.g., on performance in the app) outside the app	[16]	3				
social media	• personalized home page (feed) • postings to be displayed in the feed of other connected users • viewing, sharing, commenting, and responding to posts from connected users or the company	[16]	5	x	(x)	(x)	(x)
teams	• grouping of users • setting collective objectives • aggregation of performance • (e.g., participation in competitions as a team)	[20]	3	x	x	x	
information	• on-demand access to informational articles (e.g., videos, articles, instructions, process descriptions) on sustainability topics or the company	[19]	4				
tracking	• automated recording of user behavior outside the app (e.g., pedometer) • recording of user behavior based on user input (e.g., number of vegetarian meals per week)	[19]	8	(x)	(x)	(x)	(x)
calculator/KPIs	• automated calculation of certain values (e.g., CO_2 savings or water consumption) at the push of a button based on input or tracking data	[19,38]	1	x	x	x	x
visualization	• graphical representation of (current) environmental performance based on tracking (e.g., charts, live ticker, fictitious thriving planet or garden, or fictitious pet to be cared for as a metaphor) • for businesses: Aggregated presentation of environmental performance in dashboards outside of the app	[3,20]	5	x	x	x	x
reminder/advice	• regular, eventually individualized, notifications (e.g., email, push message, bell), for example about news, achievements, challenges, or as suggestions for optimizing environmental performance	[16]	6	x		x	x
objectives/quests	• goal setting (individually or collectively in teams or organization-wide) • pursuit of goal achievement • linking personal goals with corporate goals	[16]	4	x	x	x	x

Table 3. *Cont.*

App Feature	Key Functionalities [1]	Source	Mentions (E1–E13)	Realization (App Analysis Results) [2]			
				Changers	Codyo	KlimaKarl	Sustayn
challenges	• playful access through predefined or user-initiated competitions (e.g., CO_2-saving competition) or one-time challenges	[20]	4	x	x	x	
ranking	• automated generation and display of ranking lists for the performance of individual users based on badges, points, etc.	[16,20]	2	x	x	x	
badges	• automated generation of badges (e.g., employee of the month, app user of the day, premium user) and display in user profile	[16,20]	0			x	x
points	• automated calculation and output of a numerical value of environmental performance (e.g., as CO_2 equivalents) enables the operationalization of the environmental performance of certain actions • points as digital currency app users can invest (cf. co-determination, donations)	[20]	2	x	x	x	x
incentives/ reward system	• unlocking of rewards outside the app based on performance in the app • monetary rewards (e.g., food vouchers for the canteen) • non-monetary/symbolic rewards (e.g., privileges like premium parking space)	[20]	6	x			x
donations	• individual donation at any time to pre-selected causes, either monetarily or through the use of a digital currency • deposit of digital currency (points) into a fictitious, collective donation account, as a basis for regular corporate donations • unlocking donations based on competitive performance	[19]	4	x	x	x	x
chat *	• direct messaging (text messages) • video calls • file sending		3	x		(x)	
chatbot *	• AI-based fictional character as personal assistant for users (e.g., provides information about current results, direct messages or posts of daily tips for environmentally friendly behavior) or moderator of competitions		0			x	
co-determination *	• voting on company-wide sustainability issues and actions (crowdfunding principle, cf. points)		3		x	x	x
survey/ feedback *	• surveys on the corporate environmental performance • user feedback on needs or improvement suggestions regarding environmental performance to the company		6			x	

Table 3. *Cont.*

App Feature	Key Functionalities [1]	Source	Mentions (E1–E13)	Realization (App Analysis Results) [2]			
				Changers	Codyo	KlimaKarl	Sustayn
quiz *	• taking quizzes on sustainability topics		1			x	x
wiki *	• wiki page sorted/ordered by specific topics that users can enter to add or retrieve information at any time		2		x		
			Sum	15	15	19	14

Note. [1] The description of the key functionalities are a combination of the literature and the empirical evidence from the interviews. [2] Based on the app comparison matrix (Sources: Websites and Google Play Store pages from July 2021). * New app features not explicitly mentioned in previous literature. x = Key functionalities realized. (x) = Selected key functionalities realized.

4.3.2. Gamification & Nudging

Our empirical results underpin the growing attention of scholarly works on gamification and nudging (cf. Sections 2.2.2 and 2.2.3). All of the analyzed apps built in gamification elements, such as visualizations, objectives, or points, using different app features (Table 3). The engagement loops created by gamification elements [20] could increase the company member's motivation for self-optimization (MR1) and thus promote the constant repetition of sustainable behavior. Hopefully this would positively affect other, less conscious elements of sustainability-oriented corporate culture [29]. For example, AE2 reported on changes in employee behavior after the temporary company-wide competition organized through the app, especially in the fields of mobility and nutrition (use of public transport or bicycles instead of cars; vegetarian diet).

While "gamify" constitutes one of five IS functions, the evidence supports the introduction of nudging as a separate IS function. Nudging was explicitly mentioned by AE1, AE2, AE3, E9 and E10. To some extent, nudging elements can guide environmentally friendly behavior outside the app (MR1) without forcing employees' self-optimization within this orientation framework [8,45]. According to the literature, the anchoring of the sustainability orientation (MR3) forms an element of (green) nudging alongside tailored information, decision staging, default settings, limited time windows, reminder, simplification, social influence, or warning [42]. These findings lead to DP2: *Build in and combine gamification elements to create engagement loops* and DP3: *Build in nudging principles.*

Even though nudging was only implicitly considered in the analyzed literature and not further defined by the participants, E10 postulated that nudging will have a higher relevance in the future than gamification. A possible explanation for this could be issues with the use of competitions and ranking lists in corporate contexts. That is, company members might have reservations against occupying upper or lower ranks (AE1). Furthermore, we noted the overlap of various app features with both, gamification and nudging principles. Limited time windows (nudging principle) for actions create a gamified context. The app feature visualization creates another gamification opportunity for making performances comparable without using rankings and addresses the nudging principle "simplification".

