Fraunhofer Institut
Experimentelles
Software Engineering

Teamware for Participative Experience-Based Business Process Inspection & Introduction: The indiGo Project

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Submitted for publication to Journal
Distributed and Parallel Databases
January 2004 Special Issue on
Teamware Technologies

IESE-Report No. 031.03/E
Version 1.0
April 28, 2003

A publication by Fraunhofer IESE

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Abstract

Up-to-date and used business processes are of utmost importance for organizations to keep in touch with rapid changing market demands. Nevertheless, many organizations neglect these processes and leave the knowledge about them in the heads of their experts. To create accepted and reliable business processes various experts and users have to be integrated into the definition and inspection phases of business processes. In this paper, we present the indiGo framework for moderated eParticipative Process Learning and Inspection, where potential process users and process experts collaboratively develop business processes supported by experiences from similar and applied business processes. In indiGo, moderation is used for team coordination as well as conflict resolution. Participation and decisions in process improvement are supported through experience management techniques. The moderated eDiscussions are used to collect, resolve, and integrate different views on business processes as well as to find errors and obstacles in the process application. Additionally, we present first results of a long-term case study for the evaluation of our methods. The results indicate that processes introduced, inspected, and modeled with process user participation results in process models with higher acceptance and higher perceived quality.

Keywords: teamware for process inspections, process introduction, process improvement, process inspection, eParticipative process learning, experience management, indiGo

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1 Introduction

The approach of the BMBF funded project indiGo is to increase their applicability as well as support their inspection and improvement – especially in the Software Business. It offers members of an organization to engage in moderated discourses about the structure, content, and execution of a process model.

As depicted in Figure 1, the process improvement lifecycle in indiGo starts with a plain process model ("original process model"). This process model is annotated, discussed, and enriched with lessons learned by the members of an organization to be finally revised into the applicable process model based on corporate goals. To support the evolution of process models in an organization, indiGo offers an integrated, comprehensive set of methods and a technical infrastructure as a joint effort of two German Fraunhofer institutes: Fraunhofer IESE (Institute for Experimental Software Engineering) in Kaiserslautern and Fraunhofer AiS (Autonomous Intelligent Systems) in Sankt Augustin.

