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Assisted Sustainability – A Practical IS Approach to Promote Corporate Sustainability

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Completed Research

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Abstract

Sustainability is no longer a new trend, but an increasingly important necessity. Information Systems (IS) research is also addressing the topic more often, although, for example, company practices lack applicable solutions. At the same time, the demand for corporate sustainability and opportunities to apply digital enterprise solutions is growing. This situation creates an enormous potential to profitably couple the demand with the opportunities. In our paper, we discuss the potential that personal virtual assistants (PVAs) have to create corporate sustainability effects. Using a triangulated methodological approach, critical gaps are identified by means of a systematic literature review. Based on this, qualitative group discussions and interviews are used to analyze other influencing factors and correlations in an empirical study. It subsequently becomes clear that sustainability is subordinate to the cost-benefit trade-off, which most companies regard as being the most critical. Consequently, we present a practice-oriented bridging framework to overcome this drawback.

Keywords

Personal virtual assistants, corporate sustainability, Economics of Convention.

Introduction

The world is undergoing transformative and disruptive processes. New technologies cause some of these processes, while the apparently unrelenting change in our environment and climate cause others. It is therefore not surprising that sustainability and digitalization are the two megatrends of our time (Isaksson et al. 2018). The demand for them is high, since various studies have proved the need for sustainable change (Calic et al. 2020; Hahn and Reimsbach 2014; Isaksson et al. 2018; White et al. 2019). However, change requires willing individuals or entities that embrace sustainable development (Tussyadiah and Miller 2019). Companies are a possible change-enabler. They are not only an expression of a corporate landscape, but their actions also shape the social and the ecological environments (Lamming and Hampson 1996). In addition, companies must respond to market needs to remain competitive, both of which are, in turn, linked to the increasingly important need for sustainable action and more sustainable products (Chen and Kim 2021; White et al. 2019). The call of innovators of digital technologies for a sustainable and digital economy through information systems (IS) is a logical consequence of the current developments for a sustainable and digital economy (Cohron et al. 2019; de la Boutetière et al. 2018).

The compelling need for change requires practical linking possibilities. A key area of application that is also shaping the working environment are digital assistants based on artificial intelligence (AI) technologies.

These are promising IS in the corporate context, influencing the actions and decisions of the executing actors in companies – the employees (Maedche et al. 2019). A possible implementation and the system of interest in this paper are personal virtual assistants (PVAs), which are computer programs characterized by their ability to independently interpret and respond to a request that a human makes externally (Austin and Kenneth 2016; McTear 2017; Qiu et al. 2020). Practical solutions focused on the (human) user can have a direct impact on companies' and the environment's development. Keeping the above in mind: What gaps do the use of PVAs for corporate sustainability show between theory and practice, and how can these be bridged? We aim to develop a use case framework for PVAs to support corporate sustainability. The underlying research and application areas are interdisciplinary ones. We therefore presumed that a triangulated approach would be the most effective. Besides using an iterative, systematic literature review to create a starting point, we analyze an empirical data set of group discussions and qualitative interviews through the theoretical lens of the economics of convention (EC) (Boltanski and Thévenot 2006). The latter is a general social science theory proposing a pragmatic and situative perspective for studying coordination and conflicts, and for analyzing the underlying justifications and conventions (Boltanski and Thévenot 2006). We study the potential of coordination and conflict that arises from this interdisciplinary context through the theoretical perspective of the EC and its sustainability concept. From the results, we finally develop a framework for assisted sustainability.

Conceptual Background

Personal Virtual Assistants

PVAs belong to the group of virtual assistants and, in the framework of this work, are a very promising field in a corporate context. They can communicate with the user and, like human assistants, perform various tasks (Io and Lee 2017; Maedche et al. 2019). They are multi-purpose and offer solutions to many organizational challenges, such as potentially sustainability management (Maedche et al. 2019). PVA systems are implemented either digitally in the form of software, apps, websites, or in standalone devices such as Amazon's Alexa. They can also be integrated into other systems, for example, as part of an infotainment and navigation system in automobiles, of a corporate portal/intranet, or of a smart home. PVAs are used for the collection or distribution of information, for example, via above mentioned programs or audio-enabled devices (Campagna et al. 2018). They also assist users with app-based functions, such as financial management (Gretalita et al. 2017). Given consent, they also track user behavior and merge personal data from multiple sources, anticipate people's needs, act autonomously on behalf of the user, improve through learning, and build trust (Austin and Kenneth 2016). PVAs are also called enterprise assistants (EA) or virtual agents (Io and Lee 2017). As a subcategory of virtual assistants, they are part of AI-based digital assistants. Areas of application include assistance with routine tasks or assisted decision-making (Maedche et al. 2019). AI-based digital assistants hold great and disruptive development potential for businesses, also because most of the assistants to date are designed for serious use cases such as in the working context (Dhiman et al. 2022; Nguyen et al. 2022). It has particularly great potential at the economic level in terms of cost savings and more efficient decision-making processes (Buxmann et al. 2021). To date, however, there have been few, if any, use cases of PVAs in an explicit sustainability context, which makes a study of this versatile technology in this setting even more important.

