

Six Generic Types of Information Systems Evaluation

Stefan Cronholm, Göran Goldkuhl
Department of Computer and Information Science
Linköping University
E-mail scr@ida.liu.se, ggo@ida.liu.se

Abstract

The aim of this paper is to contribute to the decision of how to perform evaluation depending on the evaluation context. Three general strategies of how to perform evaluation together with two general strategies of what to evaluate are identified. From the three “how-strategies” and the two “what-strategies” we derive a matrix consisting of six generic types of evaluation. Each one of the six types are categorised on a ideal typical level.

Keywords: IS Evaluation, IS Assessment, Information Systems, Goal-based evaluation, Goal-free evaluation, Criteria-based evaluation

1. Introduction

All over the world there is a huge amount of money spent on IT (e.g. Seddon, 2001). It is therefore important to evaluate the outcome. Evaluation is never an easy task and consequently there are a lot of suggestions for how to evaluate IT-system. Much of the literature on evaluation takes a formal-rational view and sees evaluation as a largely quantitative process of calculating the likely cost/benefit on the basis of defined criteria (Walsham, 1993). There are also interpretative approaches (e.g. Remenyi, 1999; Walsham, 1993). The interpretative perspective views IT-systems often as social systems that have information technology embedded into it (Goldkuhl & Lyytinen, 1982).

There are formative and summative approaches containing different measures or criteria. Some approaches are focusing on harder economical criteria and others are focusing on softer user-oriented criteria. According to Walsham (1993) and Scriven (1967) formative evaluation aims to provide systematic feedback to the designers and implementers while summative evaluation is concerned with identifying and assessing the worth of programme outcomes in the light of initially specified success criteria after the implementation of the change programme is completed. The criteria used are often derived from one specific perspective or theory.

All of the approaches, formal-rational, interpretative or criteria-based, are different ways and their primary message is *how* the evaluator should act in order to perform evaluation. Besides this “how-message” it is also important to decide about *what* to evaluate. When evaluating IT-systems we can think of at least two different situations that can be evaluated. In this paper, we differ between evaluation of IT-system as such and evaluation of IT-systems in use. From the questions of how to evaluate and what to evaluate we derive a matrix consisting of two dimensions “how to evaluate” and “what to evaluate”. The combination of the two dimensions results in six different evaluation types and the purpose of this paper is to, on an ideal typical level, identify and characterise each of the derived evaluation types. The aim of the matrix is to support different choices of how to perform an evaluation depending on the evaluation situation.

The different ways of how to evaluate and what to evaluate are identified from reading literature and from insights from empirical findings in evaluation projects where we have participated (Ågerfalk et al., 2002).

2. Strategies concerning how to evaluate

We distinguish between three types of strategies:

- Goal-based evaluation
- Goal-free evaluation
- Criteria-based evaluation

The differentiation is made in relation to what drives the evaluation. Goal-based evaluation means that explicit goals from the organisational context drive the evaluation. These goals are used to measure the IT-system. The goal-free evaluation means that no such explicit goals are used. Goal-free evaluation is an inductive and situationally driven strategy. Criteria-based evaluation means that some explicit general criteria are used as an evaluation yardstick. The difference to goal-based evaluation is that the criteria are general and not restricted to a specific organisational context.

2.1 Goal-based evaluation

Goal-based evaluation can be seen to be formal-rational to its character (e.g. Walsham, 1993). Walsham means that a formal-rational view sees evaluation mainly as quantitative process of calculating the likely costs and benefits. According to Patton (1990) goal-based evaluation is defined as measuring the extent to which a program or intervention has attained clear and specific objectives. The focus is on intended services and outcomes of a program – the goals. Good et al (1986) claim that evaluations should be measurable and that the evaluation should meet the requirements specification.

One common criticism of the formal-rational view is that such evaluation concentrates on technical and economical aspects rather than human and social aspects (Hirschheim & Smithson, 1988). Further Hirschheim & Smithson means that this can have major negative consequences in terms of decreased user satisfaction but also broader organizational consequences in terms of system value. We agree with the criticism of Hirschheim & Smithson, but when analysing goal-based evaluation in an ideal typical way there is no imperative relation between a focus on technical and economical aspects and goal-based evaluation. Of course, the stated goals can be of a human or organisational character. However, the traditional way of understanding goal-based evaluation is often related to harder measurable goals.

