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COLLABORATIVE DEVELOPMENT OF PERFORMANCE INDICATORS FOR IT APPLICATIONS

Abstract. Designing performance indicators for measuring the value of IT supported processes is an important and recurring task in controlling and management. Involving different stakeholders and perspectives in the development of an evoked set of performance indicators is the key to improve the quality and acceptance of performance measures. We apply an approach for designing repeatable processes for the development of such performance indicators as high-value collaborative tasks using techniques of the collaboration engineering. We show how this collaboration engineering approach can be designed (building on the collaboration process design approach by Kolfschoten et al. (2006)) and how it needs to be extended for designing a performance measurement tool for IT applications. The case describes the development process within a major automotive manufacturer for a reporting application. It shows that the approach is promising to avoid classical problems of the performance measurement, e.g. conflicting interests of various stakeholders. The developed concept provides a collaborative approach for companies to develop key performance indicators in a politically challenging environment and to generate a valid performance measurement tool. The results suggest that the outcome of the workshop provides a broad variety of indicators, which represent different aspects of benefits of the application. The use of collaboration engineering approaches for the field of performance measurement delivers promising results and offers interesting options for further research, i.e. standardization potentials for collaborative performance tool development and requirements of corporate environments.

Keywords: Workshop, Value of IT, Performance Measurement, Performance Indicators, Collaboration Engineering, Group Support Systems

1 INTRODUCTION

Do IT investments lead to sustainable competitive advantages? A current study shows that more than 80 percent of CIOs and IT-executives believe that the difficulties in measuring the value of IT have a negative impact on IT-budgets, and lead to internal communication problems regarding the productive efficiency of IT performance within companies (n.n. 2007). Due to the existing difficulties in quantizing the value of IT, many companies focus on cost aspects (Horvath 2001). This approach does not incorporate the fact that IT has no direct impact on the value of a company, that is, IT supports business processes and business models, thus making it almost impossible to measure its effects solely with financial indicators (Krcmar 2009).

This justifies the necessity of developing performance indicators which measure multi-dimensional IT effects on business processes (Reichwald, Möslein et al. 2000). As there are many performance measurement instruments, e.g., the balanced scorecard (Kaplan and Norton 1992), which mainly incorporate strategic objectives, management tends to choose strategic performance indicators without proper consideration of tactical and operational needs. This leads to acceptance and quality issues, as these perspectives are not taken into account. As Harrington has said, "Only what gets measured gets done" (1991). Hence, a misfit between performance measurement and a required set of indicators leads to a structural problem in measuring performance and identifying optimization potentials.

Thus, it is necessary to include stakeholders with different perspectives and knowledge within the development process. Unfortunately, one of the biggest challenges in developing an effective measurement approach is to actually use information of relevant stakeholders, thereby avoiding political and hierarchical effects during the development process (Müller, Ahlemann et al. 2010).

This calls for a systematic approach to developing performance indicators - one which is adaptable to different requirements and technologies (Irani 2002). Here, systematically designed workshops represent a highly promising tool. Thereby, stakeholders can be actively integrated in order to support the development process in a structured way.

To make the approaches easily reproducible and to get a reliable structure, i.e. a generally applicable modularized approach, the workshops need to be highly scaffolded and be supported by use of technology. This can easily be provided by group support systems. They foster systematically designed workshops and the development process by providing anonymity, store capacity for created knowledge, and equal rights to every workshop participant. Also, the afore-mentioned challenges of avoiding political conflicts can be adequately addressed in workshop environments, where it is possible to increase visibility of such conflicts and thereby help to raise the acceptance of the performance measurement tool (Lu, Cai et al. 2000).

The approach is conducted for a major German automotive company, which has recently introduced a reporting system. The system includes various reports, such as HR reports, production reports and is used by a wide variety of departments, such as controlling, HR, production and the management itself.

2 COLLABORATION ENGINEERING WITH GROUP SUPPORT SYSTEMS FOR WORKSHOP DESIGN

To integrate relevant stakeholders and to gain access to their knowledge we chose a collaborative approach. Particularly during the phase of idea finding, collaboration benefits from heterogeneous groups, a group with participants from various areas or departments. The knowledge and ideas from different stakeholders will be incorporated in the collaborative process. Nonaka (1994) argues that one prerequisite for knowledge creation and innovation is requisite variety. Furthermore heterogeneous groups are suitable to process ideas in workshops, Jackson (1992) states "heterogeneous groups are

more likely than homogeneous groups to be creative and to reach high-quality decisions". Also the results of a collaborative setting, where a group consisting of various stakeholders worked together, are more likely to be accepted (Hoffman and Maier 1961).