Corporate Sustainability

"Sustainable development is development that meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development and Brundtland 1991). Sustainability therefore means designing the consumption or use of a particular target unit in such a way that, to a certain extent, it will still be available for use in the future; consequently, the given, natural system's essential characteristics are preserved in the long term (World Commission on Environment and Development and Brundtland 1991). The renowned triple bottom line model (TBL) puts these requirements into a structural context. According to this established model, sustainable action must strive to achieve a balance between three aspects: the ecological, the economic, and the social (Elkington 1999). Companies are an important stakeholder group for this theoretical construct's implementation. Corporate sustainability therefore aims at the simultaneous consideration of ecology, economy, and social aspects in corporate activities – both operationally and strategically (Ahmed and Sundaram 2011; Chen et al. 2021; Umarusman and Hacivelioğullari 2021). Owing to companies' primary

focus on steady, economic growth, areas of tension or goal conflicts often arise with the remaining aspects of sustainability (Chen and Kim 2021; Lamming and Hampson 1996). However, there are many ways of establishing sustainable action in a company. An established example is resource efficiency, which means the careful use of the resources that a company requires – such as water, energy, and raw materials – therefore leading to ecological sustainability. In addition to these sustainable ecological effects, a company can often also achieve performance enhancements through associated cost reductions, which contribute to economic sustainability (Chernikova et al. 2020). Companies can realize social sustainability through many different measures by focusing on individuals and their needs, such as health or education (Volpato et al. 2019). These include, for example, respecting and promoting worker protection across the supply chain, measures in the area of work-life balance, and supporting social projects (Umarusman and Hacivelioğullari 2021). For reasons of complexity, we focus mainly on the ecological aspect of sustainability in this paper. Economic sustainability in companies is achieved through measures to maintain competitiveness and maximize profits (Elkington 1999).

Economics of Convention

The economics of convention (EC) proposes consistent pragmatic concepts for the economic and sociological analysis of behavioral coordination (Boltanski and Thévenot 2006). Overcoming neoclassical and institutional paradigms by introducing a triangulated approach, the EC presents a general theory to explain the organization of economic activity. In their fundamental research, Storper and Salais (1997), for example, explore the basic frameworks of economic action or "possible worlds of production", in which economic actors coordinate their actions with one another and interpret what others are doing in ways that convention prescribes. This theoretical approach has been used in many different fields, for example, the production of consumer goods (Boisard 2003; Storper and Salais 1997) and health (Batifoulier et al. 2018; Da Silva 2018; Sharon 2018). Boltanski and Thévenot (2006) identified six conventions, also called registers, each of which is based on Western liberal societies' various philosophical foundations and concepts of justice and what is fair: Industry, Market, Inspiration, Civic, House, and Opinion. This list was expanded by adding two more registers, Project and Green (Boltanski and Chiapello 2005; Lafaye and Thévenot 1993). Table 1 provides an overview of each of these registers with their justification principle.

Register	**Common good**	**Values**
Industry	Increased efficiency	Functionality, expertise, optimization
Project	Innovation and network	Activity, connection
Market	Economic growth	Competition, cost, profit
Inspiration	Inspiration	Emotion, spontaneity
Civic	Collective will	Inclusivity, equality
House	Tradition	Hierarch, trust
Opinion	Public opinion	Popularity, fame
Green	Protection of environment	Environmental activism