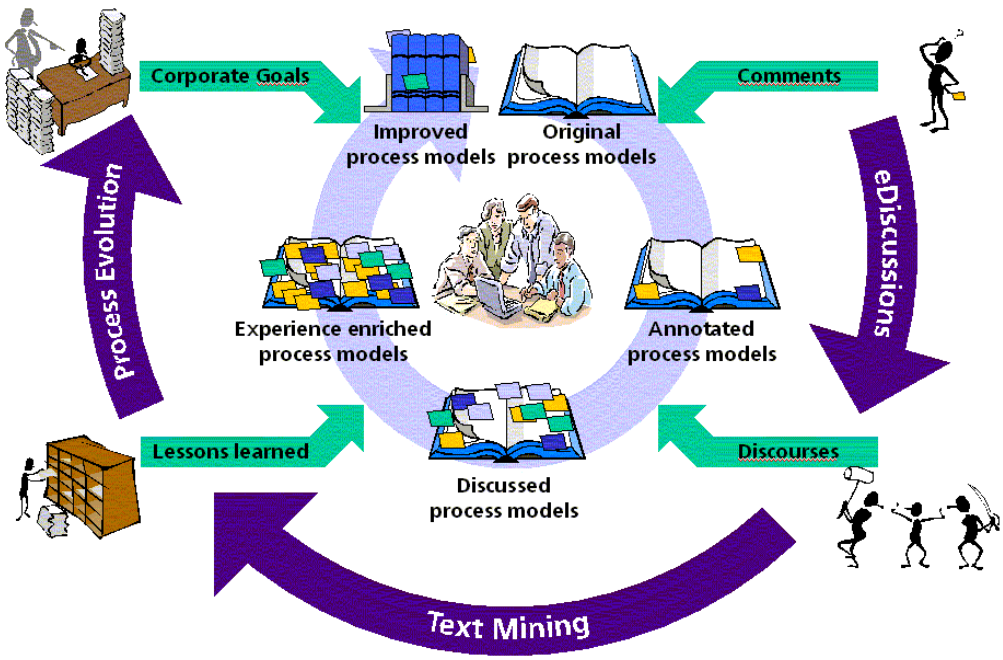

Figure 1 The process lifecycle in indiGo

Both the developed methods and the indiGo architecture were evaluated mid 2002 in a case study with various business processes carried out at IESE.

In section 2 we introduce the indiGo framework and include an example to clarify the indiGo approach. Thereafter, related work in our context is given in section 3. Section 4 and 5 are concerned with the methodology and technology of indiGo while Section 6 illuminates the evaluation of indiGo in a realistic organizational environment. Finally, we give a short summary and outlook on future work.

2 indiGo Lifecycle by example

The key objective of indiGo is to develop and sustain process models that are accepted by the organizations members, adapted to organizational changes on demand, and continuously enriched with experience from the operating business of the organization. It reaches these goals by offering members of an organization to engage as a team in moderated discourses to inspect and improve a process model and presents process-related lessons learned from similar applied process models, fitting to the current project context. Completed discourses and comments are analyzed and summarized to improve related process models and capture lessons learned from the participants.

According to the process lifecycle in indiGo from the previous section the three phases of a process model in an organizational context is depicted in Figure 2.

