Setting the Scene for Actability Evaluation – Understanding Information Systems in Context

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Abstract. The paper presents an approach to the evaluation of information systems based on the concept of information systems actability, which is suggested as an important alternative way to understand the role and pragmatic use of IT-systems within organizations. The results, empirically informed by two case studies, show that the suggested approach can effectively be used to direct evaluators' attention to important aspects of an IT-system related to the social actions performed by its use within a business context.

Keywords: Actability, evaluation, business context, quality in use, social action, heuristics.

1. Introduction

The concept of information systems actability has been proposed as an important alternative way to understand the role and pragmatic use of IT-based information systems within organizations (Goldkuhl and Ågerfalk 2002). In this perspective, it is not enough to view an information system (IS) as a technical black box having some social and organizational effects; information systems must be understood in a deeper sense than as just one kind of technical artefact. Following Goldkuhl and Ågerfalk (2002), we define information systems actability as: *an information system's ability to perform actions, and to permit, promote and facilitate the performance of actions by users, both through the system and based on information from the system, in some business context.*

One way to think of actability is as an 'action enhancement' of the usability concept for achieving quality in use (see Bevan (1999) for a discussion of the latter two concepts). The action enhancement consists of a solid founding of the concept in social action theories (e.g., Mead 1938; Weber 1978) and particularly in speech act theory (Austin 1962; Searle 1969; 1979; Habermas 1984). More accurately, actability can be regarded as representing a quite extensive theory of information systems as information action systems (Ågerfalk 1999; Goldkuhl and Ågerfalk 2002). From the perspective of actability, information systems are used to perform social action, that is, action that is oriented to the behaviour of others and which is usually purposeful. Frequently, this action character of information systems is made implicit, which has been identified as a major problem of information systems in organizations (Goldkuhl and Ågerfalk 2002).

Information systems are always part of a business context. An IS is used for communication between actors in the business. An IS is thus a mediating instrument for communication. To understand and evaluate an IS it is essential to include its action context in the scope of the evaluation (cf. Walsham 1993). According to the actability perspective, actions of an IS and actions of its users and other stakeholders should be seen as an integrated whole. The rela-

tionship between different actions of an IS and different actions of users is an important topic of investigation.

This paper presents an approach to evaluation of information systems based on the concept of information systems actability. In the paper, we present the concept of actability briefly and argue why it is important to consider communicative aspects of information systems in order to evaluate their quality in use. We also present the suggested evaluation approach and some fundamental assumptions and criteria that we believe are essential for such evaluation. Finally, we discuss its usefulness in two case studies.

In our research we have used a reflexive approach (Alvesson and Sköldberg 2000) utilizing the dialectics between theoretical concepts and empirical findings. Specifically, we commenced with a theoretically justified idea about an actability evaluation approach. Significant parts of our preliminary model were then tested in the two case studies. Findings from these tests served as a source for refining the evaluation approach. A discussion about this refinement and its relation to the empirical findings is presented in Section 4.

2. Information Systems Actability – What to Evaluate?

The point of departure for IS actability is the social actions performed by the use of the IS. In general, actions have consequences, that is, they cause changes in the world. Such changes may consist of physical changes, such as a relocation of some merchandise, or changes in the participating actor's social world, such as the creation of a commitment. The latter type of actions may be understood as communicative actions (Habermas 1984) or speech acts (Searle 1969; 1979), frequently performed by use of information systems.

In order to perform an action, certain action prerequisites must be met (Goldkuhl and Ågerfalk 2002). Such prerequisites depend on both internal factors, such as the performing actor's abilities, emotions, understanding of the business context, *et cetera*, and external factors, such as previously established social facts. A particular form of action prerequisite is manifested by the requirement that social action must conform to certain 'universal' *validity claims* (Habermas 1984). In short, such claims mean that actions should be comprehensible, refer to the true (or inter-subjectively believed) state of the world, represent sincere intentions, and be performed in accordance with socially accepted norms (Lyytinen 1986; Eriksson 1998; Goldkuhl and Ågerfalk 2002).