4.3.3. Green IT

The objective of fostering sustainability-oriented corporate culture through app use focuses on the promotion of the company's sustainability performance through IS. In turn, the participants highlighted specific sustainability requirements (MR5) for app design. They expressed considerations regarding energy consumption, the timeframe for deployment, the communication and integration with other IS, such as the intranet (E6) through open

interfaces (E10), data protection, and accessibility (MR2). This leads to DP4: *Meet Green IT principles and realize open interfaces.*

4.4. Intervention and Maturity Levels

Based on the codes under the "app intervention level" and "tool implementation" theme we identified five variables to describe the app intervention and maturity level (Table 4). AE2 presents an example for the use of gamification as a kick-off for implementing the sustainability strategy, thus suggesting that there are different opportunities for embedding the app into the sustainability strategy:

> "Larger customers . . . mostly did that accompanying. . . . Just as we had hoped. They had a climate week or some kind of kick-off for a sustainability strategy . . . and then included [our app] as an additional element to approach the whole thing in a playful way." (AE2)

The two strongly diverging poles of the integration with work tasks and the spill-over to employees' life account for the avoidance of potential feelings of paternalism or being left out among employees raised by organizational psychologists (E10, E11). The following statement addresses the link with employees' private life:

> "We're in paternalism when a company dictates . . . what is going on via an app designed for private individuals." (E10)

Especially blue-collar workers might be neglected in the implementation of digital tools, HomeOffice opportunities and culture development. E11 explained issues arising from different working conditions as follows:

> "What concerns me a little about corporate culture is that . . . in many companies, not all employees have the benefit of such tools. . . . And if I'm sitting at a checkout in a supermarket, of course I don't have the advantage of doing that. And, uh, I don't think you should underestimate the fact that this can also lead to social discontent." (E11)

Table 4. Intervention and maturity levels of apps for fostering sustainability-oriented corporate culture.

Variable	Description	Characteristics	Examples
embeddedness in overall sustainability strategy	the role of the mobile app within the overall sustainability strategy of the organization	activating/accompanying supplement	• app suggests sustainability actions (e.g., setting up a beehive) (AE3).
		downstream supplement	• app reminds users to separate waste or save water (E8)
integration with work tasks/ organizational processes	the degree to which the app is linked with work tasks or organizational processes	strong integration	• app enables registration for company events via QR code (AE3) • app conveys company-specific content and processes (E6)
		low integration	• app addresses blue collar workers with lack of opportunities for app use in the workplace on non-work topics (E6)
spill-over to employee's private life	the degree to which the app also influences private contexts of organizational members	consciously strong spill-over	• app controls/records private mobility behavior (E1) • app motivates vegetarian diet (AE2) • app allows for self-information on the company and its sustainability initiatives at all times (e.g., on the train) (E6)
		consciously avoided spill over	• app is not tailored to employees as private individuals (E10)

Table 4. *Cont.*

Variable	Description	Characteristics	Examples
application duration	timeframe within which the app is used, ranging from temporary to continuous use	continuously/ long-term	• app is used in the company for a long time (AE3)
		temporary (reoccurring)	• app is used as part of a competition for a pre-defined period of time (AE2)
		temporary (one-time)	• companies switch between different apps/IS in the medium to long term (E11)
engagement level	the degree to which individuals can interact with the app or engage with the implementation and development process	user entries	• app accompanies users through the day and relies on regular entries (AE1)
		app co-creation/ co-development	• app features are jointly selected and further developed together with employees, making the app implementation an organizational journey (E1)

5. Discussion

This research set out to develop a framework on the use of apps for fostering sustainability oriented corporate culture (Figure 3). Therein, the meta-requirements and design principles offer a strategic approach to addressing the issues relating to sustainability-oriented corporate culture.

Identifying seven issues in the development of sustainability-oriented corporate culture in the context of the new digital work environment (RQ1) acknowledges corporate culture as an integral element of sustainable and digital business development [1]. For example, corporate culture appeared as an intangible asset for managing the challenges provided by the COVID-19 pandemic [9]. In the post-pandemic working world, maintaining the corporate culture will remain a major challenge [51]. Through adapting a multi-dimensional understanding of sustainability-oriented corporate culture [1,28], this study extends the current focus of apps and IS research on the promotion of sustainable behavior, for example sustainable energy use [3,23], and awareness of sustainability [21,24–27]. Furthermore, this proposes manageable elements for upholding and nurturing a sustainability-oriented corporate culture [20]. In summary, we postulate that to achieve positive effects of app use, such as increased creativity or better exploitation of innovation potential [18], apps should intend to activate unused potential (MR2) through addressing all cultural dimensions.

The five app meta-requirements (RQ2) offer a strategic approach towards addressing the culture development issues. In contrast to the five IS functions suggesting strategies for promoting the achievement of sustainability goals in private contexts [19], our meta-requirements contain a normative element. Ideally, one app would consider all five meta-requirements to adequately address challenges provided by the new digital working environment (MR4) and principles of Green IT (MR5) while fostering sustainability-oriented corporate culture.

