Towards Collaborative Green Business Process Management

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Abstract

Sustainable and efficient energy management poses a major challenge for organizations, as well as the whole society. Organizational strategies for saving energy are currently largely coined by two main courses of action: Green process optimization and investing into more energy efficient infrastructure, or energy campaigns or feedback mechanisms. We show how both approaches face limitations concerning the scope of intervention and carve out the necessity for an integrated approach on fostering sustainability in organizations and envision a Collaborative Green Business Process Management. Such modell should integrate all stakeholders, thus bridging the gap between strategic planning and everyday work in order to manage sustainability strategies more effectively and efficient. We conclude in laying out a research agenda, which we seek to address in course of an ongoing research project within a long term cooperation with several different organizations.

1. Introduction

Sustainable and efficient energy management poses a major challenge for organizations, as well as the whole society. Politics starts recognizing the need for a regulation of industries' environmental footprint in order to manage energy turnaround and implement incentives, too. The German government, for example, has enacted tax reductions for organizations introducing a holistic energy management system based on ISO/DIN EN 50001 [1]. This legislation explicitly calls for introducing a continuous improvement process based on analysis of energy consumption information [1].

In order to achieve these goals, strategies are currently largely coined by two main courses of action: On the tactical-strategical level, strategies often based on green process optimization and investing into more energy efficient infrastructure [2]. Both measures are part of organizational structure that needs to be implemented and adopted to become effective [3]. On the operative level, strategies target the individual worker motivating green behavior via energy campaigns or feedback mechanisms [4]–[6].

Both approaches, however, face limitations concerning the scope of intervention. Though most management-driven approaches claim to provide holistic energy management tools, in solely relying on information of organizational structure, they face two problems: Firstly, such approaches tend to underestimate the relevance of actual work practices on energy consumption, which only can be influenced to a certain extend by the organizational structure [7]. Secondly and even worse, management-driven BPM is inclined to define inefficient processes, if they conflict with the needs of the situated working practices. Hence: "*at the end of the day, it is people that will make processes function effectively and efficiently, no matter how much they are automated. If you do not*

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get the people 'on board' with the project and new processes, then they will find a way to ensure that the processes either do not work or do not work efficiently"[8].

Behavioral sustainability campaigns, on the other hand, explicitly target the informal or operative behavior, which is usually left out by methods of sustainable process definition [5], [6] (c.f. figure 1 middle). Behavorial approaches, however, typically do not include strategies of perpetuating effects in terms of (re-)designing processes of an organization. This is one of the reasons, why they remain a one-time intervention with diminishing effects over time [5]. So in order to address the gap between the structural, organizational level and the informal practice level different stakeholders need to be considered when remodelling and living green processes.

Process design usually involves the creation of graphical representations of processes [9]. These process models are used to not only display the current as-is state of a process, but also serves as a means to discuss potential modifications. Thus, they also act as a planning tool for organizational change before actually applying it. In most approaches workers are not directly involved in the design process itself, but are rather limited to provide information. In contrast, collaborative modelling aims for a direct integration of them to co-develop improvement strategies and finally introduce accurate changes, fitting both process and workers perspective [10]–[13]. It increases the motivation of people to actually change their behavior. It also supports the reflection about the actual work, thus creating an opportunity to uncover potentials for more efficient processes and practices that otherwise been uncovered.

Involving stakeholders directly through introducing **Collaborative GreenBPM** is thus not only expected to motivate people involved in processes to alter their behavior with respect to energy consumption. It also is expected to uncover potentials to save energy that would not have been uncovered when people focus solely on improving their own energy consumption based upon observations that are limited to the scope of their workplace. We thus do not aim to introduce a whole new BPM standard, but instead want to sensitize existing standards, to extend their models concering environmental information and understanding green processes as a collaborate enterprise. Thus moving from GreenBPM to **Collaborative GreenBPM** and show implications brought along with such an extension.