Table 1. Registers of Worth

According to Table 1, there is a plurality of possible registers, which we regard as interpretative frameworks that actors develop and manage in order to evaluate and coordinate situations (Diaz-Bone 2019). This does not imply that each individual (or organization) is part of a particular register, or that individuals act consciously according to any of the mentioned registers' principles (Da Silva 2018). On the contrary, actors can, depending on their interactions with others, easily pass from one register to another (Da Silva 2018). Coordination requires agreement on a common principle or on the realization of an understanding, which can emerge between different registers. No register is more rational than any other since they all refer to a legitimate and immeasurable collective concept. The decision is a choice between various similar registers linked to common goods (Diaz-Bone 2018). The typology offers an applicable framework for identifying the plurality of registers. With a specific focus on the Green register, and its potential, as well as its conflicts with other registers, the EC offers a pragmatic and theoretical access to digitally assisted corporate

sustainability. Furthermore, we believe that this triangulated approach balances different research areas' (sustainability, IS, and economics) demands with human centricity (Human et al. 2019).

Research Process and Methods

Literature Review

We conducted a literature review to investigate whether and to what extent PVAs and sustainability have been examined together in a corporate context, and whether the proposed solutions or suggested approaches have been developed to date. Our review took the form of a systematic literature review (SLR) based on an iterative process (Okoli 2015; Paré et al. 2015; Rowe 2014). This approach allows for describing existing knowledge to identify research gaps and provide guidance for further research in this area (Okoli 2015). The iterative process is regarded as adequate for the study's topic in a field that is relatively new and unexplored. Consequently, we examined the literature in scientific databases such as ACM Digital Library, EBSCOhost, Science Direct, IEEE, Google Scholar, IGI Global INFOSCI, and Web of Science. The search took place between December 2020 and January 2021. We defined keywords primarily containing the required technological reference (main keywords: PVA, CA, VA, EA, digital assistant, chatbot, and conversational interface) and, secondarily, a sustainability reference (sub keywords: Sustainability, sustainability management, corporate responsibility, corporate social responsibility, corporate digital responsibility, responsible). First, we scanned all the displayed search results' titles and abstracts based on the required keyword pairs which resulted in a first corpus of 60 papers. The second step was to apply a practical screen in the form of established criteria reflecting the SLR's purpose, which ensured that only relevant literature was included in the subsequent analysis (Okoli 2015). We based the choice of papers on the following criteria: papers that jointly examine the main and the sub keyword to investigate business-related PVAs and sustainability, or those that do so in comparable ways; papers regarded as relevant based on their title or abstract (even if one or more keywords were missing); papers with rather ecological aspects, but also the economic and the social aspects, of sustainability. Out of scope was literature only considering the producing or designing of sustainable software or technology per se; papers based on text mining, on agent-based models, and multi-agent models; and not peer-reviewed papers in journals. Papers that still did not fit after this practical screen had been applied, were also removed, leaving a preliminary corpus of 38 papers.

Owing to the paucity of the identified literature, another keyword was added to this iterative process: sustainable human-computer interaction (HCI) (Boell and Cecez-Kecmanovic 2015). This keyword occurred significantly often in the upstream search and was considered eligible for consideration due to its characteristic as a "heterogeneous development field of research" in HCI (Nyström and Mustaquim 2014). Eleven more papers were identified which resulted in an overall corpus of 49 paper. In addition to the theoretical work mentioned above, we also consulted seven non-scientific studies in the field undertaken between 2017 and 2020 during this iterative review process, to understand where the implementation of digital innovations, such as PVAs for sustainability management, fails in companies.

Empirical Approach

To study the potential of PVAs in companies, we developed an empirical triangulated research design, combining group discussions with individual interviews, and integrating the specific lens of the EC in the data analysis. The research was carried out from June 2019 to February 2020, for which we recruited 43 employed participants of a special training program (anonymized and referred to as Int01 - Int43). In a first step, we conducted ten group discussions of approximately 1.5 hours each with groups of four to five employees, to discuss tasks that PVAs could support, assist with, or undertake completely. Following these group discussions, we conducted 43 individual interviews lasting 40 to 55 minutes each with the group discussions' participants. After a short introduction to the EC and its registers (supported by a pictogram), we asked the interviewees to rank the registers' importance for their respective employers and for themselves. In a third step, we asked them which registers a PVA could easily support and to explain their order.