The four design principles specify promising opportunities for the technical realization of the meta-requirements (RQ3). More specifically, we contribute to the design science perspective in proposing 24 app features with numerous key functionalities (DP1), emphasizing the potential of nudging (DP2) and gamification (DP3), and considering the principles of Green IT (DP4). The empirical evidence widely supports the potential of previously discussed app features [16,19,20] for the specific intention of fostering sustainability-oriented corporate culture. In addition, our app analysis distinguishes four new features (chat/chatbot, co-determination, survey/feedback, wiki). Similarly, DP3 not only supports the widely acknowledged relevance of gamification [16,20,25], but also emphasizes that gamification should not only be used to promote sustainable behavior. Thus, we postulate that gamification features constitute a special form of co-creation (I6) with a potential influence on the manifestation of a sustainable orientation within the underlying

mechanisms of the corporate culture [28]. In one example: during a sustainability competition organized through an app like KlimaKarl, it is more likely that corporate members "reflect and talk about [sustainable behavior] . . . and this simply receives a completely new significance in the office, where it might not have been appropriate before" (AE2). A higher awareness of sustainability issues and potential solutions (internal capabilities, I5) or the co-creation (I6) between organizational members with a similar sustainability motivation or interest (so-called sustainability champions) constitute potential outcomes of this enhanced exchange (I6). Longer-term effects could be that corporate members stop tolerating unsustainable behavior (I7) and the manifestation of sustainability-oriented values, ethics, and attitudes (I1–I2).

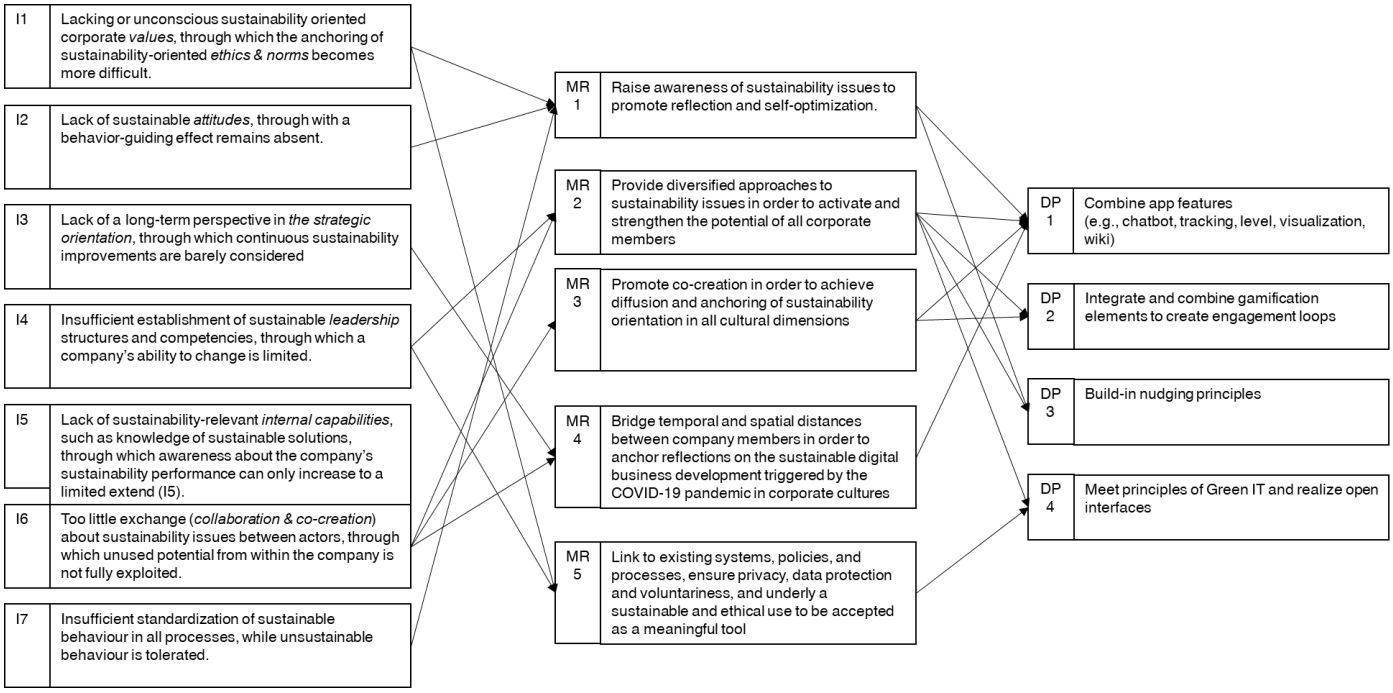

Figure 3. Issues relating to sustainability-oriented corporate culture (I) and meta-requirements (MR) and design principles (DP) for apps with the intention to fostering sustainability-oriented corporate culture.