From an actability perspective, information systems provide a repertoire of actions, an *action potential*, to perform by and through the systems. Actions performed by use of information systems can be performed as *automatic actions* (performed by the system itself in accordance with pre-specified 'programmed' rules), as *interactive actions* (performed through the system in interaction between a user and the system), or as *consequential actions* (performed outside of the system but based on information from it). These three types of action help to identify three corresponding types of use situations: interactive, automatic, and consequential. A use situation (of any of the three types) consists of one or more social actions, referred to as *e-actions* (elementary actions). An e-action results in a non-empty set of *ae-messages* (action elementary messages). Interactive and consequential e-actions can be further decomposed into their constituent *e-interactions* (elementary interactions). An e-interaction is a single interaction between a performer and an IS performed by use of an *interactive screen document* in the IS (such as a form or dialog box). A non-automatic e-action is thus made up of

one or several e-interactions performed in a certain sequence, which the design may put restrictions upon, such as dictating a certain order of e-interactions. (Goldkuhl and Ågerfalk 2002; Ågerfalk 2002)

Let us consider an example: a use situation concerning order management. Parts of this use situation could be the e-actions 'place order' and 'order confirmation'. Typical e-interactions as parts of 'order confirmation' could be 'identify customer', 'check delivery possibilities', 'change delivery conditions' and 'send order confirmation'. The last e-interaction would then be the e-interaction used to execute the whole e-action (Ågerfalk 1999).

Drawing on the speech act theory of Searle (1969; 1979), an ae-message consists of two fundamental components: a *propositional content* and an *action mode*. The propositional content represents what the ae-message is about (the conceptual structure of the things the message refers to) and the action mode represents what the communicator does in relation to an interpreter (making a promise, commanding, stating, *et cetera*). Typically the action mode of an ae-message is signified by a so-called 'illocutionary verb' in the screen document. For example, a screen document used to place an order typically contains the illocutionary verb 'order' to signify that the information contained in the document, the propositional content, is about ordering something. All that is 'said' within an information system (that is, all ae-messages) include these two components according to the actability perspective. An ae-message contains a propositional content, carries an action mode and is communicated within a business context. (Ågerfalk 2002)

In addition to e-actions, it is possible to talk about *navigation actions* performed in order to navigate within the IS. These 'support actions' are not strictly part of the social action taking place at the interface, but are provided to enable it. An example would be navigating from a 'Start' screen document to a document used to handle the order management use situation.
Within actability, an important distinction is made between those who perform action and those upon whose commission actions are performed (Ågerfalk 2001). For example, a salesperson might communicate an offer (thus acting as a *performer*) on commission of the sales department for which he works. The sales department, and in the end the sales manager, would then be acting as the *communicator* who is ultimately responsible for the action, and hence for the relationships it creates with potential *interpreters*.

Altogether, this gives us three levels of action performed in interaction with an IS: the use situation as a whole, the e-action, and the e-interaction. In all three, there are at least an actor and an IS involved, and all three involve a communicating actor and an interpreting actor that communicate, possibly mediated by a performer that can be the system itself or another human actor.

Furthermore, information systems are usually equipped with information storage and retrieval facilities (e.g., databases and database management systems). From the perspective of actability, one key feature of such facilities is to provide an action memory. That is, a memory that stores information about performed e-actions (and corresponding ae-messages), and important action prerequisites.

3. A Suggested Actability Evaluation Approach

The suggested evaluation approach consists of two parts: an evaluation process model and two 'analytic tools' used during evaluation: a set of actability heuristics (criteria) and an analytical schema for classifying IS functionality in relation to action.
In the remainder of this section, we will address these parts in turn and argue their suitability for evaluation of information systems in context.

3.1 Evaluation Process Model

The suggested evaluation process model is divided into two phases. Each phase represents a different approach to the evaluation (see Figure 1) and consists of three stages: survey, evaluation and formulation of change proposals.