We chose the participants and interviewees based on their homogeneity regarding their knowledge of PVAs. Their participation in specific economics and IS training programs shows their affinity for and their at least partial technology expertise. They are all students in IS or economics with a focus on IS/digitization. Those

participants between 25 and 60 years old, comprising 15 females and 28 males, formed a heterogeneous group in terms of their jobs and employers. Ten of the participants worked for public employers, while 33 were employed in the corporate sector. This group's working experiences ranged from the student level to a senior level, comprising fields such as IS security, logistics, medical research, software development, human resources, insurance, mechanical engineering, and automotive industry. Further, they were asked to prepare for the group discussions as part of their training program by searching for different PVA best (and worst) practices and to develop PVA-use scenarios. During the interviews, the interviewees mainly started off ranking the registers for their organization, then for themselves as an employee, and then for PVA-use scenarios. Not all the registers were always included in these rankings, as some interviewees explicitly excluded some of them due to their subordinate importance for one or more of the above-mentioned questions. Thereafter, the participants justified their rankings, explained them, and illustrated them by means of examples. The analysis of the interviews comprised a first step of coding the registers' ranking positions, and a second one of weighting their ranked position to show their proportional weight. Other aspects, such as conflicts between the registers, were coded by following a qualitative content analysis (Denzin and Lincoln 2011; Mayring 2000), which was thereafter processed by means of Atlas.ti.

Findings

Iterative Literature Review

The SLR failed to identify any direct work on PVA and sustainability, not even in a corporate context. After 2010, the interest and number of publications diminished, followed by another rocketing peak in 2018. Thereafter, the number of publications fell again, due to a stagnation in the interest and a lack of outcomes (Bates et al. 2018; Silberman et al. 2014). Conference proceedings and workshop outlines are the most common kind of literature in the review corpus. Most of the literature has a broad focus, meaning that the work's topics range rather widely. Furthermore, the identified literature rarely deals with a business context. However, business cases are at least conceivable after the transfer of knowledge (Horn et al. 2011; Ross 2011). Most of the work in this area is also at a high level of abstraction. There are many discussions and exchanges, but implementable solutions are few and far between. However, the work that does address sustainability concludes that this area requires more research (Jakobi and Stevens 2015; Silberman et al. 2014).

The SLR at hand, which mostly spotted theoretical work, has also identified the following theoretical gaps: First, there are the gaps that we can attribute to both sustainability and PVA deficits. These are, (1) that there is very little literature on the joint topic of PVA and sustainability. Furthermore, (2) an observable gap is that interest and the outcomes in this area have also declined. Consequently, sustainability in the PVA context seems to make no real impact, since it is only a special issue focus, or a conference or journal topic, not leading to any rigorous engagement. Further, (3) the behavioral change that technologies such as PVAs can produce is needed, but hard to achieve (Tussyadiah and Miller 2019). The last theoretical gap (4) is also related to behavior change since top-down instructions and a willing corporate culture are required to achieve behavioral change and acceptance. In addition to the theoretical gaps, we scrutinized practical studies on the implementation of digital innovations in companies. The associated success factors led to additional practical gaps: Power in the form of leadership, as well as knowledge and skilled professionals are required; the corporate culture and the availability of technology play a decisive role. Eventually, there is a cost-benefit trade-off, which means that in pursuit of profit, the cost-benefit must be weighted. These gaps were further evaluated by means of the empirical findings.

Group Discussions and Interviews

The group discussions focused on the tasks that PVAs could support, assist with, or undertake completely and included open questions which did not comprise any specific questions on sustainability. Their analysis shows that none of the participants mentioned sustainability and, consequently, the Green register, hence no connection between PVAs potential use and sustainability was drawn. This confirms the gaps identified beforehand, as sustainability does not seem to be an issue in the discussion of PVAs and their potential and promising roles in companies yet.

In contrast and based on a pictogram showing the different EC registers, the plurality of registers was mentioned and discussed in the individual interviews. Regarding the corporate perspective and not

surprisingly, the Market register dominates. Beyond that, the interviewees' personal preferences in their role as employees highlight the Civic and Inspirational registers. In both the organizational and employee rankings, the Green register is dispersed, showing a tendency to be more important for employees than for organizations. "I would completely exclude points such as hierarchy and sustainability. They are usually subordinate in a company, unless you advertise them to the outside world" (Int03). This quote illustrates that the Green register often increases in importance when the product or the clients require more awareness of sustainability. Consequently, the interviews support the findings from the SLR, showing the lack of importance of the Green register without this precondition. Only when it contributes to a cost reduction, a competitive win, builds synergies with the Market register, or increases recognition of the company, does the Green register become more relevant. "Ultimately, the whole thing has to be profitable" (Int12). Hence, if sustainability does not go hand in hand with cost reduction or profit making, the company will no longer focus on sustainability. Figure 1 illustrates this trade-off between the Market and the Green register in part A, the left part of the figure.