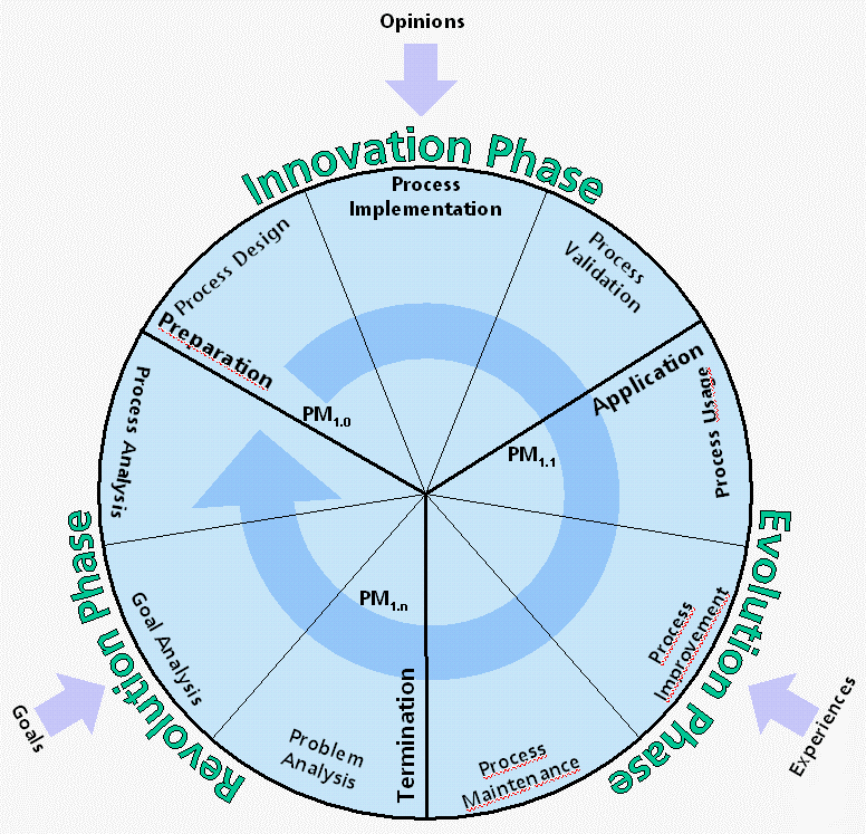

Figure 2 The process lifecycle in an organizational context

The *innovation phase* of a process model is used for the "theoretical" discussion of the process and its model in order to define, inspect, or introduce the model to the participants. In the *evolution phase*, the reworked processes model is applied, and experience about processes execution are recorded. Compared to the discussion in the innovation phase, the discussion in the evolution phase has a lower complexity compared to the discussions in the innovation phase: Fewer discussions threads are discussed in parallel (usually only one). Furthermore, discussions tend to be shorter (e.g. in a question / answer style or lessons learned about the process). This discussion do not need to be supported by the responsible process owner and do not need a dedicated moderator Therefore, the model will not be subject to major revisions as it is currently in use. Finally, in the *revolution phase*, if severe problems or organizational changes occur, information about the rework of a process model is collected that serves as input to the next innovation phase. Strategy processes care about the financing of and goal-setting for process learning. An example of Strategy processes is planning the build-up of the process models used by the organization.

2.1 An example

For the better comprehension of indiGo the remainder of this section is dedicated to an exemplary application of indiGo. Imagine a senior project manager who is responsible for the process "project acquisition". He can use indiGo in three phases of the process lifecycle: to develop and introduce the process (innovation phase), to evolve it during its application (evolution phase) and to rework it before a major revision (revolution phase).

In the *innovation phase,* he has the option to either rework an already existing process model or create a new one from scratch. Let's assume he created a process model based on his own opinions and asked a colleague to check the result. With indiGo he has the opportunity to extract experiences (like known organizational problems) from a knowledge base while developing or inspecting the model and publish it to gain feedback from real process users.

The first step for him and the moderator is to define several goals for the discussion like: "Should the payment method made more explicit or should every project manager negotiate his own payment method with the customer?" Subsequently he publishes the process model on indiGo and defines a team of participating process expert and users. Thereon every participant inspects the process model based on the given goals to understand, comment, and enrich it with their own experiences. Simultaneously they look for typing errors, evaluate the ease of use, or make a dry-run of the process. Each participant can attach private annotations to the process and discuss it with other participants. The moderator coordinates the team, resolves occurring conflicts, guides the team

toward a consensus, summarizes the discussion , and extracts ideas and experiences assisted by text mining techniques.

Finally the project manager uses the compiled ideas, consenses, and experiences from the discussions to rework the discussed process model. After the finalization of the process model, he publishes it on the corporate intranet (e.g., indiGo or CoIN-IQ) and informs all concerned parties of the new improved and "official" process model.

In the *evolution phase,* the goals of the discussion are basically the same - observe the running process, fix minor problems and collect experiences (i.e., lessons learned) and opinions about the application of the process model. However, the discussions are invoked on demand, i.e., when a questions or a problem arises.

For example, assume another Project Manager has to compose an offer for a subcontract from a small start-up, using a subprocess of project acquisition devoted to contract creation. It suggests that the payment method should not be too fine-grained in order to minimize administrative overhead. This Project Manager feels uncomfortable with that guideline. The year before he had had a subcontract with a start-up, which got bankrupt. As a result, the last payment was lost although the work has been completed. Therefore, this Project Manager prefers to design the new offer with a frequent payment schedule, at the cost of more overhead in the administrative unit. Clearly, he should not modify the organization's process model for industrial project acquisition on his own. He would probably attach a personal note (i.e., annotation) to the subprocess and initiate that her experience is recorded as a lesson learned and shared with her colleagues through the discussion forum and then condensed into a lessons learned. If the person in charge of the process model likes the experience, he can use the information from the discussion forum in order to change the process model.

After some time in operation, the process model is subject to substantial changes and enters the *revolution phase*. The underlying cause for this review can be caused by changed business objectives, changes of laws, or other environmental changes. Let's assume that the introduction of new accounting software is planned that changes the responsibilities for data input and would result in a process model that is not applicable any more. The new responsibilities and process changes are discussed using the indiGo platform similar to the introduction phase.