The first phase, referred to as *ideal typical analysis*, is inspired by criteria-based evaluation (Patton 1990) and heuristic evaluation (Nielsen 1993). During this phase the IS is evaluated against a set of actability heuristics (see Section 3.2.1). The aims are to survey the possible uses of the system and to identify possible problems that, based on the heuristics as well as business goals, might lead to problems in real use situations. This is a form of expert evaluation performed without involving the actual users and the results can be seen as theoretically justified change proposals.

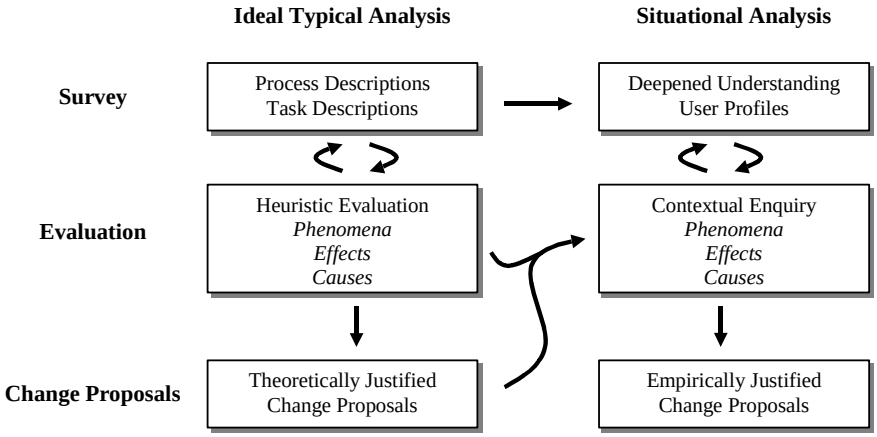

Figure 1: The evaluation process model

The second phase, referred to as *situational analysis*, is inspired by goal-free evaluation (Patton 1990) and contextual enquiry (Beyer and Holtzblatt 1998). During this phase the IS is evaluated in its real use context together with its users. This evaluation is more open-ended and leads to a deeper understanding of the business context and the use of the system within that context. The potential problems identified during the first phase are used to direct attention alongside a systematic search for strengths and problems not identified earlier. The results from this phase can be seen as empirically justified change proposals and as verification or rejection of the previously suggested change proposals. This evaluation work is also important to gain knowledge about the merits of the actability heuristics used and hence about the concept of actability as such.

Throughout the evaluation, identified strengths and problems are analysed in terms of effects and causes and classified according to a schema based on desired, existing, used, perceived and satisfactory functionality (see Section 3.2.2). This classification makes it possible, for

example, to discuss who will be affected by a problem and the importance of correcting it. Throughout the evaluation, we refer to possible strengths and problems by the more neutral concept of *phenomena*.

As discussed above, the concept of actability gives us three levels of action at which the use of the system can be evaluated: the use situation as a whole, the e-action, and the e-interaction. The choice of level depends on required granularity. This is important since we can choose to dig deeper into certain parts of an IS while remaining at a more shallow level in other parts.

3.1.1 Ideal Typical Analysis

The first measure to take during IS evaluation is to obtain a firm understanding of the business context in which the IS is used. This includes reconstructing and describing the overall action structures that form the processes of the business under study. In our suggested approach, this means to describe the actions typically performed in the business, and the results of, and prerequisites for, those actions. The resulting process description shows how all actions and use situations fit together to form the business and to achieve the business' goals. In addition to this 'bird's-eye view', it is important to apply an actor's view as well and describe individual tasks (use situations) performed by the users. These two views together describe the business context in complementary ways.

During this phase, evaluation of the IS is performed without access to actual users. Instead, a combination of criteria-based evaluation (Patton 1990) and heuristic evaluation (Nielsen 1993) is adopted. The evaluation is thus focused upon existing action potential provided by the system. This action potential is analysed with respect to a set of actability heuristics (see Section 3.2.1) as well as business goals and anticipated individual goals. The reason to favour such an approach is that heuristics can be used to direct evaluators' attention to key actability issues. The idea is that theoretical models of human action (e.g., Norman 1988; Searle 1969; 1979; Habermas 1984) can be used to give an indication of where the users will potentially run into problems in real usage.

