IT Support for Sustainable Development in Organizations

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Abstract. This contribution is based on Habermas' theory of communicative action and his distinction between lifeworld and social subsystems like the economy, science and public administration. This distinction does not only help in understanding the role of generalized action orientations and symbolic mechanisms in social subsystems, one important conclusion is that evolution and transition of orientations and mechanisms require communication and discourse: communication about problems, about problematic orientations, new ways and mutual insights etc. IT support in this regard (conversation support) plays a completely different role than "normal" information systems that are aimed at the stabilization of established orientations (like in economy profit maximization in combination with Taylor's efficiency thinking). This allows discussion of different IT solutions with respect to their capabilities supporting the transition phase of sustainable development, as well as their contributions to modified or new generalized action orientations: environmental management information systems (EMIS), specialized modeling tools (e.g. life cycle assessment tools) but also all-purpose tools such as Excel, Email and web-based social networks.

Keywords: Communicative Action, Systemic Mechanisms, Communication, Conversation, Generalized Action Orientation, Lifeworld.

1 Introduction

IT support for sustainability has been in discussion for more than fifteen years now. Many new approaches have been presented; prototypes and software tools demonstrated that, in principle, effective support for more sustainability in organizations, in particular in companies, is possible. Good examples in this regard are software tools for life cycle assessment [1, 2]. The implementations of which are used in several companies and associations. They help to perform life cycle assessments as well as material and energy flow based cost accountings [3]. Research projects addressed the question of how to combine the new concepts with standard software systems in companies, in particular enterprise resource planning systems (ERP systems): Interfaces, additional data fields within the ERP system, required reporting components etc. [4, 5, 6, 7].

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However, the success of all these efforts was limited since life cycle assessment tools are in use in only a very small percentage of companies. Effective and fully integrated support for corporate sustainability in ERP systems is still not available [8, 9]. Companies use the new approaches mainly for the purpose of cost cutting. In this contribution we discuss the reasons for this. To do this we apply Habermas' communication theory [10, 11]. Habermas introduced the concept of lifeworld and social subsystems such as public administration, economics, science etc. We will show that software support is mainly developed to support these social subsystems. This kind of software is called management information system or decision support system [12]. The social subsystems have established their own specific generalized action orientations (like value creation in economics) and systemic mechanisms. With respect to sustainable development, new concepts supporting sustainability can stay in conflict with these generalized action orientations so that they cannot be applied in practice. These theories might allow us to formulate ways to overcome these problems.

2 IT Based Decision Support

As mentioned above, computers should mainly support action in social subsystems. Because of this, researchers and software developers adopt the generalized action orientations of these subsystems. For example, in economics, managers are treated as the most important functional units. They are decision makers and need all relevant information to come to an optimal decision. Accordingly, the software solutions are called decision support systems or management information systems. With regard to environmental protection and sustainability, generalized action orientations of economy are the starting point, too. The corresponding software solutions are called environmental management information systems ((EMIS) [4, 13]. These systems are motivated by the idea that in order for managers to find the optimal solutions including aspects of environmental protection and sustainable development they require certain information which is provided by these information systems.

One of the first approaches for better decision support was the period-oriented input/output eco-balance [3]. This type of eco-balance shows all input and output material and energy flows for one year. The problem with this concept is that it is not compatible with conventional approaches, in particular cost accounting. Cost accounting can be interpreted as a conclusion of Taylor's philosophy of efficiency: The main purpose of scientific management, and therefore of appropriate management information systems, is to increase efficiency. In the introduction of his book Taylor quotes the former US president Roosevelt: "The conservation of our national resources is only preliminary to the larger question of national efficiency" [14].

Efficiency can be defined as a relationship between the positive outcomes of a process and the required effort to generate these outcomes. A typical form of efficiency is a ratio. The enumerator represents the outcomes, e.g. in terms of revenues for sold products, the denominator the effort. The effort can be quantified by costs [15].