Collaboration is a way of solving complex tasks as a joint effort to reach a common goal, where a single individual is unable to cope with the complexity of a task or where one performs poorly. To ensure better solutions and an effective collaboration, a structured process needs to be designed (Briggs et al. 2003; Kolfschoten at al. 2009). The aim of collaboration engineering is to create collaboration patterns which can be applied to recurring processes (Briggs et al. 2006). Kolfschoten et al. (2009) divide the collaboration process design approach into the following steps:

- *Task Diagnosis*: The goal(s), requirements and constraints are elaborated with the stakeholders. This step consists of the Task, Stakeholder, Resource and Facilitator/Practitioner Analysis.
- *Task Decomposition*: The task needs to be decomposed into activities corresponding to the general patterns of collaboration. There are two ways of decomposition, pattern and result decomposition.
- *thinkLet Choice*: Activities will be matched to thinkLets. A thinkLet design pattern is „a named, packaged facilitation technique that creates a predictable and, repeatable pattern of collaboration among people working towards a goal" (Kolfschoten, Briggs et al. 2006) and can be used to facilitate reusable patterns of collaboration (Briggs and De Vreede 2009).
- *Agenda Building*: The agenda includes the sequence of thinkLets and activities, planning activities, questions and instructions. It is often represented in specific formats, i.e. facilitation process model, which includes all required details of the collaborative process.
- *Validation*: Before the process will be implemented it can be tested in various ways (i.e. pilot testing, walk-through, act it out, expert evaluation) and changes can be made to the design.

Group Support Systems (GSS) render collaborative settings more efficient and effective. Prior research has shown the advantages of GSS which tend to reduce costs and facilitate participants to perform activities faster (Grohowski, McGoff et al. 1990; Boehm, Grunbacker et al. 2001). Furthermore Zigurs and Buckland (1998) point out that GSS technology can provide communication support, process structuring and information processing. All activities performed throughout GSS can be carried out anonymously. This leads to various advantages. On the one hand anonymity in collaborative settings mitigates status differences and thus frees participant from fear of contribution; on the other hand group pressure on individuals lessens (Flanagin, Tiyaamornwong, O'Connor, & Seibold, 2002; Nunamaker, Briggs, Mittleman, Vogel, & Balthazard, 1996).

3 DESIGNING COLLABORATION FOR PERFORMANCE INDICATOR DEVELOPMENT

We designed the process based on the collaboration process design approach provided by Kolfschoten et al. (2009). The objective was to develop at least ten performance indicators for an IT reporting system (Task Diagnosis). Goal was to develop key performance indicators, which comprehensively show the value of the reporting system. Thereby, a set of qualitative and quantitative factors should be considered. Finally, the indicators should prove the economical use of the system and should support the IT department in their argumentation for further investments into the system. The process was scheduled for almost seven hours, including breaks. In prior meetings possible participants were identified to execute the collaborative task, and a GSS was supplied. Adequate participants were identified by interviews with a high-ranking member of the IT department. The participants were key users, which meant that they were high-frequent users of the system. Furthermore they had detailed knowledge about functions and performance characteristics. Two participants worked in the IT department, including the head of the department. Three participants were part of the controlling department and another two participants were part of the production department. They were chosen because of their profound knowledge of the company's processes as well as their long-term experiences with the system. In the following step, we subdivided the task with pattern decomposition (Briggs et al. 2006)) into six activities (Task Decomposition) (Figure 1).