Further, there is no imperative relation between a goal-based approach, and a quantitative process. A judgement of, if the goals have been fulfilled can be evaluated with a qualitative process. As we see it, the differences between a quantitative and qualitative strategy is that the quantitative strategy aims to decide if the goals are fulfilled and which goals that are fulfilled. The fulfilment of the goals will be expressed in quantitative numbers. There are also goals of more social or human character. The fulfilment of this types of goals is preferably expressed in qualitative terms. The qualitative process has also, besides the if- and which questions, a better possibility to describe how the goals are fulfilled. This means that the qualitative approach aims at achieving richer descriptions. The goals that are used for evaluation are derived from an organisational context. That means that they are situationally applicable, which means that they act like specific business goals.

The basic strategy of this approach is to measure if predefined goals are fulfilled or not; to what extent and in what ways. The approach is deductive. What is measured depends on the

character of the goals and a quantitative approach as well as qualitative approach could be used. In this paper we adopt the concept of goal-based evaluation from Patton (1990) in order to identify this approach.

2.2 Goal-free evaluation

The second identified approach is a more interpretative approach (e.g. Remenyi, 1999; Walsham, 1993). The interpretative perspective views IT-systems as social systems that have information technology embedded into it (Goldkuhl & Lyytinen, 1982). The aim of interpretive evaluation is to gain a deeper understanding of the nature of what is to be evaluated and to generate motivation and commitment (Hirschheim & Smithson, 1988). The involvement of a wide range of stakeholder groups is essential to this approach of evaluation. This can also be a practical obstacle where time or resources for the evaluation are short. Patton (1990) uses the term goal-free evaluation. Goal-free evaluation is defined as gathering data on a broad array of actual effects and evaluating the importance of these effects in meeting demonstrated needs (Patton, 1990, Scriven, 1972). The evaluator makes a deliberate attempt to avoid all rhetoric related to program goals; no discussion about goals is held with staff; no program brochures or proposals are read; only the program's outcomes and measurable effects are studied. The aim of goal-free evaluation is to (Patton, 1990):

- 1) avoid the risk of narrowly studying stated program objectives and thereby missing important unanticipated outcomes
- 2) remove the negative connotations attached to discovery of unanticipated effect: "The hole language of side-effected or secondary effect or even unanticipated effect tended to be a put-down of what might well be a crucial achievement, especially in terms of new priorities."
- 3) eliminate the perceptual biases introduced into an evaluation by knowledge of goals; and
- 4) maintain evaluator objectivity and independence through goal-free conditions

In this paper, we adopt the concept of goal-free evaluation from Patton (1990) in order to identify this approach. The basic strategy of this approach is inductive evaluation. The approach aims at discovering qualities of the object of study. One can say that the evaluator makes an inventory of possible problems and that the knowledge of the object of study emerges during the progress of the evaluation.

2.3 Criteria-based evaluation

The third identified approach is a criteria-based approach. There are lot of criteria-based approaches around such as checklists, heuristics, principles or quality ideals. In the area of Human-Computer Interaction you can find different checklists or heuristics (e.g. Nielsen, 1994; Nielsen, 1993, Shneiderman, 1998). What is typical for these approaches is that the IT-systems interface and/or the interaction between users and IT-systems acts as a basis for the evaluation together with a set of predefined criteria. More action oriented quality ideals and principles for evaluation can be found in Cronholm & Goldkuhl (2002) and in Ågerfalk et al (2002). The basis for these action oriented ideals is to understand if and how the IT-system support the actions performed in the business (see discussion of IT-systems in section 3.1)

The criteria used are grounded in and derived from one or more specific perspectives or theories. For example, the criteria in Nielsen's (1994) checklist are derived from cognitive and computer science. The action oriented ideals are mainly derived from language action theory but also inspired by usability issues. Using criteria means to set focus on certain qualities that according to the perspective is important to evaluate. At the same time the attention accord-

ing to the criteria also de-emphasize other qualities. The criteria chosen governs the evaluator's attention and thereby the kind of knowledge the evaluator achieves.

Another difference in comparison to goal-based evaluation is that the criteria that are used are not derived from a specific organisational context. That means that they are more general applicable (see section 2.1). Ideal typically, the basic strategy of criteria-based evaluation is pure deductive. The word criteria is often used in relation to preordinate designs, and the use of this term has a 'hard' scientific feel which supports the tendency to prioritize technical and quantitative data (Walsham, 1993). Ideal typically this view is too limited. A criteria-based approach does not exclude of softer criteria; confer for example Ågerfalk et al (2002).