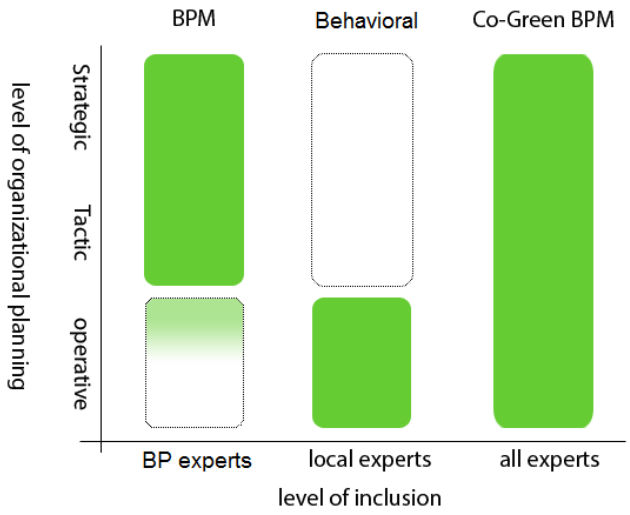

Figure 1: Comparing the two dominant approaches to increase organizational sustainability and introducing Co-GreenBPM

2. Sustainability in BPM and organizational development

2.1. Energy feedback for behavioral change

In course of the oil crisis in the 1970's research of enviromental psychologists started to take an interest into the influence of behavior on energy consumption and investigated into consumption feedback as a means of encouraging energy conservation [14]. Alongside, a body of theoretical approaches emerged within environmental research, seeking to understand individual's (un-) sustainable behaviors. Early and most common approaches adopted rational choice theory [15], arguing that energy relevant behavior is conceptualized as an act of informed decision-making by consumers. Over time, other theories (like Stern's Value Belief Norm Theory [16]) emerged, consider e.g. subjective norms, beliefs and the influence of social surrounding. Both, concepts of norms and rational behavior provide theoretical ground for persuasion and feedback campaigns, which nowadays are the most widespread methods of trying to implement changes to behavioral energy consumption [17], [18]. In particular, design concepts such as providing direct feedback, enabling social comparison and supporting goal setting were inspired by these theories [19].

Strategies inspired by enviromental psychology are mainly applied in the domestic context. In organizational settings, there are only few experiences and guidelines, where the most rely on monetary incentive schemes. Evaluative studies suggest, however, that other factors such as the design concepts of feedback may be of more relevance [20], [21]. Following this, several best practices and guidelines for campaigns, buildings of public administration and companies alike have been created [22], [23]. These typically focus on classic materials like posters, flyers, information brochures and letters from superior authority. They also give some advice on how to use emails and web-sites, but suggestions for using smart technologies most commonly are not addressed in such toolboxes.

More recent research tries to make use of such existing ubiquituous sensing technologies in developing feedback solutions for organizations [24], [25]. First general design guidelines and wireframe sketches were developed by Foster et al. [26] using focus group sessions. Based on a literature review about techniques of intervention appropriate for the workplace, Yun et al. [27] implemented a first functional prototype of an energy-dashboard.

The few studies evaluating eco-feedback in organizational context show mixed results. Carrico and Riemer [8] show that providing monthly feedback with a motivating message has a positive effect on energy savings of university workers. Installing eco-feedback applications on the desktop of university workers, Murtagh et al. [28] also found a significant reduction of consumption. However, they noticed a complex relationship between feedback and behavior and found a manifold of reasons exist 'not to switch things off'. Using smart metering technology in a research institute, Schwartz et al. [29] observed significant positive effects too, but only on short-term, with conservation fading successively over time.

While feedback generally shows effects, it remains an open challenge to establish long-term feedback systems and embed them into organizational routine. This in turn, reduces costs of one-time interventions and at the same time supports sustaining effects and learning about energy efficiency. Combining energy feedback for workers with common change management methods, which are most often in place in organizations today, thus poses an interesting opportunity.

2.2. BPM for organizational sustainability

Nowadays, the optimiziation of organizational practices often is managed through business process management approaches. The literature contains very diverse approaches and lifecycles in context

of business process management methods. These approaches often involve various phase models that are repeated iteratively, to achieve a continuous improvement process (CIP).

Following van der Aalst [3] for example, BPM iterates through four phases. In the process design phase, business processes are identified and designed/redesigned. The configuration phase includes configuration and selection of the system and implementation of first-phase designs. In the enactment phase the configured systems are used to execute and monitor the operational business processes. Finally, during the diagnosis and evaluation phase, monitored information is analyzed to identify problems and to detect potential room for improvements. Working on practical guidelines, Jeston and Nelis [30] distinguish ten phases, starting from organization strategy phase to ensure that the organizations' strategy is clearly understood by project team members. After a development phase follow phases of implementation, realization of values and sustaining performance to guarantee the continued process agility and improvments.