Taken together, the meta-requirements, design principles, and variables indicating the app intervention and maturity level constitute quality criteria. In essence, the app quality is determined by the institutionalization of a sustainability orientation in single cultural dimensions. For an assessment of the successful embeddedness into the overall sustainability strategy, the integration of the app with existing sustainability measures, such as bike leasing [20], forms a potential indicator. Previous works have not explicitly addressed app intervention and maturity levels. However, the number of IS functions fulfilled by the app [19] or the number of actions provoked by gamification engagement loops (action–incentive–motivation) [20] could serve as indicators for app maturity. Following the concept of engagement loops, the app co-creation process, indicating a strong engagement level, presents a relevant element of app intervention. Arranging the app co-creation as an "organizational journey" (E1) provides a new perspective on app user engagement. The postulated impact of IS use on corporate culture [5] suggest stronger engagement with the wider IS context for promoting sustainability as a potential effect of high engagement levels. This includes the fostering of a sustainability-oriented corporate culture.

5.1. Implications to Theory and Practice

The implications of our qualitative findings to research and practice are manifold. Both parties should acknowledge the multi-dimensionality of sustainability-oriented corporate culture instead of simply focusing on changing behavior when investigating or employing apps.

We should note that we exemplarily focused on apps for fostering sustainability-oriented corporate culture through IS. In particular, IS researchers should be aware that the findings might be applicable to other IS. For example, digital platforms could be understood as a superordinate IS to apps [4,54], as the platform idea frames the formulated meta-requirements. According to [55], participation platforms provided opportunities for spatially distant actors (MR4) to participate with varying intensity (MR3) through different access points (MR2) in the COVID-19 pandemic.

While the analyzed scholarly works have not explicitly addressed the intention of fostering sustainability-oriented corporate culture through apps, our framework improves the classification of previous findings and points towards future research opportunities. The classification addresses the potential influence of app features on single cultural dimensions, as well as the technical realization of gamification or nudging principles. For example, the most covered IS function among sustainability apps "informate" [19] not only has the potential to promote behavior change, but would also foster underlying knowledge and awareness about sustainability issues (internal capabilities, I5). The IS function "transformate" is of relevance for public domain use cases [19]. Our research suggests that in corporate contexts nudging (DP2) is a more suitable concept for representing the IS function concerned with the de-institutionalization of unsustainable behavior and the institutionalization of sustainable behavior (I7).

By introducing "nudge" as an IS function for corporate contexts, DP2 proposes the intentional use of apps for fostering sustainability-oriented corporate culture as a new context for organizational nudging. This integrates the specifications of green nudging [43] and digital nudging [40]. From a design science perspective, we showed that app features, especially survey, feedback, or visualization, technically realize nudging principles [41] and are overlapping with gamification elements. This integration of gamification and nudging can ensure a more holistic theoretical embeddedness of future research on sustainability/culture development apps. For example, [56] integrated gamification and nudging in their recent works on well-being apps. The gamification study by [3] focused on feedback without referring to the concept of nudging. As our participants partly postulated a more important role of nudging in the future, we should take a deeper look into the wide range of opportunities our evidence suggests for building-in the "giving feedback" nudging principle [41]. Firstly, app users receive (personalized) feedback through the app feature reminder/advice. Secondly, through the survey/feedback feature, app users can give their corporation feedback. This promotes the institutionalization of continuous improvements of the sustainability performance of business processes (I3). Thirdly, if an app co-creation process is implemented, app users can give app developers feedback on the app design, thus enhancing the user experience.

For practitioners, the findings should be an inspiration for using apps for nurturing a sustainability-oriented corporate culture. For planning and monitoring the app use, practitioners should consider the quality criteria and the outlined pitfalls of an insufficiently reflected app implementation, such as arising feelings of paternalism among employees. Furthermore, given the increase of remote work [6], an important outlook for the use of apps for fostering sustainability culture would be the connection of individuals across companies or among members of co-working spaces [57]. This could ensure the achievement of a critical mass for app features relying on a substantial number of users to unfold their potential, such as team quests or wikis. This opportunity makes this targeted app use more attractive for smaller companies. At the same time, this marks a low threshold launch for sustainable co-creation between actors from different companies or organizations.

In spite of the increasing calls for a digital and green twin transition [58] and the disruption of markets and working environments through digitalization [1], we would like to add that the app use for fostering sustainability-oriented corporate culture could stimulate IS application ideas in sustainability management. Using apps as a low entry point allows corporate members to experience and recognize the benefits of IS use in sustainability management. To ensure that this would result in a manifestation of the integrative view on digitalization and sustainability, leaders should explicitly communicate the role of apps and other IS for sustainability when embedding the app into the sustainability strategy.

5.2. Limitations and Future Research

As every qualitative study, our research is subject to limitations that need to be considered in the interpretation of the results. However, the different qualitative analyses relying on established approaches, such as member-checking, engagement with existing literature, and the analyses through different researchers to minimize the influence of individual perceptions, increase the trustworthiness of our results [49].

It was beyond the scope of this explorative study to investigate the real effects of app use on sustainability-oriented corporate culture. Future research needs to validate the impact of key functionalities built into app features on the anchoring of a sustainability orientation in single cultural dimensions. This includes the investigation of different degrees of influence among app features (MR3) and the impact of different combinations of app features (DP1).

Another set of limitations concerns the technical realization (design science perspective). As our research exemplarily focused on apps because they present a deliberately low entry-point, some relevant IS features might still be uncovered. Accordingly, future research should transfer the research approach and insights of this study to the wider context of IS use in sustainability management. Furthermore, the app features do not yet holistically reflect a technical realization of all green nudging principles (DP2). This gap should be addressed to account for the increasing relevance of digital and green nudging. Another research avenue covers the herein suggested synergy effects between sustainability and health management. For example, biking to work would have positive environmental and health benefits [16]. As the participants mentioning this comparison assumed that health management apps are more advanced, future research should explore the adaptation of successful key functionalities from occupational safety apps, or health management apps [56] for fostering sustainability-oriented corporate culture.