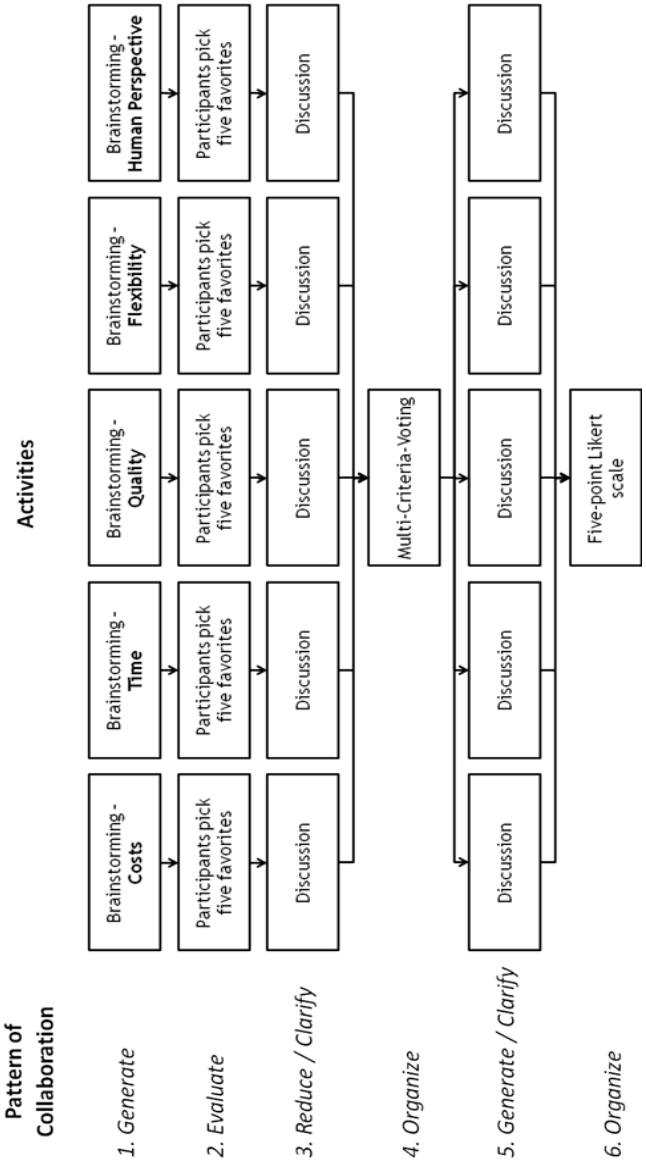

Figure 1: Workshop Activities

To organize the output, we chose the multi-layer-systematic approach by Reichwald et al. (2000). The approach includes five different categories, namely, Costs, Time, Quality, Flexibility and Human Perspective. Furthermore, it includes structural-based layers, including an individual layer, a departmental layer, a process layer and an

organizational layer. This system was developed to support the process of identifying relevant performance indicators for various IT-supported organizations and as it can be modified for various needs in the business context, the approach was chosen for the survey at hand.

Based on the categories (Costs, Time, etc.) five anonymous brainstorming sessions were planned to identify IS benefits. The choice of GSS limited the range of supported thinkLets. Since unsupported thinkLets were not necessary for our setting, this limitation had no impact on the workshop (thinkLet Choice). Despite the restrictions on group size and expected ideas (Briggs and De Vreede 2009), we chose OnePage for the brainstorming activity. This thinkLet allowed participants to create ideas which could be shared immediately with the whole group. The benefits of the OnePagethinkLet were twofold: participants could get a deeper understanding of IS benefits by reading entries, and they could create new benefits based on previous contributions. Given the limited duration of the workshop and the intended objective, an easy and fast way to rank the brainstorming results was sought. CheckMark (Briggs and De Vreede 2009) allowed specifying a maximum of ideas to be checkmarked; thus, every participant could choose anonymously his (in our case) five favorite IS benefits after each brainstorming session. Subsequently, the ten most favored IS benefits were discussed to gain a common understanding among the participants, to remove duplicates, and identify further influential benefits.

The five reviewed and revised lists with benefits needed to be filed in the multi-layer-system. We chose multi-criteria voting to allow participants to categorize the benefits of each category to the layers.

The following discussions were conducted without GSS. Each IS benefit needed to be discussed in the whole group to transform the identified benefit into a corresponding performance indicator. Before closing the workshop, the most significant performance indicators needed to be identified by participants via single-criteria-voting.

Based on the chosen thinkLets and activities, we developed the agenda for the workshop (Agenda Building) presented in Table 1.

Table 1: Workshop Agenda

Time	**Activity**	**Aim / Output**
10:00	Workshop introduction – agenda and goals	Structure of the workshop and goals are known
10:20	Brief introduction of the used GSS incl. test-brainstorming and -voting	Participants can use the software
10:35	Brainstorming – Costs	1st list with benefits (Costs)
10:50	Pick your 5 favorites – Costs	1st prioritized list with benefits (Costs)
11:00	Discussion – Costs	1st reviewed and revised lists (Costs)
11:20	Brainstorming, Pick your 5 favorites, Discussion – Time	2nd reviewed and revised lists (Time)
11:50	*Break*	