Either way, if a new solution or consensus turns up, it will be added as a new experience to the experience base. The person in charge of the process model is pointed to the suggested improvement that he uses as a decision support for periodical improvements to the process model.

2.2 Advantages for Process Users and Process Owners

When indiGo is used during the innovation, evolution, and revolution phases as described before, several advantages arise for both the users of a process model as well as the process owners. The following advantages are based on the usage of the teamware features of indiGo, that allows an asynchronous and distributed contribution of participating members of the team.

- More people can participate in the modelling and inspection of process models and minimize potential problems that could occur during the execution of the process model.

- Another advantage is the access on a comprehensive set of experiences from a knowledge base. They help process owners to create and improve a process model as well as to support process users in the execution of the process by providing problem descriptions, experiences, solutions and decisions from similar past process applications.

Furthermore, indiGo minimizes and can even eliminate time spent in – sometimes unproductive – process modeling meetings. These meetings are replaced or minimized when discussions and decisions are transferred in the virtual space of eDiscussions. The reduction of meeting time can be a strong motivation for participating in eDiscussions and therefore is communicated to potential participants of eDiscussion.

3 Related Work

One central issue in knowledge management, decision support, and teamwork is how to offer the right knowledge at the right time. As the domain of indiGo is based on process models, they form the backbone for knowledge delivery. While applying a particular process model, members of the organization find supplementary knowledge with regard to the users' current project context. This supplementary knowledge is provided through associated discussions in the users' groups, his private annotations and of course records lessons learned from other projects. In the remainder of this section we discuss several related systems for participative process learning as realized by the indiGo approach.

As a preliminary conclusion, indiGo is more comprehensive than other approaches to organizational process learning [Tau00, Berg01] and distributed knowledge management because it bridges the gap between informal, communication-oriented knowledge and formal, organization-oriented knowledge and provides a socio-technical solution that covers individual knowledge usage as well as social knowledge creation.

The related work in the area of process learning can be subdivided into discussion group software, collaborative modeling of business processes, process model related discussion and experience capturing as well as lessons learned systems. Each of this area is presented in the following with one or more examples. (For a more detailed overview from a technical perspective, please refer to [Alth+02].)

Concerning *discussion group software*, this area itself can be subdivided into three sub-areas that are relevant to process learning: consensus building, collaborative problem solving and document review. Since all these areas can be supported more or less by conventional web-based discussion groups or newservers, examples are only given for systems specializing in one of the subareas. For consensus building, i.e., deciding about a disputed topic, the German town Esslingen acts as an example from eGoverment [Märk+02]. Concerning collaborative problem solving, i.e., several people work on solving a problem, there are examples from general decisions making like Compendium [Comp03], or dedicated eLearning systems like WBT-Master from the coronet project [AnPf02]. As third sub-area, examples for document review software are D3E [D3E03], which allows the discussion of documents as a whole or in sections.

Tools for *collaborative process modeling* allow locally and temporally distributed persons to design a process. A commercial example is the ARIS collaborative suite from IDS-Scheer [ARIS03]. CHIPS [HaWa99] from Fraunhofer IPSI offers

additional support for process execution by linking process instances with resources on BSCW servers.

Examples for *process annotating* systems are a combination of the Electronic Process Guide with the discussion software page seeder [Scot03] and the WESPI system from DaimlerChrysler [vHun00]. Both of them allow to discuss process models, The latter also allows to create frequently asked questions lists based on email contributions.

Finally, decision support *lessons learned* systems capture experience. Example that capture experience from software engineering project are CoIN-EF [Deck+01] and the Lids System from Daimler Chrysler [vHun00].

4 Methodology

As depicted in Figure 3, the indigo methodology consists of five methods. The introduction method is used to instantiate an indigo system in a new organization. How an organization can accomplish process improvement and enhancement using the indiGo platform (its technical side) is the core of the Process Learning method. The Process Learning Methods encapsulates the eModeration-, Text-Mining- and Process-Evolution-Method by proving a framework for initialization and results handling. Each method is described in one of the following subsections.