There are also limitations regarding the insights into the successful app implementation. The evidence for MR5 (providing meaningfulness) mainly draws attention to potential acceptance problems and highlights support measures to avoid reactance to app use. While these are necessary to consider, future research should also identify motivators for app use among corporate members. Furthermore, as the sample does not include companies that have been using apps to promote sustainability-oriented corporate culture for a longer period, our results lack a cost–benefit analysis. One could expect benefits throughout all three sustainability dimensions, such as increased resource efficiency (ecological dimension), employee satisfaction/employer attractiveness (social dimension), organizational resilience or innovative strength (economic dimension), as well as increased digital competencies. The actual ecological, social, and economic impact should be measured in monetary terms using KPIs. This should be compared with implementation costs (personnel costs), software costs, and hardware costs (provision of mobile devices), among other things, to derive a thus far unconsidered cost for developing and nurturing sustainability-oriented corporate culture through IS.

6. Conclusions

The aim of the present study was to develop a framework on the use of apps for fostering sustainability-oriented corporate culture. We achieved this through exploring three research questions by means of a literature analysis, an app analysis, and expert

interviews following Grounded Theory methodology. As a result, we accentuated seven issues regarding the development of sustainability-oriented corporate culture (RQ1), identified five meta-requirements as a strategic approach to addressing these issues (RQ2), and derived four design principles for their technical realization, as well as five variables indicating the intervention and maturity level (RQ3). This framework considers the multidimensionality of corporate culture, challenges in culture development associated with the new digital working environment, principles of Green IT, as well as the relevance and overlap of gamification and nudging principles.

Author Contributions: Conceptualization, C.I.; methodology, C.I.; investigation, C.I.; writing—original draft preparation, C.I.; writing—review and editing, F.T. and K.M.G.; visualization, C.I.; supervision, F.T. and K.M.G.; project administration, C.I.; funding acquisition, K.M.G. All authors have read and agreed to the published version of the manuscript.

Funding: This research and the APC were funded by Deutsche Bundesstiftung Umwelt, grant number 34937/01.

Institutional Review Board Statement: All subjects gave their informed consent for inclusion before they participated in the study. The ethics committee confirmed that ethical approval was not necessary for this non-interventional study.

Informed Consent Statement: Informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on request from the corresponding author.

Conflicts of Interest: The authors declare no conflict of interest. The funders had no role in the design of the study; in the collection, analyses, or interpretation of data; in the writing of the manuscript, or in the decision to publish the results.

Appendix A

Table A1. Interview guide (E1–E13).

Warm-Up	1.	Which role does the sustainable, digital development of working environments play in your professional context?
	2.	Which role do Information Systems play in your professional context?
	3.	From which perspective are your addressing these topics (academic, consulting, application, facilitator, . . .)
	4.	Which Information systems, especially mobile Apps, to foster environmentally sustainable development are you familiar with?
	5.	Which trends do you observe regarding
		a. the development of organizational culture towards sustainable, digital orientation?
		b. Mobile Apps with a focus on sustainable development?
Potentials	6.	Which functions are included in the mobile Apps with a focus on sustainable development you are familiar with?
		a. If non: Which functions would be useful in your opinion?
	7.	Do you see a direct applicability of these mobile Apps to promote pro-environmental behavior of organizational members?
	8.	To which degree would such an application make sense?
	9.	What is the potential of mobile Apps, especially during COVID-19 lockdowns, to foster sustainable organizational cultures?
		a. To which degree could mobile Apps foster collaboration? [1]
		b. To which degree could mobile Apps support the education and training of employees regarding sustainable-digital topics? [1]
		c. To which degree could mobile Apps support a playful/gamification approach to introduce sustainable digital issues to employees? [1]
		d. To which degree could mobile Apps foster transformation of employee habits regarding sustainable digital development within organizational and private contexts? [1]
		i. Where do you see easier entry points? (private vs. organizational level)
		ii. Where do you see potential spill overs to other contexts?

Table A1. *Cont.*

Implementation	10.	What are potential barriers for the use of mobile Apps in organizations, for example SMEs?
	11.	What are necessary requirements to achieve a targeted application of mobile Apps with a sustainability focus in organizations?
	12.	What are necessary technological requirements?
	13.	Which issues are there regarding data protection?
	14.	How could employees be motivated to use the respective mobile Apps?
	15.	Which accompanying measures are necessary for the application to achieve the desired outcome?
	16.	Where does the (main-) responsibility lie for implementation?
	17.	How could the success of these measures be monitored and assessed?
Closing	18.	What is your vision for the role of apps to foster a sustainable, digital organizational culture?

Note. Translated, original interviews were conducted in German. [1] inspired by the IS functions by [19].

Table A2. Coding framework (expert interviews).