However, other quantifications can be applied. Here, life cycle assessment and in particular eco-efficiency approaches, come into play, e.g. contributions to climate change or cumulative energy demand [16, 17]. In other words: Life cycle assessment

is the basic concept used to calculate the denominator of eco-efficiency ratios. Accordingly, ISO 14040 defines LCA as a "compilation and evaluation of the inputs, outputs and potential environmental impacts of a products system throughout its life cycle" [1, 2]. LCA does not comprise all flows of a material and energy flow system, e .g. a company or supply chain; all flows must be related to a product or service [18, 19]. This clarifies the intended application context of life cycle assessment. It is designed as a decision support instrument: "A decision-maker uses LCA for generating information on the environmental implications of products. For this purpose a model is set up covering the material and energy flows attributed to a product and their evaluation in view of their environmental impact" [20].

Although eco-efficiency is compatible with Taylor's philosophy of efficiency on a formal level, eco-efficiency is not a very successful concept in practice. Taylor's interpretation of efficiency is linked to another important (or the most important) action orientation in economics: profit maximization or value creation. We have, thus, two slightly different interpretations (or dimensions) of efficiency: On the one hand efficiency of a sustainable society that tries to avoid inadvertent damages to its natural environment and, on the other hand, an interpretation of efficiency which has its origins in the basic action orientation of the economic system. Efficiency in the second interpretation is a generalized value in modern industrial societies.

It is, after all, not surprising that the new concepts are not applied in practice: They are not compatible with basic action orientations in the social subsystem of economy. One way to make the new concepts more attractive is to include the second dimension of efficiency, i.e. by including cost accounting. In fact, cost accounting components make the software systems more attractive. Many companies apply the new concepts mainly because they incorporate new cost accounting concepts that allow new insights: waste of energy and resources. Material flow cost accounting (MFCA) is such a new concept [21]. However, these information systems cover only so-called win/win-constellations: We increase eco-efficiency only if it has a positive impact on profit maximization.

Another starting-point could be to question the generalized action orientations. Conventional and enhanced management information systems are not designed to support that. At least, these are not the only forms of IT support in organizations. To apply information technology in this regard, the question is how social subsystems and their systemic mechanisms and action orientations emerge in societies and how the action orientations can be modified or enhanced.

3 The Theory of Communicative Action

To answer these questions we applied Habermas' theory of communicative action. Habermas' concept of society [10, 11] distinguishes lifeworld and social subsystems like the society's economy or public administration. "From the internal perspective of lifeworld, society is represented as a network of communicatively mediated cooperation… What binds sociated individuals to one another and secures the integration of society is a web of communicative actions that thrives only in the light of cultural traditions, and not systemic mechanisms that are out of the reach of a member's intuitive knowledge" [22]. Communication is not interpreted as information exchange

between decision makers but as a special form of action: communicative action. This interpretation of the role of communication in a society is based on the speech act theory by Austin [23] and Searle [24].

Habermas' concept of lifeworld does not fit into the understanding of computer support discussed in the previous section. However, computers are not only used for decision support in economic and public administration. Email, chat and many Web 2.0 applications stand for a completely different form of computer use. Habermas' concept of lifeworld helps to better understand these developments.

The lifeworld is not another separated social subsystem besides others. It is rather a different perspective: an internal perspective. Winograd and Flores have applied the internal perspective of communicatively mediated cooperation to the management of organization beyond decision making: "In understanding management as taking care of articulation and activation of a network of commitments, produced primarily through promises and requests, we cover many managerial activities. Nevertheless, we also need to incorporate the most essential responsibilities of managers: to be open, to listen, and to be an authority regarding what activities and commitments the network will deal with. These can be characterized as participation in 'conversation for possibilities' that open new background for the conversation for action" [25].

From an external system's perspective a society can be described as a set of social subsystems. Action in these subsystems is not based on communication and discourse but on de-linguistified rules or systemic mechanisms. This set of rules includes mechanisms for self-organization and self-preservation. Members of these systems become functional units. Their activities are ideally completely rule-based: "Members behave toward formally organized action systems, steered via processes of exchange and power, as towards a block of quasi-natural reality" [26]. If software systems are to support social subsystems, appropriate software engineering is required. In fact, many concepts and modeling tools of modern software engineering meet these demands.