How can PVAs contribute to overcoming this gap? For PVA-potential use in companies, the Industry register dominates, since most interviewees regard PVAs' potential as their ability to assist with standardized tasks, to increase efficiency, and optimize performance. Thereby, they contribute as success factors to reduce costs and increase profits – reflected in the Market register, or PVAs' potential to connect projects, employees, and data – corresponding with the Project register. However, most interviewees have no true idea of how a PVA could support sustainability. "Yes, the fact that we no longer use so much plastic waste during lunch breaks and other similar topics are also important for me. However, I do not know where we could really use a PVA internally." (Int43) The only use cases of PVAs supporting sustainable practices, mentioned in the interviews, are the prevention of unnecessary paper consumption, the optimization of frequent business trips, and the recommendation of power-saving measures, such as automatically switching off lights, devices, or reminder functions. "The topics of sustainability and the environment are, of course, important in the overall context, but in the area in which we operate […], I see few opportunities for specifically promoting climate protection. […] Our offices run on green electricity, and we don't throw all our stuff away. The entire company has a relatively small CO_2 footprint. […] [Sustainability] plays a secondary role in our decisions because it is a minimal factor." (Int30) PVAs could also help empower leaders by offering knowledge and awareness of a company's environmental impact. In the previous quote, the interviewee with a leading function in his company shows its reflective handling of sustainability. By showing the ecological impact, a PVA could raise awareness and expand the company's knowledge. Besides the interviewees showing a lack of knowledge, their use cases are also often reduced to the individual level, as seen in the previous quotes, where sustainable behavior is seen as a personal task related to reducing waste, commuting by bicycle (Int34), etc. In this context, a promising use case for PVAs could be to assist employees in making more sustainable decisions by providing relevant information and measure options. This would provide a basis for the required behavior change by providing individuals with relevant knowledge of their behavioral choices, i.e., with assisted decision-making favoring sustainability.

Discussion and Conclusion

Implications and Impact

The aim of our paper is to identify gaps and investigate how these gaps can be bridged. To establish technologies, such as PVAs for sustainability measures in a company, it requires an initial cost-benefit analysis, as well as a suitable corporate culture. The SLR and the interviews also revealed knowledge's specific importance for a company, as its absence can have a negative impact on its development. The importance of knowledge also applies to the management level, which has a top-down influence on the company's employees (Schneider 1994). Not only in the process of establishing technologies in companies, the balancing of the costs and the benefits has been shown to play a vital role. The outlined results clarify that the Market register, which represents costs and profits, dominates. The frequently mentioned Industry register, in the form of efficiency improvements through standardization, accompanies it. Both registers are interrelated and can potentially influence each other positively, as seen in Figure 1 (part A). Further, the results show that one register in particular needs to subordinate itself to the previous registers to gain influence: the Green register, in the form of corporate ecological sustainability. If this register does not contribute to the achievement of profits (the Market register), it is deprioritized, in the sense of 'sustainability must pay off'. This cost-benefit consideration also plays a role in the introduction of new

technologies or strategic goals. At the same time, sustainably-oriented companies can also have a competitive advantage over others (Lamming and Hampson 1996; White et al. 2019). As already mentioned, measurements like reducing the use of paper and route optimization already imply that there are (resource) efficiency and sustainability effects. Therefore, although not consciously articulated, sustainability measures have a great potential to also increase efficiency and, therefore, increase profits (White et al. 2019).

The potential to implement PVAs and sustainability measures in a company was shown both in the SLR and the interviews, although they are not directly linked but mediated through the Industrial and Market register. For example, the paperless office (i.e., the increased digitization of processes), business trip and tour optimization, and energy-saving measures were the most frequently mentioned sustainable measures in companies. PVAs have the potential to map and support these and other measures. For example, a PVA could use algorithm-based software to make travel routes more CO_2-friendly or to help employees optimize their electricity consumption and reduce costs at the same time (Jakobi and Stevens 2015; Wojciechowski et al. 2021).