The results of this phase can be regarded as theoretically justified change proposals, related to an initial understanding of the business context and the actors and actions that the IS is supposed to support.

Note that at this stage it is still uncertain how the system is actually used and how the business is actually conducted. It is important to dig deeper into more hidden realms during a situational analysis. Sometimes, however, this shallow analysis is sufficient. For example, when time and other resources are limited, ideal typical (heuristic) analysis is a cost-effective method (Nielsen 1993).

3.1.2 Situational Analysis

The situational analysis is conducted on site with real users performing real tasks inspired by goal-free evaluation (Patton 1990) and contextual enquiry (Beyer and Holtzblatt 1998). During this phase, the description of the IS and its business context is refined and user profiles are created. Business goals as well as individual goals can be elaborated and assumptions made during ideal typical analysis can be verified and made more precise.
During this phase, evaluation can be extended to include not only what is actually in the system, but also to what users perceive the system to provide and what they think the system

should provide (see Section 3.2.2). Our approach to situational analysis means that evaluators work closely with users to learn both the users' tasks and the ways they use the IS. Beyer and Holtzblatt (1998) describe such contextual enquiry as a setting that tries to resemble a 'new on the job' situation, or a master and apprentice relationship between user and evaluator. The evaluator participates in the daily work and asks questions to learn more about the whole work context. Data collection is based primarily on positive and negative aspects (see discussion on 'phenomena' above) encountered in the work practice. Additionally, phenomena discovered during ideal typical analysis are used to direct attention to things that might be especially related to actability.

An approach based on contextual enquiry, which is basically a combination of thinking aloud and observations, is favoured because it enables users, at least to some extent, to express tacit knowledge (Polanyi 1983). Together with expressed thoughts and observations, evaluators have the opportunity to understand what is problematic (which can be observed from user actions) and to learn why it causes problems. The objective of situational analysis is to enable users to show and describe how actions are performed, and to express reasons for action within the actual work context. That is, to express their knowledge in action (Schön 1983).

3.1.3 A Comment on Change Proposals

A correct use of the change proposals would be to order them by significance and implement as many as feasible, then conduct another evaluation to learn more about the system and the evaluation approach as such.

3.2 Analytical Tools for Evaluation

3.2.1 A Set of Actability Heuristics

It is useful to have a set of heuristics (criteria) to direct attention towards issues central to actability. The actability heuristics presented in Table 1 comprise a summary from earlier work on actability (e.g., Ågerfalk 1999; Goldkuhl and Ågerfalk 2002) extended with insights gained during performed evaluations (see Section 4).
The set of actability heuristics presented here is tentative and will change as we learn more about actability evaluation.

Table 1: A set of information systems actability heuristics

1. Situational context awareness
Performers should always know what they are doing, and what they are supposed to be doing, by only looking at the interactive screen documents available.
2. Good conditions for action in shown information
Information shown to performers should be adequate (necessary and sufficient) so that actions can be intuitively based on it. This includes both information from developer-to-user (labels, captions, help texts, *et cetera*) and information involved in user-to-user communication.
3. Good conditions for action in required information
Information that the system requires from performers should be meaningful and easily provided to the system. That is, the performer should understand why the information is required and the information shall be accessible.
4. Easily accessible and adequate action memory
Information about previously performed actions and other action prerequisites should be easy to access.

5. Action-legible IT-systems

Expressive interactive user interface components (icons, labels, *et cetera*) should be used. The language used should correspond with the users' professional language. Known and understandable consequences of possible actions should be described. Propositional content, signifier of action mode and information about communicator should be visible and kept together. Separate messages should be kept separate (one thing at a time).

6. Legible and relevant feedback

Description and explanation of the system's performed and scheduled future action(s) should be readily available. Effects of these actions should be shown. Alternative future user actions should be visible and choice of course of action to take should be informed by the system.

7. Visible actors

Information about performer, communicator and intended interpreter(s) should be easily accessible – both role and person.