Time	Activity	Aim / Output
12:45	Brainstorming, Pick your 5 favorites, Discussion – Time	3rd reviewed and revised lists (Quality)
13:15	Brainstorming, Pick your 5 favorites, Discussion – Flexibility	4th reviewed and revised lists (Flexibility)
13:45	Brainstorming, Pick your 5 favorites, Discussion – Human Perspective	5th reviewed and revised lists (Human Perspective)
14:15	Introduction multi-layer-systematic	Participants understand the multi-layer-systematic
14:25	Multi-Criteria-Voting	Multi-layer-systematic with benefits
14:45	*Break*	
15:00	Discussions	Multi-layer-systematic with performance indicators
16:35	Single-Criteria-Voting	Prioritized list with performance indicators
16:45	Summary and farewell	
17:00	*End*	

After developing the collaboration process, we validated (Validation) the workshop by pilot testing (Kolfschoten et al. 2009). A test with five participants was designed to detect flaws within the presentation and collaboration. As a result, minor changes were made to the presentation, and the brainstorming questions were refined.

The final workshop was carried out with seven participants, all of whom were employees from different departments of a German industry company, i.e., production, IT and controlling. For the first part of the workshop, we used laptops which ran GroupSystems' ThinkTank as GSS. An experienced moderator guided the participants through the workshop, supported by a facilitator who controlled the process and collaboration software. Two employees provided help for participants, and were also responsible for the equipment of the room and catering. For the last part of the workshop, which was not supported by GSS, we used a projector and charts.

We began the workshop with information on the aims and activities, as well as an introduction to the GSS tool. The first activity of the participants was to create IS benefits (Generate pattern) based on given categories. A brainstorming question was presented, and the moderator gave 'impulses' to further activate the participants during the brainstorming. The benefits were ranked by choosing five favorites (Evaluate pattern) in the second step. A discussion followed to review and revise the benefits (Reduce and Clarify pattern). The brainstorming, rating and discussion were repeated for each layer (Costs, Time, Quality, Flexibility and Human Perspective). Five reviewed and revised lists with IS benefits were the output of the first three steps.

In the next step, the participants filed the IS benefits via multi-criteria voting to the layers of the multi-criteria-systematic, a system whereby participants could also allocate an effect to more than one layer. Performance indicators were developed based on the

prior results in the following discussions. Indicators had to be quantifiable, be based on an effect, and be filed in the layer of the multi-layer-systematic. Unfortunately the discussion to fill in the performance indicators in the Multi-layer-systematic took longer than expected and we had to cut this activity after two-third was done. At the end, the moderator summed up the results and closed the workshop.

The identification of the most significant performance indicators had also been planned as final activity in the process. Due to the time constraint and long discussions of the participants we decided to adjourn this activity after the workshop since it is not necessarily a collaborative task and each participant has to identify the significance by her-/himself. After the workshop the results were reported to the participants including a questionnaire to determine the significance of each performance indicators.

4 RESULTS

In preparation of the final evaluation, the results were checked in terms of clarity, comprehensibility and clearness. The aim of the workshop was to develop a comprehensive set of factors to evaluate the benefit of the reporting system. As the acceptance of the results by the participants is an important outcome of the workshop (cp chapter 3), all indicators were then evaluated by participants in an online questionnaire after the workshop, using a Likert scale from 5 = very relevant to 1 = not relevant. To reduce complexity and to estimate the value of the created indicators, in the following the focus is on the indicators evaluated by participants as being the most relevant (Top 10) and the least relevant (Bottom 5).