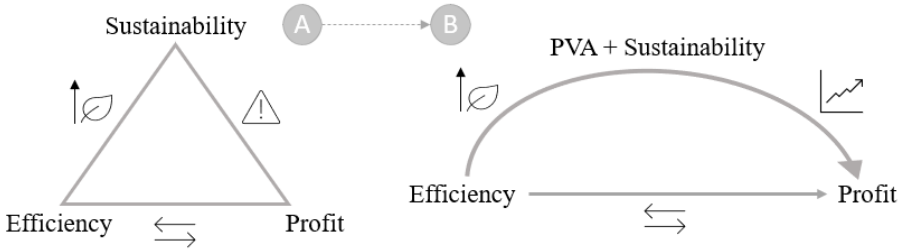

Figure 1. Bridging Framework to Assisted Sustainability

This potential needs to be tackled in a next step, which is shown in part B of Figure 1 as an enhancement of the framework shown in part A. Part B shows that measures to increase efficiency can indeed be expected to increase profits. If these measures are also linked with innovative technologies, such as PVAs and sustainability components, they will not only allow the high-priority profit target to be achieved but will also tap a greater innovation potential. The latter can be a unique selling point for the relevant company and, also, mean an increase in the customer market (compared to the situation without technology and sustainability).

The following could be a practical example: A company's products are sent out to customers by parcel post. However, these parcels are subject to the problem that the package size often exceeds the product size, which means that the company is transporting 'air', which is uneconomical and unecological. However, the more items a package contains, the greater the complexity and problem of finding an optimal package. A PVA with information on the product and package dimensions could easily and quickly communicate the optimum, package size to the relevant employee via the merchandise management system. This would not only save material (in the form of the correct package), but also time and money. The employee would then not have to solve this problem through trial and error, and the shipping costs would no longer include the previous 'air', but only the actual products that the customer ordered.

As was clarified at the beginning, the demand for sustainable and digital solutions is strong and should increase in the future. Our paper's desired contribution, even more than its theoretical scientific foundation, is to explain how digital assistants, such as PVAs, can be used for a more sustainable economy. The compelling need for change, which requires practical linkage possibilities, drives our contribution. The bridging framework outlines how PVAs and sustainability can be used to achieve the hitherto unchallenged entrepreneurial goal of making a profit as a type of pre-business case. Companies already have sustainability measures, and the digital transformation actually takes place. Both are emerging at different speeds, but, to date, they are unfortunately mostly occurring independently of each other. By uniting the two research fields with the help of our presented approach, we can take a big step closer to a (more) sustainable economy. After all, a basic – both theoretical and practical – problem that interlinks several disciplines – such as economics, computer science, the social sciences, and ecology – also requires multiple perspectives. The chosen EC approach, which is innovative in the IS field, has proved useful for assessing different moral registers, and the extent to which they contribute to cooperation or conflict. This approach, tried and tested in economics and social sciences, is also a useful alternative in IS research for examining

different values, perspectives, and cooperation logics (Diaz-Bone and Horvath 2021). In the context of an interdisciplinary topic with practical relevance, we therefore suggest a conscious theoretical and moral reflection.

Limitations and Outlook

The papers that are included in our research range from 2007 up to January 2021. At the time of publication, however, new developments may have occurred, which, given past developments, we do not consider worrying. In our study, we focused mainly on environmental sustainability due to capacity constraints, which should certainly be extended to the social sustainability aspect in further research. The potential negative impacts across all sustainability dimensions should also be considered in further work (Ahmed and Sundaram 2007). Regarding the empirical study, the sample size, the group discussions, and interviews' quality were sufficient for the present exploratory study's purpose and objective. Anyone undertaking further research to confirm the framework should provide a quantitative study of a specific sector or case studies, which are both more appropriate. Regarding the plurality of registers attributed to the organizational level, the rankings only reflect the employees' perceptions, which might be biased and could be adjusted via another triangulated approach, including verifying details about the firms or administrations. Since few of our interviewees had practical experience of PVAs in their working context, the register ranking for PVAs is based on possible and not actual PVA use. Owing to this still limited implementation of PVAs in the corporate context, our findings on PVAs are closer to scenario building propositions than assessments of PVA use.

We developed the bridging framework from practice-related derivations and kept them at an abstract level. In a further step, this approach should be refined and tested in practice to achieve its full practical relevance. It would be beneficial to reflect on the framework with the intended target group, namely companies that will make a sustainable contribution in the future with the help of PVAs. We consequently suggest that the framework should be refined and, in the best case, tested in practice.

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