Typically, approaches base on the deming cycle (shewhart cycle) of plan, do, check and act [31]. Accordingly, it is also legitimate to jump back and forth between this phases. Approaches within GreenBPM commonly refer to this model as well. Therefore, in case of a holistic infrastructure for collecting and distributing environmental information of processes, GreenBPM can adapt to existing BPM tools, instead of having to reinvent the wheel.

This affinity is reflected by the GreenBPM model of vom Brocke et al. [2], which expands the classic dimensions of the BPM model by Becker and Kugeler [32]. The commonality model includes six phases (processes description, workflow definition, workflow instance execution, their monitoring, workflow reporting and entire process reporting) evaluated by dimensions of: cost, quality, flexibility and time. Vom Brocke et al. add "Sustainablility" as a dimension of decision making, arguing for consideration of sustainability objectives in workflows. Deriving a GreenBPM approach from van der Aalst [3], Nowak et al. [33] demonstrate how integrating environmental information into BPM has effects on both general conduct (inclusion of further stakeholders) and design of specific phases (including new key figures). Therefore, sustainability as an issue influences the whole BPM process. Yet, this does not imply adding another stream of information, but sometimes just processing existing information a different way.

BPM-initiatives are commonly created by management as a result of strategic planning. These initiatives are usually driven by a top-down approach, often run by external consultants analyzing existing processes and (re-)designing them with respect to strategic goals. In order to do so, these consultants may gather information about processes in question as well as their surroundings using a number of sources. These sources include, but are not limited to, analysing existing process-documentation, running interviews with process stakeholders or analysing information created in software systems. Based upon the information gathered, each process is then modelled, analysed and altered by aforementioned consultants, aiming at reaching strategic goals set by management. It may be necessary to run multiple cycles until a sufficient stage for the model is reached. This model is then used to implement the process. Within this approach, the individual worker mainly appears in the organizational implement phase where all designed and developed processes will actually be brought to life [8]. Various strategies are used to ensure that people apply new process functions effectively and efficiently. These include: people change management strategies to overcome the not-invented-here syndrome; setup training strategies to overcome information and knowledge deficits; and management and controlling startegies to verify whether the actual process is in line with the process designed.

Approaches like the one described before can be considered a common practice within organizations. However, as this conduct limits the influence of people directly involved in or affected by the processes at stake to providing information, thus not allowing them to directly

participate in design, this potentially limits peoples' motivation to adapt to the newly designed processes. Furthermore, by gathering information from single sources and putting it together afterwards, information about the process is only presented from a single perspective, thus leaving out important information.

In order to address aforementioned limitations, different approaches have been created in recent years, which can be subsumed as collaborative modelling [10], [12], [13]. At the centre of these approaches are workshop concepts in which stakeholders together with consultants jointly develop models of processes, analyse them and discuss possible changes. These approaches allow for stakeholders to directly participate in process design, thus potentially increasing their motivation to adapt to process modifications afterwards. Furthermore, these approaches also allow people to exchange perspectives within workshops, discuss alternatives and come up with a more sophisticated solution on which all stakeholders can agree.

Our concept of Co-GreenBPM stands in the tradition of these collaborative approaches. The concept especially targeting the analysis phase within an ongoing improvement processes. This phase is crucial for redesigning green processes since on the one hand it helps innovating organizations, but on the other hand also acknowledges existing organizational needs, contraints, and opportunities. Also, in this phase, key questions such as the following need to be addressed: what (enviromental) information is needed for whom, what (new) sources of information are to be used, and how can existing information sources fill possible gaps; how green process optimization had an impact on which work practices. Such questions, however, could not be answered once and for all, but pose moving targets, depending on individuals, their learning curve, roles within the organization and so on.