8. Restrictions and opportunities in navigation utilized

Should admit focus and work task changes. Sometimes sequence restrictions are necessary and desirable.

9. Accurate timing

Messages should reach intended interpreters in due time. If not, resulting delays may cause problems for the organization (such as additional actions for the performer).

10. Interpretation initiative

Receipt and interpretation of messages should be possible at desired places and in desirable ways. This may be affected by technological solution in terms of, for example, transmission strategy (push or pull, synchronous or asynchronous, *et cetera*) and types of devices (mobile phones, PCs, PDAs, *et cetera*).

11. Distribution of actions

The performance of actions should be allocated to human actors and information systems so that users gain maximal support in terms of, for example, decision support *vs.* automated actions.

3.2.2 The D.EU.PS. Model

For actability evaluation, we propose to use a comprehensive model of IS usage, which we refer to as the D.EU.PS. model (pronounced 'dupes', and representing combinations of desired, existing, utilized, perceived, and satisfactory functionality). The D.EU.PS. model (see Figure 2) provides a means to classify the functionality of a system into five different but overlapping classes.

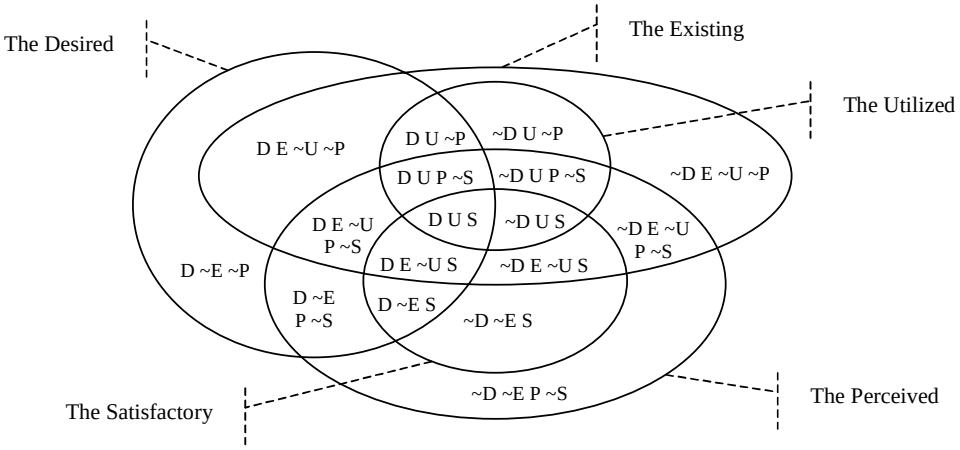

Figure 2: The D.EU.PS. model of IS usage

First, there is the *desired* functionality. This is the functionality that users want in the system. The desired functionality need not necessarily correspond with the *existing* functionality, which is the second class of the model. There might be desired functionality that does not exist and existing functionality that is undesired. A subset of the existing functionality constitutes the *utilized* functionality, the third class. This is the functionality of the system that is actually being used. Within the model, we distinguish further between existing and desired functionality on the one hand and *perceived* functionality on the other. The perceived functionality corresponds to what users believe that they can do with the system and constitutes the fourth class. This functionality could correspond to existing functionality. It may also contain non-existing functionality; users might believe a certain function exists even though it does not. A subset of the perceived functionality constitutes the *satisfactory* functionality, which is the fifth and final class of the model. This class consists of functionality that can be perceived and also be perceived as possible to use with satisfaction.

It is important to understand that these five classes are not mutually exclusive. Rather, they together constitute seventeen classes that are combinations of the five (see Figure 2). Ultimately, all functionality should be D.U.S.; that is, desired and utilized with satisfaction.

4. Lessons Learned from the Case Studies

In this section, we present two case studies in order to explore the usefulness of the suggested evaluation approach. These are a Swedish Internet bank system and an IS used to book rooms, teachers, students and extra equipment at a university. We will illustrate aspects of these systems that are particularly interesting in relation to the suggested evaluation approach (i.e., interesting from an actability perspective).