3. Strategies concerning what to evaluate

We distinguish between two strategies; evaluating:

- IT-system as such
- IT-system in use

IT-systems can be viewed from many different perspectives. Our framework for IT evaluation is not dependent on any particular perspective.

3.1 IT-systems as such

Evaluating IT-systems as such means to evaluate the IT-system without any involvement from users. In this situation there are only the evaluator and the IT-system involved. The data sources that could be used for this strategy is the IT-system itself and possible documentation of the IT-system. How the evaluation is performed depends on the "how-strategy" chosen. Choosing to evaluate "IT-systems as such" does not exclude any of the strategies of "how to evaluate". The evaluator could use a goal-based, goal-free or criteria-based strategy.

The outcome of the evaluation is based on the evaluator's understanding of how the IT-system supports the organisation. This strategy is free from user's perceptions of how the IT-system benefits to their work.

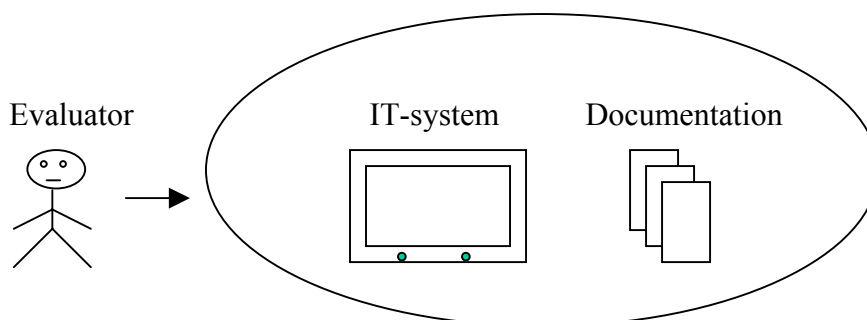


Figure 1 Two possible data sources for IT-systems in use

3.2 IT-systems in use

The other strategy of "what to evaluate" is "IT-systems in use". Evaluating IT-systems in use means to study a use situation where a user interacts with an IT-system. This analysis situation is more complex than the situation "IT-systems as such" since it also includes a user, but it also has the possibility to give a richer picture.

The data sources for this situation could be interviews of the users and their perceptions and understanding of the IT-system's quality, observations of users interacting with IT-systems, the IT-system itself and the possible documentation of the IT-system. Compared to the strategy "IT-systems as such" this strategy offers more possible data sources. When there are high requirements on data quality the evaluator can chose to combine all the data sources in order to reach high degree of triangulating. If there are fewer resources at hand the evaluator can chose one or two of the possible data sources.

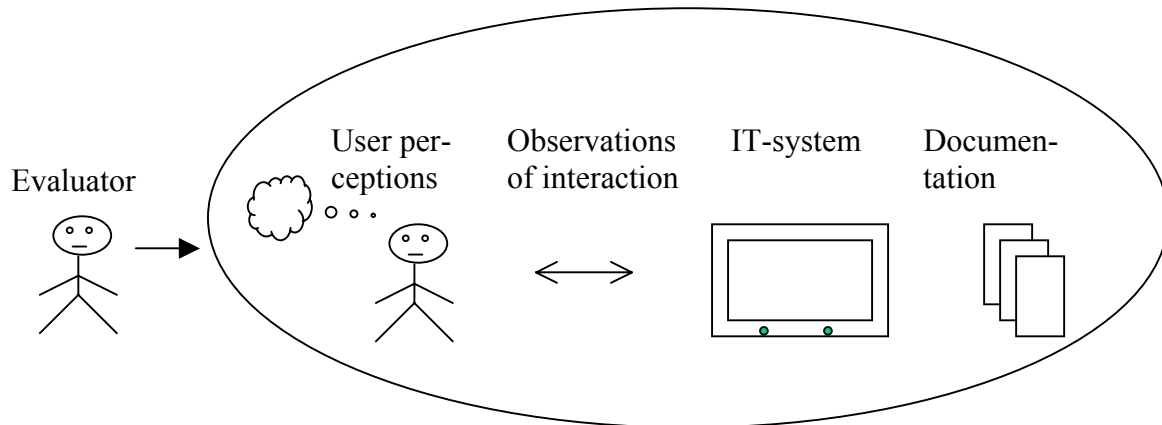


Figure 2 Four possible data sources for IT-system in use

An argument for choosing the strategy "IT-systems in use" is presented by Whiteside & Wixon (1987). They claim that "... usability becomes a purely subjective property of the interaction between a specific user and the computer at a specific moment in time". There are always subjective perceptions such as the users attitude towards an IT-system that are harder to measure.