Therefore, our concept relies on a bottom-up management approach, which brings changes to the cycles used before in BPM considering the following issues:

1) In contrast to a top-down change management, in a Co-GreenBPM, next to BPM-specialists, all relevant stakeholders are asked for participation. Especially workers should be participate as they are experts of the demands of the situated work practices and opportunities provided by knowledge of the operational level. In general, the diversity of the stakeholder makes the process more complex having a negative impact on the efficiency of process design phase. Yet including a wide array of knowledge generally has a positive impact on the effectivity of the designed process as it takes the constraints and demands of the operational and strategic level into account. In particular to overcome the asymmetries of knowledges among the stakeholdes, modelling should take place in collaborative workshops where all participants are valued as experts for their domain.
2) In a green process the enviromental information are needed by various stakeholders (e.g. the management, the worker, the controller, etc). Hence, information needs to be tailored to the individual demands of different stakeholders. Therefore, providing individualized views on process and energy consumption information will enable stakeholders to use their tacit knowledge to reflect how processes and(!) situated work could be designed in more sustainable ways. Taking the energy's complex nature [34] this, however, raises the question, which kind of information workers need to reflect on their energy consumption behavior in terms of both, their own workplace and the organizations processes. Such tailored feedback for included stakeholders needs to provide basis for decision making when designing sustainable processes.
3) Traditional eco-feedback systems mainly focus on direct feedback to motivate people to act pro-enviromental with the current situation [17], [18]. In context of Co-GreenBPM eco-feedback should additionally empower people to reflect on their work practice with regard to green processes (and visa versa). Moreover, if polluting practices are not caused by a lack of

motivation, but current process design, workers should be empowered to become aware of this and contribute this knowledge to a continuous improvement process. In addition, such information should be accessible in collaborate GreenBPM workshops, so that it could be shared and discussed with the others.

3. Envisioning Co-GreenBPM

Taking the aforementioned approaches into account we envision Co-GreenBPM as being an approach that ties together individual energy feedback with mechanisms of collaborative modeling. This approach should make use of existing business process management tools, which have proven effective to change organizational structures.

In order to add to such tools' efficiency, we aim at adding the workers' perspective and local expertise to guide the definition of new workflows by making use of their knowledge on tweaks of everyday working activities. Workshops are in the center of this appraoach, in which people that involved in or affected by processes can discuss about their respective energy consumption, identify potentials and alter processes with respect to tapping these potentials. By bringing people from multiple teams and potentially multiple departments together is expected to foster the identification of energy saving potentials that go beyond individual workplace adjustments. We furthermore envision Co-GreenBPM as being a bottom-up rather than top-down approach. Using energy feedback systems that allow process stakeholders to view their current and past energy consumption in a suitable way for them and not only on an individual level but also with respect to the processes they perform, could enable them to identifiy space for optimization. It should then be possible for them to trigger aforementions workshops. Subsequently, the energy feedback allows assessing the impact of the changes that they made to a process and then may trigger another round of workshops thus at best resulting in a continuous process of improvement.

We, however, also do not neglect Co-GreenBPM being potentially triggered by management. But we argue that even when its being a top-down initiative, worker-level should be involved, thus integrating multiple perspectives and increasing motivation among participants to actively alter behavior afterwards.

4. Discussion & Research Agenda

We have addressed the gap between green processes and green practices by combing environmental psychological and organizational theories. We presented Co-GreenBPM as a conceptual framework to bridge the gap taking into account work practices as well as strategic process improvement. We further outlined the key challenges of how enviromental information should be included into a collaborative GreenBPM in order to enable stakeholders to make sense of information, thus tapping the full sustainability potential in organizations.

In the next step we want to enrich our theoretical consideration by empirical work. We further want to investige in more detail on effective ways including environmental information to identify green process improvments and used such information in collaborative modeling workshops.

This covers two main interests: On the one hand, we will investigate on the various views, interests and motivations on green process and what kind of environmental information is needed, both, everyday and at strategic work level. This also includes ways of feeding back such information effectively and efficient to stakeholders in a collaborative BPM process. On the other hand we will research on impact of environmental information on decision-making, processes modeling and process adoption. Concerning this, we are currently approaching a variety of organizations including manufacturing, trading sector and office work. Based on a Action Research Methodology [35] we conduct interviews with different stakeholders within the companies including workers,

energy managers and manager. We also measuring the organizational energy consumption information and create first mock-ups how to inform the various stakeholders by providing tailored information.

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