Category	First-Order Code	Count
corporate culture	awareness	129
	characteristics	122
	culture development	203
	micro/subculture	58
	responsibility	18
perspective	macro level	48
	micro level	121
working world	labor organization	111
	pandemic	73
	homeoffice/mobile working	123
digitalization	digital corporate culture	134
	digital competencies	94
	IT for green	100
	sustainable digitalization	67
sustainability	connectivity	82
	pro-environmental behavior	138
	sustainability-oriented corporate culture	170
tool implementation	motivation for use	169
	potential	274
	integration	98
	data protection	47
	level of intervention	110
	time horizon	36
	accompanying measures	175
	optimization	74
digital tools	social apps	29
	health and sports apps	51
	sustainability apps	341
	other apps/tools	352
	intranet	20
	artificial intelligence	9
	other technology	51
	information and communication technology	47

Table A2. *Cont.*

Category	First-Order Code	Count
IT4S objective	activate	69
	collaborate & communicate	118
	compare	101
	educate	163
	gamify	30
	inform	32
	nudging	12
	transform	29
IT4S design	app design	102
	badges	11
	calculator	11
	chat/direct messaging	28
	co-determination rights	26
	community/network	38
	contests	42
	donations	14
	feedback/reminder	49
	goal setting/quests	21
	info videos/contributions	29
	level	20
	points	32
	q&a	4
	quiz	20
	rankings	13
	rewards (reward system)	33
	settings	6
	social media	39
	social sharing (sharing contest results)	16
	teams	31
	tracking	36
	user profile/avatar	12
	visualizations/statistics	36
problems	hurdles and barriers	330
	gaps and needs	275
combined codes	culture development × potential	22
	culture development × hurdles and barriers	38

References

1. Isensee, C.; Teuteberg, F.; Griese, K.-M.; Topi, C. The Relationship between Organizational Culture, Sustainability, and Digitalization in SMEs: A Systematic Review. *J. Clean. Prod.* **2020**, *275*, 122944. [CrossRef]
2. Aguiar-Castillo, L.; Rufo-Torres, J.; De Saa-Pérez, P.; Perez-Jimenez, R. How to Encourage Recycling Behaviour? The Case of WasteApp: A Gamified Mobile Application. *Sustainability* **2018**, *10*, 1544. [CrossRef]
3. Oppong-Tawiah, D.; Webster, J.; Staples, S.; Cameron, A.-F.; Ortiz de Guinea, A.; Hung, T.Y. Developing a Gamified Mobile Application to Encourage Sustainable Energy Use in the Office. *J. Bus. Res.* **2020**, *106*, 388–405. [CrossRef]
4. Iria, J.; Fonseca, N.; Cassola, F.; Barbosa, A.; Soares, F.; Coelho, A.; Ozdemir, A. A Gamification Platform to Foster Energy Efficiency in Office Buildings. *Energy Build.* **2020**, *222*, 110101. [CrossRef]
5. Leidner, D.E.; Kayworth, T. Review: A Review of Culture in Information Systems Research: Toward a Theory of Information Technology Culture Conflict. *MIS Q.* **2006**, *30*, 357–399. [CrossRef]
6. Mykytyn, P.P. COVID-19 and Its Impacts on Managing Information Systems. *Inf. Syst. Manag.* **2020**, *37*, 267–271. [CrossRef]
7. Gregurec, I.; Tomičić Furjan, M.; Tomičić-Pupek, K. The Impact of COVID-19 on Sustainable Business Models in SMEs. *Sustainability* **2021**, *13*, 1098.
8. Dwivedi, Y.K.; Hughes, D.L.; Coombs, C.; Constantiou, I.; Duan, Y.; Edwards, J.S.; Gupta, B.; Lal, B.; Misra, S.; Prashant, P.; et al. Impact of COVID-19 Pandemic on Information Management Research and Practice: Transforming Education, Work and Life. *Int. J. Inf. Manag.* **2020**, *55*, 102211. [CrossRef]