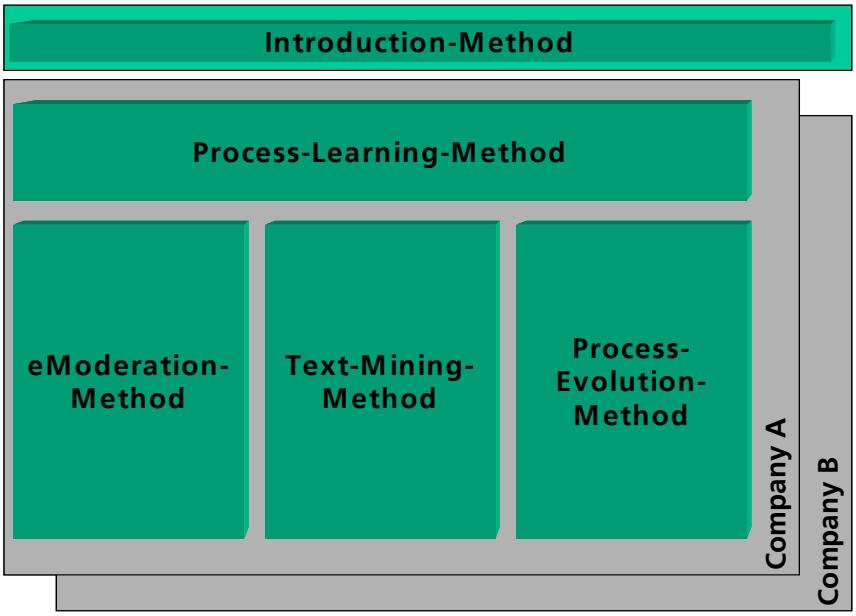

Figure 3 Overview of the indiGo Methodology

4.1 Introduction Method

Task of the Introduction Method is the instantiation and adaption of the other methods to the need of a certain organization. This enables a quick, but controlled start of process learning to use the dynamic of change in the beginning. On the content level, the Introduction Method first cares about the association of organization members to process learning roles. Second, a plan for the bootstrapping introduction of the following methods via process discussion is set and executed.

4.2 Process Learning Method

The Process Learning Method guides the process learning efforts performed within an organization. In particular, it coordinates the actions performed by the eModeration-, Text-Mining and Process Evolution methods. It is represented as a process model and thus itself subject to process learning. The two central parts of the Process Learning Method are presented in an overview in the following: (a) the role model, which describes the general responsibilities for process learning and (b) the Process Learning processes, which coordinates the actions of those roles.

The *role model* creates an abstraction layer that allows assigning organization members to a role without the need to change the process where this role is involved in. Among others, the key roles involved in the process learning efforts are the members of an organization, the moderator of process discussions, the process owner and the process author. The members have the task to discuss the process models, report problems in process execution and provide experience relevant for the processes. The moderator facilitates the discussion of the members of the organization and summarizes the result of a discussion. The process owner is responsible for a set of processes, and thus allowed to take decisions about the definition and content of a process. The process author creates and maintains the process model. If not performed by the same person, the process author prepares models and options to be decided by the process owner. These roles are supported by the EF team [Feld+00], which acts as a backbone and service provider for process learning.
Based on this role model, the *Process Learning processes* coordinates the actions of process learning. One major action is to initiate process-related discussions and fed their results back to the process model and to capture the resulting lessons learned. Furthermore, these processes ensure that problems appearing during process execution are (a) directed to the responsible member of an organization and (b) that the solution is preserved as lessons learned.

The process learning processes are divided into three categories: core, strategy, and support processes. Core processes are about the creation and evolution of the process models. Their structure – according to the three phases of the process model lifecycle from the previous section is depicted in **Error! Reference source not found.**: the innovation, evolution and revolution phases.