A special kind of functional unit can change structures: decision makers. External observers can identify different phases of decision making abstract from the lifeworld: problem analysis, goal definition information collection, decision. Decision makers optimize the structures with respect to predefined rules. In fact, if decision support systems or the underlying concepts are not compatible with the rules, they cannot be applied by decision makers.

4 Co-evolution of Lifeworld and Social Subsystems

The question is why modern societies need social subsystems? Habermas' answer is: because of complexity. He started with the ritually preserved fund of social solidarity and existing norms and personal identities in traditional societies [26]. In a process of linguistification more and more of the old norms and rules are questioned. Step by step normatively guided actions are replaced by communication-based action. This dramatically increases the complexity. Not every new solution can be consensus-based. The focus of communication is rather on new mutual insights and action orientations. Rules are an effective way of reducing complexity. Finally, this process generates new rules and generalized action orientations. So the

process of linguistification is a process of de-linguistification at the same time. "Action oriented to mutual understanding gains more and more independence from normative contexts. At the same time, even greater demands are made upon this basic medium of everyday language; it gets overloaded in the end and replaced by de-linguistified media" [27]. That's the paradox of communication: It triggers a co-evolutionary process and "modern societies attain a level of system differentiation at which increasingly autonomous organizations are connected with one another via delinguistified media of communication: these systemic mechanisms – for example, money – steer a social intercourse that has been largely disconnected from norms and values, above all in those subsystems of purposive rational economic and administrative action that, on Weber's diagnosis, have become independent of their moral-political foundations" [26]. Based on this theory, economic efficiency, as described by Taylor, cost cutting and value creation are generalized action orientations in the social subsystem of economy. It is the result of a "social evolution as a second-order process of differentiation: system and lifeworld are differentiated in the sense that the complexity of the one and the rationality of the other grow" [26].

However, communication not only allows questioning of the norms and rules of traditional societies; it also allows challenging the systemic mechanisms and action orientations in social subsystems. With regard to corporate sustainability, before developing new information systems, it is required to place emphasis on generalized action orientations in relevant social subsystems: What is the relationship between the action orientations and the concept of sustainable development? If there are contradictory forces then how can we harmonize the orientations? Based on Habermas' theory of communication action, a process of linguistification is required.

5 IT Support – Lifeworld and System

Information technology can support these processes in two different ways. To support the process of linguistification, communication and conversation support systems come into play. If new generalized action orientations emerge, computer-based management information systems for corporate sustainability are required.

Because the process of linguistification is a process of de -linguistification at the same time, this process can be characterized as a transition phase. Computer support for this transition phase should be more than arbitrary conversation support. The action orientations in the subsystems, and of sustainable development, define the background of all communication processes in this phase so that IT support for "effective communication" [28] is required.

In the following, we make use of Habermas' two perspectives: lifeworld and system. In addition, another perspective on the subject will be adopted and examined: We are looking for "transition support systems".

5.1 Lifeworld Support

As mentioned above, research in the field of applied computer science is often focused on specific social subsystems. The basic action orientations and systemic

mechanisms are adopted. The promise is that the IT systems help to optimize the structures. However, other forms of computer use play an important role in our societies: computers as a new medium of communication: Web 2.0, Twitter, chat rooms and forums on the web. Sites like Geocaching and OpenStreetMap have established new collective forms of cooperation. The most important and most dangerous aspect of many software games is that they provide a virtual background of new collective forms of life.

Habermas' definition of lifeworld: "From the internal perspective of lifeworld, society is represented as a network of communicatively mediated cooperation" can be used as well to characterize this form of computer support. Two questions arise: Can computers really support the lifeworld? The main problem in this regard is what Habermas calls the "colonization of the lifeworld" [29]: If we apply concepts and software solutions to parts of the lifeworld, we will transform these parts into parts of social subsystems. But if lifeworld support is possible: What are the images of such an interpretation of computer science?