4.1 About the Cases

4.1.1 The Internet Bank

The evaluation of the banking system, performed by two evaluators, was a pilot test of the initial version of our suggested approach. One had several years experience with the system and the other was completely new to it. The situational analysis was conducted with colleagues within an academic department who use the Internet bank to pay their bills. Five users participated in the enquiry.

The focus in the study was on the interactive use situation ‘pay bills’ consisting of two e-actions, ‘give payment commission’ and ‘approve receiver’, and one main navigation action, ‘go to register new recipient’. Both e-actions have the customer as communicator and performer and the Internet bank provider as interpreter.

A weakness in the study was that we conducted the ideal typical analysis without collaboration with the bank. Therefore, we can only speculate about the bank’s intentions, rationale, *et cetera*.

4.1.2 The Booking System

The evaluation of the booking system was based on the approach presented in the paper, but focused mainly on the heuristic evaluation. A researcher and lecturer who has been a regular user of the system for approximately two years performed the evaluation.

The study focused on the use situation that we considered most central in the booking system: 'perform booking'. In order to complete a booking, several measures have to be taken, including 'find previous bookings' performed using different search criteria.
When this study started, heuristics 3, 9, 10 and 11 (see Table 1) were not yet formulated.

4.2 The Use of Heuristics

The heuristics presented in Section 3.2.1 should be considered as a work in progress. Nonetheless, they have helped us to emphasize some important parts of the evaluated information systems.

During ideal typical analysis of the Internet bank, we identified several potential actability problems. These problems were highlighted during situational analysis. We could then check if the users perceived the potential problems that we had identified.

During evaluation of the banking system, we formulated the heuristic *good conditions for action in required information*. The lack of such a heuristic was identified when we analysed the result from the user tests. We did not have a heuristic that explained the identified phenomena. For example, several users were unsatisfied with having to input information that they did not consider meaningful. An example is that dates could not be provided to the system the expected way using hyphens, i.e., as in 2002-01-25.

Three heuristics were added to the set during the evaluation of the booking system. These are *accurate timing*, *interpretation initiative* and *distribution of actions*. They can be illustrated by the example of a lecturer who – due to sudden illness – wants to perform a last minute change in the schedule. The system supports the re-scheduling. However, there are several things left to do to ensure that his students receive this important information. This is especially important, since many of the students commute to the university. Some problems can only be solved by a number of manual actions. In this case, the student has to take the *interpretation initiative*. Most students print their schedules at course start, and then check the IS for changes periodically. However, there is no guarantee that they will be aware of changes (until it is too late). If e-mails were sent automatically to the course participants whenever a last minute change in the schedule is made, it would be more likely that students would receive the information in due time. If even more advanced technology was utilized, the message could be pushed to the students (e.g., using SMS messaging). In this case, it is obvious that the *accurate timing* heuristic is closely related to the interpretation initiative.

On reflection, it is not straightforward to study an isolated IS within an organization. In the example above, the teacher could obtain a list with e-mail addresses of the students from another system (which had to be done manually) and use it to notify all the students. Ideally, these actions would be performed by the booking system. The heuristic *distribution of actions* helps us to focus on this problem.

We further note that it takes a great deal of time to evaluate a system using all the heuristics (cf. Nielsen 1993). Consequently, there is a need for support to identify what to focus on during the evaluation.

4.3 The Use of the D.EU.PS. Model

The D.EU.PS. model was used in the situational analysis of the Internet bank. The enquiry was designed as typical questions based on the actability heuristics, the D.EU.PS. model and problems that were identified during ideal typical analysis. We asked questions such as is this functionality desired, satisfactory and is there anything that you lack in the system?