Strategy processes care about the financing of and goal-setting for process learning. An Example of Strategy processes is planning the build-up of the process models used by the organization. Finally, support processes describe the internal actions performed by the organizations members responsible for process learning. An important example of such processes is the feedback session performed at the end of the introduction phase, which aims on the improvement of the process learning processes.

4.3 eModeration Method

eModeration is the part of the indiGo methodology to keep the eDiscussions running in order to focus the discourse on the predefined goals and elicit experiences from the participants. Since this part of the indiGo Methodology is dedicated to using discussion groups for consensus building und problem solution about business processes, it is described in more detailed in the following.

The eModeration starts when the process author is ready with the first approved draft of the process model and assigns the eModerator. As input the eModerator receives the process model and context information about the why, who, how, whom for and what for the process is created or changed. Based on this information, the eModeration Method takes care of the full eModeration lifecycle (Figure 4).

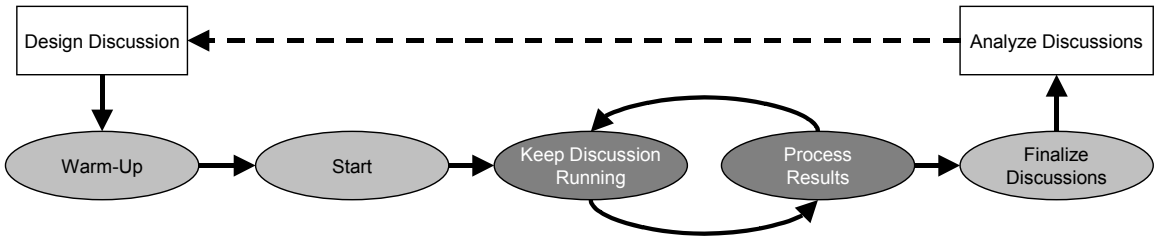

Figure 4 The eModeration Lifycycle

The lifecycle starts with the design of the discussion. The questions clarified in this phase are: (1) Which topics like open questions from process modelling should be discussed (and answered during the discussion. (2) For which members of an organization is the discussed process relevant, thus being potential participants? (3) When and how long are these participants available? (4) Should the participant only give their opinion about the process (consultation) or should they are allowed to make decision ("real" participation)? (4) Should some parts of the discussion be performed in meetings, and how are the results of these meetings transferred to the discussion and vice versa? (6) Will the discussion structured into phases (e.g. brainstorming, detailing, decision), and how long are these phases?

In the "warm-up" step, the participants are invited to the discussion. If needed, they might be introduced to each other and will be given a short introduction to the ePINS. In any case, they should be reminded of the netiquette, which is a set of rules about the expected behaviour of participants. In the start step, the eModerator mentions the parts of the discussion design relevant to the participants like duration of phases and topics to be discussed. Then next two steps are about keeping the discussion focussed und lively and are repeated as needed. "Keep discussion running" is about stimulating contributions by open questions or by inviting experts. It also includes focussing participants deviating

from the discussed topics back on the objective of the discussion. (To avoid exposing these participants, they should be addressed directly). "Process Results" is about creating an overview of the achievements of the discussion reached so far. In particular, this includes creating discussion summaries. These summaries give the current participants feedback about the results reached so far and highlight topics for the next discussion round. Furthermore, summaries allow new participants to enter the discussions without reading the whole contributions provided so far. In the "Finalize Discussion" step, the eModerator processes the results of the discussions (e.g., improvement suggestions and lessons learned) and forwards them to the interested roles like the process owner and the EF-Team. To improve their own moderation skills and for improving the eModeration Method, a short (self)-retrospective is about the discussion is performed.