How the evaluation of "IT-systems in use" is performed depends on the "how-strategy" chosen (see section 2). Ideal typically, it is possible to choose any of the three strategies goal-based, goal-free or criteria-based when studying "IT-systems in use". The outcome of this evaluation is not only based on the evaluator's understanding of how the IT-system support the organisation. It is also based on the users perceptions of how the IT-system supports their work.

4. Characterisation of six generic types of evaluation

Combining the three approaches of "how to evaluate" and the two approaches of "what to evaluate" gives a matrix of six generic types of evaluation (see table 1).

Table 1. The matrix of six generic types of information systems evaluation

	IT-systems as such	IT-systems in use
Goal-based evaluation	Type 1	Type 2
Goal-free evaluation	Type 3	Type 4
Criteria-based evaluation	Type 5	Type 6

In this section, we will characterize the six different types in order highlight similarities and differences. The characterization is done through classifying the evaluation types according to some general criteria:

- Main perspective
- What to achieve knowledge about
- Data sources
- Deductive or inductive
- Who will participate
- When to chose this type

Besides characterizing each type, we also give an example of how each evaluation type could be performed.

4.1 Type 1 - Goal-based evaluation of IT-systems as such

The first type is a combination of goal-based evaluation and IT-system as such. This combination means that the evaluation is performed according to some predefined goals and that the object of evaluation is the IT-system (see table 2). According to the literature the perspective of goal-based evaluation often is technical and economical. We mean that the perspective depends on the character of the goals (see section 2.1). Using a goal-based evaluation combined with studying IT-systems as such means that the evaluator wants to decide if the goals have been fulfilled. The strategy is deductive. The data sources for this type, besides the IT-system is goal descriptions, requirement specifications and descriptions of the IT-system.

This type has a low degree of participation. This evaluation type is performed without involvement from users or other stakeholders. This type could be chosen when a focused evaluation according to the stated goals is wanted or when there are fewer resources at hand.

One example of how this evaluation type could be performed is when an evaluator expert evaluates if the design of IT-system offers possibilities for fulfilling the business goals. The evaluator compares for example the IT-systems functionality, interface and possible interactions with required support for business actions stated in the requirements documentation.

Table 2: Goal-based evaluation of IT-systems as such

Main perspective	Depends on the character of the goals
What to achieve knowledge about	Has the IT-system fulfilled the desired business goals? The IT-systems' potential positive and negative consequences for the business. What is the presumed contribution of the IT-system?
Data sources	IT-system, goal descriptions, requirement specifications, descriptions of the IT-system
Deductive or inductive	Deductive
Who is participating	Evaluator expert
When to chose this type	When a clearly focused evaluation is wanted, when there are fewer resources at hand, when there is no users available

4.2 Type 2 - Goal-based evaluation of IT-systems in use

The second type is a combination of goal-based evaluation and IT-systems in use. This combination means that the evaluation is performed according to some predefined goals and that the object of evaluation is the IT-system in use (see table 3). The evaluation perspective depends on the character of the goals (see section 2.1). Using a goal-based evaluation combined with studying IT-systems in use means that the evaluator wants to decide if the goals have been fulfilled. The strategy is deductive.

One major difference between this type and type 1 is that there are more data sources at hand. Besides the IT-system, goal descriptions, requirement specifications and descriptions of the IT-system there is an interaction between users and the IT-system. This interaction can be observed. This interaction also results in an understanding and attitudes of the user regarding the IT-system. Interviews of the users' understanding, attitudes and opinions are another possible data source. This type also offers possibilities for a broader participation than type 1 does. Besides the evaluator there are also users involved. This type could be chosen when a focused evaluation according to the stated goals is wanted or when there are more resources at hand.

One example of how this evaluation type could be performed is when an evaluator observes and/or interviews users in order to decide if the goals have been fulfilled. The evaluator compares what he has observed and the users perceptions from using the IT-system with required support for business actions stated in the requirements documentation. During the observation methods like "think aloud" (Monk et al, 1993) could be applied. This means that evaluator during the observation encouraging the user to describe what he is doing or what he is thinking of.