Winograd and Flores have presented an analysis and a new approach (language-action perspective) for a special part of the lifeworld [28]. This approach is restricted to companies: companies are part of the subsystem economy as well as of the lifeworld of the members. They propose to interpret management as support for "effective communication" instead of decision-making. However, such an approach is closely related to the social subsystem of economy and cannot cover phenomena like Geocaching or Blogging. More general approaches for computer-based lifeworld support are still not available, whereas several components or basic findings of such an approach are already on hand: groupware, human computer interaction, computers as a medium etc.

In the following we discuss software applications with regard to their lifeworld support.

(1) The first example is Geocaching [30]. Geocaching is in a way a modern form of the treasure hunt. However, geocaches does not really contain treasures, the "cache items" are more or less cheap things like pencils, coins from foreign countries or similar. The geocaching website www.geocaching.com describes all available caches including their geographical position. GPS equipment is required to find the caches. If geocachers find a cache they log it on the website. There is a really significant community gathered around geocaching. Geocachers have developed their own language; they have developed special forms of communication and social interaction. These phenomena are remarkable because from a systems perspective geocaching is quite useless.

(2) A second example is instant messaging (IM). Of course, IM is not useless compared to geocaching. IM plays a more and more important role in office organization. IM has the potential to increase the efficiency and effectiveness of business processes. However, this was not an intended purpose of IM; special empirical analyses were required to prove this. Because of its group-oriented functionality (distributed cooperative work, real-time communication, planning social events, socializing) instant messaging supports teams in the workplace. Handel and Herbsleb have analyzed the content of chat and categorized chat content of instant messaging at workplaces. They found that 69% of conversations relate to specific work tasks [31]. Other reasons are negotiating availability (13%), greeting (7%), non-work (3%) and humor (5%).

Although work-related content dominates instant messaging at workplaces, data exchange between decision makers does not play an important role. This was a result of sub classifying 'work'. Handel & Herbsleb write: "We dropped 'walkthrough', 'goal', 'digression' and 'clarification' since we never observed them within the 'work' portion of our protocol" [31]. The most important sub categories were technical work, project management and meeting management. Finally, Handel & Herbsleb point out that "chat was used overwhelmingly for work discussions or for articulation work to coordinate projects and meetings, and to negotiate availability" [32]. After all, empirical analyses show that today communication support systems play a critical role in enhancing effective communication within organizations. Moreover, the fact that empirical analyses are required to understand email and instant messaging in organizations emphasizes the high flexibility of these support systems.

(3) The third example is a bit strange: We have analyzed computer tools regarding their lifeworld support capabilities [33]. Computer tools have a predefined application domain. They are not useless like geocaching. However, computer tools are very flexible and unintended usage of computer tools is quite normal. Computer tools are often described as flexible decision support applications. Excel and LCA tools are good examples. As mentioned above, decision makers should make use of the tools to take rational decisions. An interesting aspect of computer tools with respect to lifeworld support is that they often define new languages and support good arguments, for instance, in the form of special diagrams and flow charts. For example in the field of material and energy flow analysis so-called Sankey diagrams play an important role. Sankey diagrams can be thought of as the language of material and energy flow analysis including life cycle assessment [34, 35]. The results of the analyses should be presented in the form of Sankey diagrams if possible. Here, the argumentation support becomes an important purpose of the tools.

The three examples demonstrate typical characteristics of lifeworld support. The software applications have a barely or ambiguous purpose. If the applications have an impact on social subsystems, special empirical analysis is required and the impact on structures and orientations is not predictable. This results in modified software engineering models: engineering requirements must be redefined. In the use phase, empirical analyses help us to understand the impacts of the applications and to improve future versions of the application: better recognition of new languages in the community.

5.2 System Support

As already mentioned, system support applications adopt their purposes from generalized action orientations in the respective social subsystems. The software should be a step forward. The conclusions are:

(1) Optimal compatibility with systemic mechanisms is required. Therefore, extensive system integration is necessary. For example, so-called stand alone solutions are suboptimal. Highly integrated enterprise resource planning systems should be the backbone of the corporate management information systems [36].