9. Li, K.; Liu, X.; Mai, F.; Zhang, T. *The Role of Corporate Culture in Bad Times: Evidence from the COVID-19 Pandemic*; Social Science Research Network: Rochester, NY, USA, 2021.
10. Development of App Usage by Category Worldwide in Q1. 2020. Available online: https://de.statista.com/statistik/daten/studie/1114936/umfrage/anstieg-der-app-nutzung/ (accessed on 5 January 2022).
11. Stieglitz, S.; Potthoff, T.; Kißmer, T. Digital Nudging am Arbeitsplatz. *HMD* **2017**, *54*, 965–976. [CrossRef]
12. Morschheuser, B.; Werder, K.; Hamari, J.; Abe, J. How to Gamify? A Method For Designing Gamification. In Proceedings of the HICSS Hawaii International Conference on System Science, Hilton Waikoloa Village, HI, USA, 4–7 January 2017. [CrossRef]
13. Brauer, B.; Ebermann, C.; Kolbe, L. An Acceptance Model for User-Centric Persuasive Environmental Sustainable IS. In Proceedings of the ICIS International Conference on Informatio Systems, Dublin, Ireland, 11–14 December 2016.
14. Piwowar-Sulej, K. Pro-Environmental Organizational Culture: Its Essence and a Concept for Its Operationalization. *Sustainability* **2020**, *12*, 4197. [CrossRef]
15. Soini, K.; Dessein, J. Culture-Sustainability Relation: Towards a Conceptual Framework. *Sustainability* **2016**, *8*, 167. [CrossRef]
16. Sullivan, R.K.; Marsh, S.; Halvarsson, J.; Holdsworth, M.; Waterlander, W.; Poelman, M.P.; Salmond, J.A.; Christian, H.; Koh, L.S.; Cade, J.E.; et al. Smartphone Apps for Measuring Human Health and Climate Change Co-Benefits: A Comparison and Quality Rating of Available Apps. *JMIR Mhealth Uhealth* **2016**, *4*, e135. [CrossRef] [PubMed]
17. App-Installation vs. App-Nutzung (YouGov 2017). Available online: https://de.statista.com/infografik/12225/installierte-vs-genutze-apps-auf-dem-smartphone/ (accessed on 5 January 2022).
18. Arnold, R.C.G.; Schiffer, M.; Chevalier, K. *Faktor Google—Wie Deutsche Unternehmen Google Einsetzen*; IW Köln: Köln, Germany, 2011.
19. Brauer, B.; Ebermann, C.; Hildebrandt, B.; Remané, G.; Kolbe, L.M. Green By App: The Contribution of Mobile Applications to Environmental Sustainability. In Proceedings of the PACIS Pacific Asia Conferenec on Information Systems, Chiayi, Taiwan, 27 June–1 July 2016.
20. Henn, F.; Kluge, S. Play it Green!—Konzeptionelle Entwicklung und Design eines Gamification Prototyps zur Motivation von umweltbewusstem Verhalten innerhalb eines Unternehmens. *HMD* **2021**, *58*, 134–154. [CrossRef]
21. Paravizo, E.; Chaim, O.C.; Braatz, D.; Muschard, B.; Rozenfeld, H. Exploring Gamification to Support Manufacturing Education on Industry 4.0 as an Enabler for Innovation and Sustainability. *Procedia Manuf.* **2018**, *21*, 438–445. [CrossRef]
22. Nair, A.K.S.; Bhattacharyya, S.S. Is Sustainability a Motive to Buy? An Exploratory Study in the Context of Mobile Applications Channel among Young Indian Consumers. *Foresight* **2019**, *21*, 177–199. [CrossRef]
23. Kjeldskov, J.; Skov, M.B.; Paay, J.; Pathmanathan, R. Using Mobile Phones to Support Sustainability: A Field Study of Residential Electricity Consumption. In Proceedings of the SIGCHI Conference on Human Factors in Computing Systems, Austin, TX, USA, 5–10 May 2012; Association for Computing Machinery: New York, NY, USA, 2012; pp. 2347–2356.
24. Turan Çimşir, B.; Uzunboylu, H. Awareness Training for Sustainable Development: Development, Implementation and Evaluation of a Mobile Application. *Sustainability* **2019**, *11*, 611. [CrossRef]
25. Gatti, L.; Ulrich, M.; Seele, P. Education for Sustainable Development through Business Simulation Games: An Exploratory Study of Sustainability Gamification and Its Effects on Students' Learning Outcomes. *J. Clean. Prod.* **2019**, *207*, 667–678. [CrossRef]
26. Montiel, I.; Delgado-Ceballos, J.; Ortiz-de-Mandojana, N.; Antolin-Lopez, R. New Ways of Teaching: Using Technology and Mobile Apps to Educate on Societal Grand Challenges. *J. Bus. Ethics* **2020**, *161*, 243–251. [CrossRef]
27. Alonso-Martínez, D.; Jiménez-Parra, B.; González-Álvarez, N.; Godos-Díez, J.-L.; Cabeza-García, L. Taking Advantage of Students' Passion for Apps in Sustainability and CSR Teaching. *Sustainability* **2019**, *11*, 779. [CrossRef]
28. Chen, Y. Green Organizational Identity: Sources and Consequence. *Manag. Decis.* **2011**, *49*, 384–404. [CrossRef]
29. Schein, E.H. *Organizational Culture and Leadership*, 4th ed.; The Jossey-Bass Business & Management Series; Jossey-Bass: San Francisco, CA, USA, 2010.
30. Linnenluecke, M.K.; Griffiths, A. Corporate Sustainability and Organizational Culture. *J. World Bus.* **2010**, *45*, 357–366. [CrossRef]
31. Vodonick, J. The Key to Organizational Sustainability: Nurturing a Culture of Change. *Syst. Res. Behav. Sci.* **2018**, *35*, 458–468. [CrossRef]
32. Seele, P.; Lock, I. The Game-Changing Potential of Digitalization for Sustainability: Possibilities, Perils, and Pathways. *Sustain. Sci.* **2017**, *12*, 183–185. [CrossRef]
33. Harris, L.C.; Crane, A. The Greening of Organizational Culture: Management Views on the Depth, Degree and Diffusion of Change. *J. Organ. Chang. Manag.* **2002**, *15*, 214–234. [CrossRef]
34. Ketprapakorn, N.; Kantabutra, S. Culture Development for Sustainable SMEs: Toward a Behavioral Theory. *Sustainability* **2019**, *11*, 2629. [CrossRef]
35. Hirsch, P.B. Sustaining Corporate Culture in a World of Hybrid Work. *J. Bus. Strategy* **2021**, *42*, 358–361. [CrossRef]
36. Melnyk, L.; Dehtyarova, I.; Kubatko, O.; Karintseva, O.; Derykolenko, A. Disruptive Technologies for the Transition of Digital Economies towards Sustainability. *Econ. Ann.* **2019**, *179*, 22–30. [CrossRef]
37. Feroz, A.K.; Zo, H.; Chiravuri, A. Digital Transformation and Environmental Sustainability: A Review and Research Agenda. *Sustainability* **2021**, *13*, 1530. [CrossRef]
38. Suruliraj, B.; Nkwo, M.; Orji, R. Persuasive Mobile Apps for Sustainable Waste Management: A Systematic Review. In *Persuasive Technology. Designing for Future Change*; Gram-Hansen, S.B., Jonasen, T.S., Midden, C., Eds.; Lecture Notes in Computer Science; Springer: Cham, Switzerland, 2020; Volume 12064, pp. 182–194.