The protocols used during the analysis were based on the D.EU.PS model. The model, as an analytic tool, supported the evaluator in the situational evaluation to direct attention to key aspects. We discovered that in order for a user to perceive a function as desired, the benefits of the function must be communicated so that users understand why to use the functionality (the action potential provided by the system must be comprehensible). The perception of what is considered desired in the system can also differ among users and management. For example, security codes have to be provided to the IS several times during the bill-paying process. This was considered meaningless by the bill-paying users – it required more time, but it did not make the system feel more secure (~D U ~S, that is). On the other hand, the Internet bank provider probably wants to promote a feeling of security and prevent misuse. We also notice that to be able to utilize a function, a fundamental aspect in the system is that the user knows how to use it. For example, a user did not know how to change already registered information and therefore did not use that functionality (D E ~U ~P, that is). When the users said that a function was not satisfactory, the terms 'sure' and 'unsure' were frequently used descriptions. For example, a user felt unsure about what occurred (~S, that is). A statement that also reappeared was that functionality was perceived as 'bad' (~S) or 'good' (S).

The seventeen unions derived from the five classes of the D.EU.PS. model were used to classify functions in the banking system. An example of this is shown in Table 2, which describes one of the e-actions supported by the system. According to the D.EU.PS. classification, this function is good, but it could be made even better. The importance of the effects on the user described in Table 2 could be used as a basis for future changes in the system.

Table 2: The IS function 'Register new recipient'

User(s)	Class	Phenomena	Effect	Cause
U5	D U P ~S	User considers it disturbing that a new window is opened.	User is disturbed while performing payments.	User has to shift focus to register a new recipient.
U3	D U S	User considers this function to work fine.	User feels that registering a new recipient is a part of the bill payment process.	User registers new recipients when he pays a bill to them for the first time.

During the situational analysis, it felt as if we were disturbing the users by asking questions about all functions. This is probably because we evaluated on the detailed level of e-interactions. Another problem was that users performed their tasks quickly and it was sometimes hard to query how different functions were perceived. Perhaps this is inherent in the contextual inquiry approach, which demands that you study the users' actual work.

4.4 The Need for a Layered Model of Action

After evaluation of the banking system, we realized that despite the rather narrow evaluation we had produced a significant amount of documentation. The problem was that we had pursued the evaluation on the e-interaction level. The first lesson we learned was that we needed support in the evaluation model to choose the level of evaluation.

The evaluation of the booking system – which focused on the use situation level – generated three new heuristics. The banking system evaluation pointed out a new heuristic on the lower levels – e-action and e-interaction. The second lesson we learned was that by focusing on different levels of the system, we obtain indications of problems related not only to the evaluated system, but also to the concept of actability.

5. Conclusion

In this paper we have presented a contextual IS evaluation approach based on the concept of information systems actability. Actability gives a theoretical foundation for studying information systems within their business context. This is important in order to see how the use of the IS, including the distribution between IT-supported and fully automated tasks, affects and is affected by the social context surrounding it.

The suggested approach to IS evaluation combines ideal typical evaluation based on heuristics with situational evaluation influenced mainly by contextual enquiry. The combination makes it possible to balance expert-based evaluation and in-depth participative studies taking tradeoffs such as allotted time and resources into account.

The heuristics used are based on the concept of actability, and they represent a way to operationalize the concept into tangible properties of the IS and its surrounding business context, including interacting users and, for example, system owners as providers of action potential and communicators of information upon whose commission interacting users act.

In addition to heuristics, the approach makes use of a model for classification of IS functionality (and hence action potential) as combinations of desired, existing, used, perceived and satisfactory functionality (the D.EU.PS. model). Based on that classification, causes and effects can be analysed in more detail and change proposals formulated accordingly.

When applying the evaluation approach, a choice is given regarding on what level of granularity to perform the evaluation. Based on the concept of actability we have distinguished between three levels: the use situation, the elementary action, and the elementary interaction performed to formulate and execute elementary actions.

The usefulness of the suggested approach has been demonstrated by presenting insights gained from two case studies. The results show that the proposed heuristics can be used effectively to direct evaluators' attention to important aspects of an IS related to the social actions performed by use of it within a business context. The results also show that action viewed at different levels of abstraction in conjunction with the D.EU.PS. model can be used as a means to decide appropriate analysis depth, and hence appropriate effort to put into evaluation. We also gained new insights about the concept of IS actability as such, and therefore about understanding information systems in context altogether.

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