4.4 Text-Mining Method

In indiGo, the available data comprises of contributions to group discussions, process models and lessons learned, the type of the contribution and their relations. The applied techniques from text mining will be text classification, text clustering, and text summarization. The goal is the simplification of the work of moderators, process authors and process users in the indiGo context. Full automatization of any method mentioned above is still not feasible. Therefore, the Text-Mining Method will describe how to use one of these Text-Mining techniques to facilitate process learning: *Text Classification* is used to detect different types of contributions like questions, opinions and doubts to create awareness for these contributions. *Text Clustering* procedures and the hierarchical analysis of textual similarities [Mehl02] enhances the presentation of textual data in order to support the moderator in formalizing contributions as reusable experiences or cases.

4.5 Process Evolution Method

The Process Evolution Method takes care that changes in the process models are implemented, communicated and recorded. The main trigger for the actions described in the process evolution method are the improvement suggestions taken from the discussions during the innovation phase of a process. Besides adapting the process model, the evolution method describes change propagation, change information and process model versioning. The result of an execution of the Process Evolution method is a published, official process model that is known to the involved members of an organization.

5 Technology of indigo

The methodology presented in the previous section describes is supported by the technological framework of indigo. In this section, we first present generic requirements for platforms supporting eParticipative Process Learning, followed by their implementation in indiGo. These requirements are subdivided into (1) general usability criteria, (2) requirements concerning discussion group software, and (3) about the integration of experience-based information systems. The requirements close with open questions about requirements coming from the first case study of indiGo.

ID	Cat	Name	Description
GR1	Usability	Single Sign on	No separate login for discussions and lessons learned
GR2		Interlink Processes / Discussions	Processes are accessible form the discussions – and vice versa
GR3		Awareness Functions	New contributions visible on the start page and process model. Number of contributions visible on process models
GR4	Discussion Groups	Anonymous contribution	Contributions should be provided an
GR5		Notification	Notify the responsible person, when a contribution is made.
GR6		Interlink Discussion groups / contributions	Discussions and discussion groups should be able to be intertwined with each other to merge topics discussed in parallel.
GR7		Attachments	Files should be attached to discussion contributions
GR8		Access Rights	Role-based concerning read write, modify of contributions
GR9		Labeling of contributions	Contributions should be labeled with their type and the project context they come from
GR10	Experience Management	User Context	The (project) context of the user should be stored to allow one-click queries of the lessons learned database

Table 1 Generic Requirements for eParticipative Process Learning Platforms

The first group, usability, is a key issue for the success of a platform as presented in this paper. The contributions of participants are provided voluntarily. Therefore, one needs to make participation as simple as possible. Otherwise,

relevant contributions will be lost due to user frustration. As a first requirement (GR1), the whole information within the eParticipative Process Information System (ePINS) should be accessed with one password. Users view the ePINS as a integrated system and react confused when additional passwords are required. Therefore, out-of-the box discussion groups, which often require a separate login in their standard configuration, should be integrated to the user management of the process description web-pages. As a second requirement, (GR2) lessons learned and discussions groups should be reached directly from the process descriptions and vice versa. This allows users (a) to access lessons learned or contribute discussions in an ad-hoc manner and (b) have a look at the corresponding process when question arise. Awareness Features (GR3) provide additional support for ad-hoc contributions, by pointing the user to new or otherwise relevant contributions. Therefore, new contributions should be announced on the homepage of the ePINS. Furthermore, the overall number of contributions and the number of new contributions should be displayed.

The second group of generic requirements are focussed on the features of the discussion group software. The most important requirements is (GR4), i.e., that a contributor can make a contribution anonymously whenever wanted. This is a measure of building trust to the ePINS. (In the application of indiGo at IESE, this feature was requested often, but was not used so far). The notification requirement (GR5) is relevant for the evolution phase. Since discussions are invoked on demand, a process responsible needs to know whether such a demand arise, i.e., when a contribution is made. The discussion interlink requirement (GR6) is needed to merge discussion threads in different groups discussing about the same topic. The need for attaching files to contributions (GR7) allows an easy way to collect examples for documents supporting process execution. Concerning access rights (GR8), the discussion group software should at least distinguish between moderators and regular participants. Furthermore, read, write and modify should be granted independently for these roles to allow fine-tuning to different levels of trust within the group of participants. Finally, contributions should be labelled by the contribution type (e.g., question/answer) (GR9), and, if sensible, with the project context. This supports the participants of the discussion in following the threads, but also the processing of discussion contributions to lessons learned.