39. Deterding, S.; Sicart, M.; Nacke, L.; O'Hara, K.; Dixon, D. Gamification. Using Game-Design Elements in Non-Gaming Contexts. In Proceedings of the 2011 Annual Conference on Human Factors in Computing Systems—CHI EA '11, Vancouver, BC, Canada, 7–12 May 2011; ACM Press: New York, NY, USA, 2011; p. 2425.
40. Weinmann, M.; Schneider, C.; Brocke, J. Vom Digital Nudging. *Bus. Inf. Syst. Eng.* **2016**, *58*, 433–436. [CrossRef]
41. Thaler, R.H.; Sunstein, C.R.; Balz, J.P. *Choice Architecture*; Social Science Research Network: Rochester, NY, USA, 2010.
42. Meske, C.; Potthoff, T. The DINU-Model—A Process Model for the Design of Nudges. In Proceedings of the 25th European Conference on Information Systems (ECIS), Guimarães, Portugal, 5–10 June 2017; pp. 2587–2597.
43. Evans, N.; Eickers, S.; Geene, L.; Todorovic, M.; Villmow, A. *Green Nudging: A Discussion and Preliminary Evaluation of Nudging as an Environmental Policy Instrument*; Universitätsbibliothek der Freien Universität Berlin: Berlin, Germany, 2017. [CrossRef]
44. Barev, T.; Schwede, M.; Janson, A. The Dark Side of Privacy Nudging—An Experimental Study in the Context of a Digital Work Environment. In Proceedings of the 54th Hawaii International Conference on System Sciences, Kauai, HI, USA, 5–8 January 2021; p. 4114.
45. Braun, V.; Clarke, V. Using Thematic Analysis in Psychology. *Qual. Res. Psychol.* **2006**, *3*, 77–101. [CrossRef]
46. Glaser, B.G.; Strauss, A.L.; Strutzel, E. The Discovery of Grounded Theory; Strategies for Qualitative Research. *Nurs. Res.* **1968**, *17*, 364. [CrossRef]
47. Charmaz, K. *Constructing Grounded Theory*; SAGE: London, UK, 2014.
48. Charters, E. The Use of Think-Aloud Methods in Qualitative Research an Introduction to Think-Aloud Methods. *Brock Educ. J.* **2003**, *12*, 2. [CrossRef]
49. Sikolia, D.; Biros, D.; Mason, M.; Weiser, M. Trustworthiness of Grounded Theory Methodology Research in Information Systems. In *Proceedings of the MWAIS*; Association for Information Systems: Atlanta, GA, USA, 2013.
50. Isensee, C.; Griese, K.-M.; Teuteberg, F. Sustainable Artificial Intelligence: A Corporate Culture Perspective. *Sustain. Manag. Forum* **2022**, *29*, 217–230. [CrossRef]
51. Babapour Chafi, M.; Hultberg, A.; Bozic Yams, N. Post-Pandemic Office Work: Perceived Challenges and Opportunities for a Sustainable Work Environment. *Sustainability* **2022**, *14*, 294. [CrossRef]
52. Bai, C.; Quayson, M.; Sarkis, J. COVID-19 Pandemic Digitization Lessons for Sustainable Development of Micro-and Small-Enterprises. *Sustain. Prod. Consum.* **2021**, *27*, 1989–2001. [CrossRef]
53. Walle, O. Der Einsatz digitaler Lösungen zum Erreichen und zur Motivation von Beschäftigten in einem BGM. In *Digitales Betriebliches Gesundheitsmanagement: Theorie und Praxis*; Matusiewicz, D., Kaiser, L., Eds.; FOM-Edition; Springer Fachmedien: Wiesbaden, Germany, 2018; pp. 83–97.
54. Meireles, M.; Ribeiro, P.J.G. Digital Platform/Mobile App to Boost Cycling for the Promotion of Sustainable Mobility in Mid-Sized Starter Cycling Cities. *Sustainability* **2020**, *12*, 2064. [CrossRef]
55. Butt, J.-H.; Scholz, F.; Abel, P. Crisis and Change: Fallstudie zur Untersuchung der Resilienz als Erfolgsfaktor von Partizipationsplattformen während der Coronakrise. *HMD* **2021**, *58*, 778–787. [CrossRef]
56. Auf, H.; Dagman, J.; Renström, S.; Chaplin, J. Gamification and Nudging Techniques for Improving User Engagement in Mental Health and Well-Being Apps. In Proceedings of the Design Society; Cambridge University Press: Cambridge, UK, 2021; Volume 1, pp. 1647–1656. [CrossRef]
57. Goermar, L.; Barwinski, R.W.; Bouncken, R.B.; Laudien, S.M. Co-Creation in Coworking-Spaces: Boundary Conditions of Diversity. *Knowl. Manag. Res. Pract.* **2021**, *19*, 53–64. [CrossRef]
58. Ortega-Gras, J.-J.; Bueno-Delgado, M.-V.; Cañavate-Cruzado, G.; Garrido-Lova, J. Twin Transition through the Implementation of Industry 4.0 Technologies: Desk-Research Analysis and Practical Use Cases in Europe. *Sustainability* **2021**, *13*, 13601. [CrossRef]