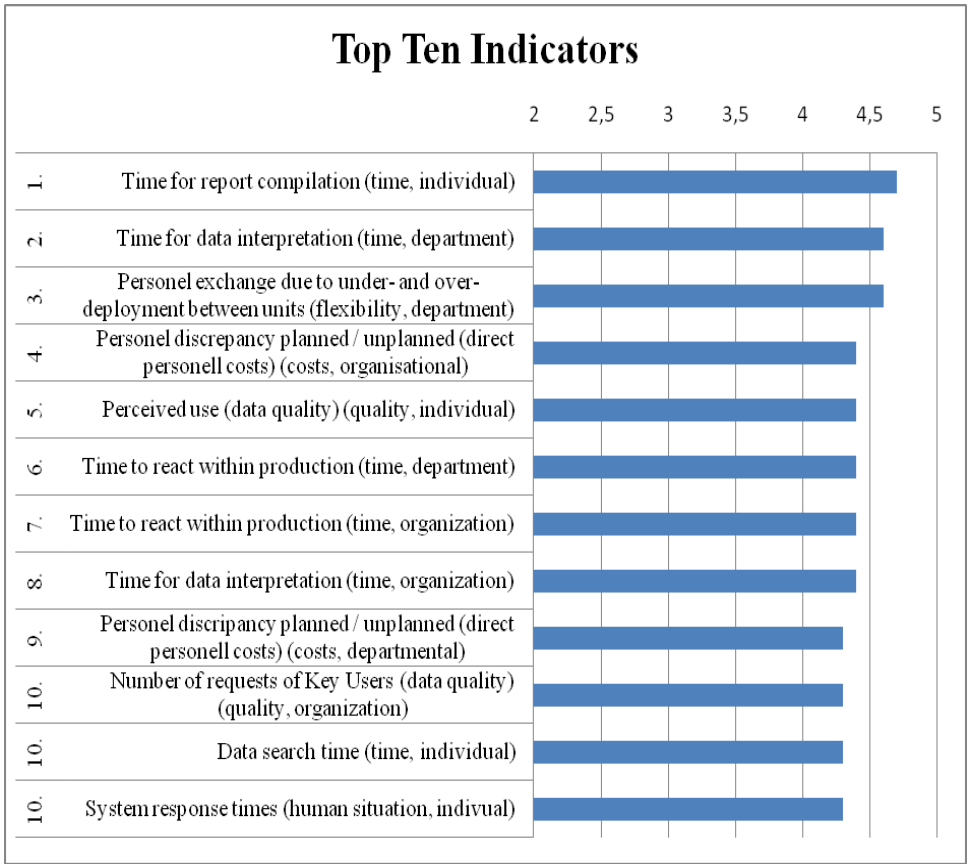

Figure 2: Top Ten Indicators evaluated by the participants

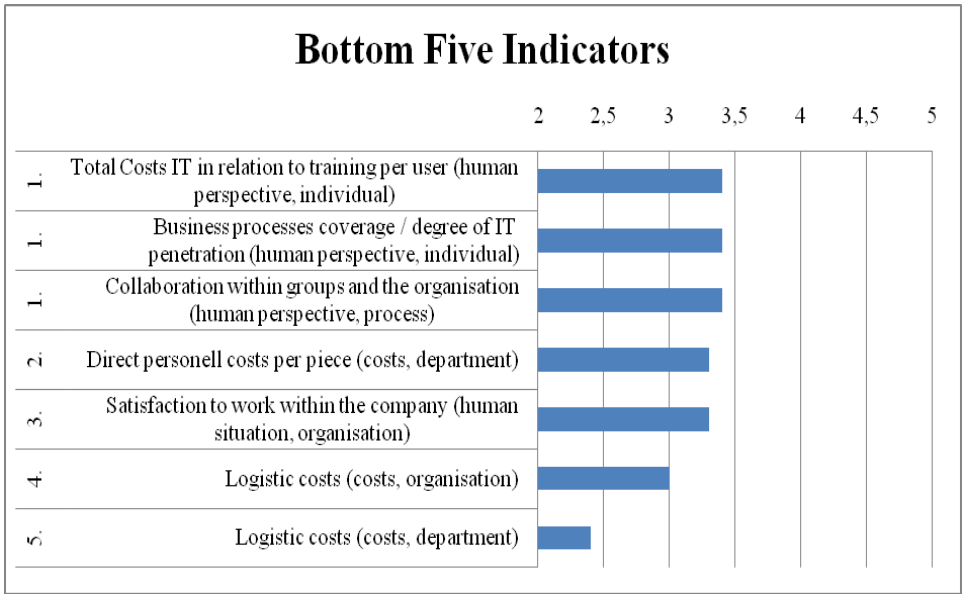

Figure 3: Bottom Five Indicators evaluated by the participants

The top ten results (Figure 2) indicate a wide range of indicator frequencies. Different layers were chosen, a differentiated evaluation of the IT-system and a comprehensible analysis of the perceived usefulness are possible. As the most popular indicators were the ones which are easy to understand and to measure, i.e. mostly expressible in time units, it can be argued that the group chose indicators which are easy to operate. Indicators of the time category dominated the ranking, as six indicators came from this category. The indicators from categories: flexibility (position 3) and human situation (position 10) are also measurable in time units. Only one indicator (position 4) belongs to the category "costs." These results seem surprising, as the authors expected a higher share of financial indicators within the Top 10 indicators as the company is mainly steered by financial indicators. Obviously, the participants, representing common users with operative tasks from different departments of the company, deemed other indicators to be more applicable to measure the IT value. The mixture of categories and levels and the specific design of the indicators shows the general necessity of involving experts from different parts of the company.