Table 3: Goal-based evaluation of IT-systems in use

Main perspective	Depends on the character of the goals
What to achieve knowledge about	Has the IT-system fulfilled the desired business goals? The IT-systems' obtained positive and negative consequences for the business. What is the accomplished contribution of the IT-system?
Data sources	IT-system, goal descriptions, requirement specifications, descriptions of the IT-system, the interaction between users and the IT-system, the users perceptions of the IT-system
Deductive or inductive	Deductive
Who will participate	Evaluators and users
When to chose this type	When a clearly focused evaluation is wanted, when there are more resources at hand.

4.3 Type 3 - Goal-free evaluation of IT-systems as such

The third type is a combination of goal-free evaluation and IT-systems as such. This combination means that the evaluation is performed more open minded and that the object of evaluation is the IT-system as such (see table 4). Using an open mind means that the evalua-

tor discovers different qualities of the IT-system. The strategy is inductive (see section 2.2). The data sources for this type are the IT-system itself and descriptions of the IT-system.

This type has a low degree of participation. This evaluation type is performed without involvement from users or other stakeholders. This type could be chosen when a broader evaluation is wanted. It could also be used as an introductory evaluation aiming at getting to know the IT-system.

One example of how this evaluation type could be performed is when an evaluator has a need to be acquainted with the IT-system. He performs an introductory open minded and problem inventing evaluation. He map out the IT-system and the knowledge that emerged from this introductory step can be deepened when combing this type of evaluation with other types of evaluation.

Table 4: Goal-free evaluation of IT-systems in use

Main perspective	Open minded approach
What to achieve knowledge about	To gain a broader understanding of the IT-system, an introductory knowledge that can be further deepened
Data sources	The IT-system, descriptions of the IT-system
Deductive or inductive	Inductive
Who will participate	Evaluator expert
When to chose this type	When a introductory study is wanted in order to be acquainted with the IT-system, when there are fewer resources at hand, when there is no users available

4.4 Type 4 – Goal-free evaluation of IT-systems in use

The fourth type is a combination of goal-free evaluation and IT-systems in use. This combination means that the evaluation is performed more open minded and that the object of evaluation is the IT-system in use (see table 5). Using an open mind means that the evaluator discovers different qualities of the IT-system independent of existing goals. The strategy is inductive (see section 2.2).

One major difference between this type and type 3 is that there are more data sources at hand. Besides the IT-system and descriptions of the IT-system there is interaction between users and the IT-system. Similar to type 2 (goal-free evaluation, IT-systems in use) this interaction can be observed. This interaction also results in an understanding and attitudes of the user regarding the IT-system. Interviews of the users’ understanding, attitudes and opinions are another possible data source. This type also offers possibilities for a broader participation than type 3 does. Besides the evaluator there are also users involved. This type could be chosen when a broad and deep evaluation is wanted and when there are more resources at hand.

One example of how this evaluation type could be performed is when there is a need for a deeper understanding of the IT-system’s strengths and problems. A qualitative analysis is performed. The evaluator could observe when the users interact with the IT-system. During the observation the evaluator could use a technique called think aloud (Monk et al, 1993). The observation can be combined with follow-up interviews. The gathered data could then be analyzed with grounded theory (Strauss & Corbin, 1998). The strategy could be iterative

which means that there are possibilities for theoretical sampling (ibid.).

Table 5: Goal-free evaluation of IT-systems in use

Main perspective	Open minded approach
What to achieve knowledge about	To gain a deeper and broader understanding of the IT-system itself, its role in the business and its social and organizational consequences
Data sources	The IT-system, observations of interactions, the users perceptions of the IT-system, the users pre-knowledge (IT-maturity)
Deductive or inductive	Inductive
Who will participate	Evaluator expert, users
When to chose this type	When a thoroughly evaluation is desired

4.5 Type 5 - Criteria-based evaluation of IT-systems as such

The first type is a combination of criteria-based evaluation and IT-system as such. This combination means that the evaluation is performed according to some predefined criteria and that the object of evaluation is the IT-system (see table 6). The evaluation perspective depends on the character of the criteria (see section 2.3). Using a criteria-based evaluation combined with studying IT-systems as such means that the evaluator wants to decide if the IT-systems' quality meets the criteria used. The strategy is deductive.