(2) A representation of the system as a computer model helps managers to find optimal structures and procedures [37]. E.g. workflow management components do not only control all important business processes, they are as well an important interface

to the real world: all processes are recorded so that the component provides basic data for cost accounting, financial accounting etc. [38].

(3) Taylor's idea of scientific management and in particular of standards (today we discuss business processes and works flows) should result in optimal and stable structures and operations. The dynamics of the socio-economic environment is an annoying and hopefully marginal phenomenon [36, 39].

From a systems perspective, computer tools are a less than optimal solution. Normally, the use of software tools is less efficient: the efforts of data collection are high, the consistency of data is often in question and system integration is poor. They are used for dealing with the dynamics of the socio-economic environment. The tools become prototypes of future fully integrated information components. LCA tools are again a good example. LCA tools are regarded as special environmental management information systems. However, they are suboptimal because of their insufficient system integration. So, it is self-evident based on experiences with LCA tools that material and energy flow based enterprise resource planning system components should be developed.

5.3 Transition Support

One aspect of lifeworld support can be interpreted as a problem. Its support applications cannot enforce predefined orientations, including sustainable development. It can happen that our societies develop new orientations, which are quite different from current definitions and interpretations of sustainable development. However, based on Habermas' theory of communicative action, modifications and enhancements of generalized action orientations require communication. As stated above, we can interpret this process of linguistification and de-linguistification as a transition phase.

Concepts for transition phase are already well known. They help to overcome problematic structures and mechanisms with respect to basic action orientations like profit maximization. Typical examples are Business Process Re-engineering, Lean Production and Supply Chain Management [40, 41]. Even if the goals of these concepts do not have much to do with lifeworld and communication, successful implementation of the concepts does require communication. Kieser [42] has analyzed the concepts in this regard. He identified different phases and aspects of such a transition: good arguments and examples for the identification of problems, the argumentation that the problems must be solved if the organization wants to have success in the long run, the presentation of several plausible examples of how to solve the problems and the advantage of being a pioneer. Successful concepts include a new language for the communities and a set of typical visualizations. Members of the communities obtain important hints on how to operationalize basic action orientations in their social context. Often the concepts can be combined with specialized consulting concepts and software applications.

With respect to sustainable development, socio-ecological transitions were connected with events like Rio 1992 or the Stern report 2006. Concepts like business process reengineering and lean production have not played a decisively important role. Maybe life cycle assessment has the capabilities.

6 Conclusions

From the perspective of social subsystems, computer science and computer applications are useful in supporting the respective generalized action orientations and optimal systemic mechanisms and structures. This results in a problematic equivalence in applied computer science. Computer science is relevant if - and only if - it is useful in a systems perspective. Our starting point, however, is "useless" computer support: People and communities can use computers in any way they want; there is no predefined purpose. By doing this, very important developments in our societies can be examined. To analyze these phenomena we adopted Habermas' theory of communicative action. This theory allows us to make the right distinctions: lifeworld support and system support.

What is the relationship to sustainable development? Based on the theory of communication action, the challenges of sustainable development are not a problem of insufficient software support. Rather, problematic generalized action orientations in relevant social subsystems prevent substantial steps forward: socio-ecological transitions. One conclusion of Habermas' theory is that societies can modify generalized action orientations and systemic mechanisms through consensus-oriented communication in the lifeworld. It is interesting that computer based lifeworld support is possible and already available; these systems have been in discussion for several years. We interpret several important Web 2.0 applications as lifeworld support systems. Many conventional software applications, in particular computer tools, also support communication processes in the lifeworld (or they provide corresponding components). However, lifeworld support includes that we cannot enforce and plan a sustainable development. So it is not useful to implement a "Sustainability Management System" in order to support the transition phase. Sustainability Management Systems, to support sustainability governance as well as enhanced EMIS, will be the second step.

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