The Bottom Five ranking (Figure 3) is dominated by indicators of the human situation category. This is easy to explain by the high number of operative participants with a strong background in production and controlling. The influence of the participants composition is strongly shown, which has to be considered before the workshop starts. A possible consequence of a certain stakeholder group might cause seriously acceptance problems after the results are presented. The "soft" human situation factors do not seem to be accepted, as indicators which only can be measured subjectively lead often to

controversial assessment about their validity. Remarkable is that the cost category is strongly represented within the ranking. Again, a strong hint is thus given that financial indicators do not seem to be as important as assumed in this context. This result shows the importance of a collaborative design. The combination of expert knowledge and evaluation of the indicators gives a strong hint, which indicators should be used to get a comprehensive overview of the value of the IT application.

After the workshop all participants gave feedback on a 15 item questionnaire. Three topics were covered, questions regarding the moderation, the results and the workshop design on a Likert-scale, ranging from 5 = totally agree to 1 = totally disagree. The moderation was evaluated thoroughly well (4,86), questions regarding the workshop design slightly worse, but still good: The conduction of the workshop was evaluated with 4,86, the conduction of the activities with 4,43 and the satisfaction with the methodology was evaluated with 4,57. So far, the results were promising. Unfortunately the results were evaluated worse. The satisfaction with the results were evaluated with 3,71. This was the result of the time consuming workshop design, which lead to the truncation after performance indicators for 3 categories were developed. The lasting two categories were filled afterwards, using the IS benefits which were developed by the participants in the workshop setting. This value can be considered under the given circumstances (truncation, time consuming design) as still good, improvements on the workshop design seem necessary though. In addition, the participants had the chance to leave comments at the end of the questionnaire. Main point of criticism was the complexity of the workshop and the time consuming design. On the other hand, nearly all participants stated that the workshop helped to structure the process and that the techniques helped to get acceptable results. Therefore, the authors assume that the participants would have stated a greater satisfaction, if all results could have been developed within one day.

The workshop resulted in developing performance indicators in a collaborative manner, and the collaboration engineering process helped the participants to follow a structured process. Various perspectives and knowledge of different stakeholders were thus integrated to achieve a multi-dimensional measurement approach. Surprisingly, most of the *best* evaluated indicators and three of the *worst* evaluated indicators were financial -a seeming contradiction of the actual dominance of financial performance indicators.

Overall, it could be shown that a collaborative design supported the process of identifying a broad set of indicators integrating various stakeholders. The implicit knowledge of the stakeholders could be used. At the same time, conflicting interests could be moderated and upcoming problems regarding the measurement of certain characteristics could be solved. The discussion and development of results created a transparent process for all participants, making sure that all participants had the same understanding of the development process and the resulting indicators. The evaluation of the results showed, that the time consuming workshop setting created problems. The presentation and efficiency of the development of the results has to be improved, the approach can be considered as promising though.

5 LIMITATIONS & OUTLOOK

Two major limitations of the developed concept for key performance indicator development need to be taken into consideration. First of all the development of an IT performance measurement is complex and difficult. Therefore it has to be shown that the presented concept is generally applicable to different scenarios. This can be considered as one of the main tasks for further research. Furthermore, the workshop concept was designed to develop a comprehensible evaluation system based on scientific findings. As it turned out, for some participants the activities were not easy to understand, and thus it is possible that some misunderstandings affected the quality of the results.

Overall, the development of performance indicators, based on collaboration engineering techniques can be considered as a promising approach. The workshop helped to collect implicit expert knowledge and to create a common understanding of a complex problem, i.e. development of a fair evaluation of an IS application. Heterogeneous participants helped to create results which represented different stakeholders within a company. At the same time upcoming conflicts could be solved by moderation techniques. Further research is necessary though. A comprehensive workshop design is extremely time consuming. Hence, it seems necessary to find ways to make the workshop conduction more efficient. In this context it seems promising to focus on IT support, to accelerate the conduction or maybe even enable an online based conduction. Research in the field of online based indicator development needs to focus on ways to design a productive development of indicators, ensuring acceptance and quality of the results. Additionally, further research should be conducted on the relevance of the developed indicators from an operational perspective, and the approach should then be implemented in other contexts to validate the relevance of the developed results.

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