The data sources for this type are the IT-system itself, descriptions of the IT-system and descriptions of the criteria. This type has a low degree of participation. This evaluation type is performed without involvement from users or other stakeholders. This type could be chosen when a focused evaluation according to the chosen criteria is wanted or when there are fewer resources at hand.

One example of how this evaluation type could be performed is when an evaluator expert evaluates if the design of IT-system meets the specified criteria. The criteria act as a lattice and work thereby a support for both focus and limitation.

Table 6: Criteria-based evaluation of IT-systems as such

Main perspective	Depending on the character of the criteria
What to achieve knowledge about	The quality of the IT-system according to the perspective that is underpinning the criteria
Data sources	The IT-system, descriptions of the IT-system, descriptions of the criteria.
Deductive or inductive	Deductive
Who will participate	Evaluator expert
When to chose this type	When a focused evaluation is wanted, when there are less resources at hand, when there is no users available

4.6 Type 6 - Criteria -based evaluation of IT-systems in use

The sixth type is a combination of criteria-based evaluation and IT-system in use. This combination means that the evaluation is performed according to some predefined criteria and that the object of evaluation is the IT-system in use (see table 7). The evaluation perspective depends on the character of the criteria (see section 2.3). Using a criteria-based evaluation combined with studying IT-systems as such means that the evaluator wants to decide if the IT-systems' quality meets the criteria used. The strategy is deductive.

One major difference between this type and type 5 is that there are more data sources at hand. Besides the IT-system and descriptions of the IT-system, there is an interaction between users and the IT-system. Similar to type 2 and 4 this interaction can be observed. This interaction also results in an understanding and attitudes of the user regarding the IT-system. Interviews of the users' understanding, attitudes and opinions are another possible data source. This type also offers possibilities for a broader participation than type 5 does. Besides the evaluator there are also users involved. This type could be chosen when a focused but not limited evaluation according to the criteria is desired or when there are more resources at hand.

One example of how this evaluation type could be performed is when an evaluator observes and/or interviews users in order to decide if the criteria are met.

Table 7: Criteria-based evaluation of IT-systems in use

Main perspective	Depending on the character of the criteria
What to achieve knowl- edge about	To gain a deeper and broader understanding of the IT-system and the users perception the IT-system
What to study	The IT-system, descriptions of the IT-system, descriptions of the criteria, observations of interactions, the users perceptions of the IT-system, the users pre-knowledge (IT-maturity)
Deductive or inductive	Deductive
Who will participate	Evaluator, users,
When to chose this type	When a thoroughly evaluation is desired that is depending on the chosen set of criteria. When there are more resources at hand

5. Conclusions

In this paper, we have discussed and characterised six generic types of evaluation based on three strategies of how to evaluate and two strategies of what to evaluate. The evaluation types are generated from studying literature but also abstracted from empirical findings in evaluation projects. We have analysed the six evaluation strategies as ideal types.

We conclude that the ideal typical analysis has contributed to question some tight couplings between a goal-based evaluation and a quantitative process. In the literature, goal-based evaluation is traditionally often described as formal-rational, quantitative and focusing on measurable goals that often are of more technical and economical character. Our analysis shows that this must not be the case. It is possible to use a goal-based approach and a qualitative process (see section 2.1 and 4.2). We think that the confusion has to do with traditional

ways of looking at evaluation. Concepts like measurable, quantitative, goals and deduction are often clustered and related to positivism. On the other side, concepts like interpretation, qualitative and induction are often clustered and related to hermeneutics.

In this paper, we have tried to nuance the different approaches of evaluation. Metaphorically one can say that we have shown that it is possible to mix eggs from different baskets. Further, we have identified, explained, characterised and exemplified different evaluation types. The evaluation types are derived from a matrix and the purpose of the matrix is to support different choices of how to perform evaluation depending on the evaluation situation.

These different evaluation types can in a practical evaluation situation be utilised together in combined ways. They can be used in different stages, where evaluation results from the earlier stages inform the later ones. It might also be possible to combine some of these types in an integrative way with instant changes in attention. Goal-based, goal-free and criteria-based can be seen as three fundamental attitudes which can be applied in evaluative situations. An alternation between these attitudes might be possible to do during a combined evaluation process.

As further research we propose an analysis of how the different evaluation types can be combined (for triangulating purposes) and operationalized into an evaluation process model. These generic types might also be possible to use in order to characterize and assess existing evaluation approaches and methods. The generic types might also be helpful (as a conceptualisation of evaluation) when one is trying to integrate and combine different evaluation methods.

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