Concerning the Experience Management Part, the only requirement is that the current (project) context of a user is stored in his or her personal setting (GR10). By using this context, a query based on the current context and the current process can be stated to retrieve the best fitting lessons learned.

However, not several questions about requirements remain open so far: First, it needs to be clarified whether one discussion group for the whole process is sufficient or whether discussion groups should be offered for each section of the process. This is a topic we a currently clarifying. Second, the need for more detailed, user-based access right is also not clear. This would allow to build closed

discussion groups, e.g., for all process owners. However this need did not arise so far in our application. To be on the safe side, both requirements should be implemented if effort allows it. If not needed, it is simply not used.

After this introduction to generic requirements and open questions, the components of the implementation together with further supporting tools are described in the following.

5.1 Implementation

The indiGo technical infrastructure consists of the Zeno groupware tool of AIS [GoKa97, Märk+02, Voss+02], IESE's experience management environment INTERESTS [Alth+01], IESE's tool for process modelling and publishing Spearmint [Beck+99, Kell+98], as well as tools for text mining of discourses from AIS.

Figure 5, shows the indiGo platform as installed at IESE. The systems mentioned above are connected by the Integrator to provide completely new services to a user of a process model. Furthermore, the Integrator allows to build upon operating systems implemented with previous versions of the above mentioned IESE technologies. These systems are part of the Corporate Information Network (CoIN), called CoIN-IQ (IESE Quality Management System), CoIN-PR (Project Registry) and CoIN-EF (Experience Factory).

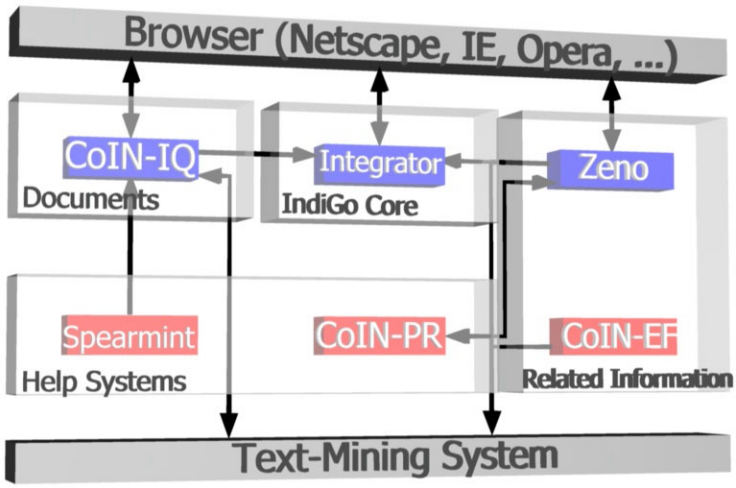

Figure 5 Information flow in the indiGo platform

The business process model repository CoIN-IQ [Deck+01]– which is edited and created using Spearmint - acts as the document source. CoIN-PR contains information about past and current projects at IESE. From these projects, a user can select his / her the project, that they are currently working on or which is of other relevance to them. This project data – called project context – is used by

Zeno to label discussions and annotations in the associated business process descriptions within CoIN-IQ. Furthermore, the project context is used to query CoIN-EF (build with INTERESTS) from a certain business process description. CoIN-EF then uses Case-based reasoning [Kolo93] to retrieve lessons learned from similar projects and processes.

6 Evaluation of indiGo

The methodology and technical system developed for indiGo was evaluated through a case study, which was performed at Fraunhofer Institute for Experimental Software Engineering (IESE) starting summer 2002. The main objective of this case study was to evaluate whether discussing process models in the introduction phase would increase their acceptance and perceived quality. A further objective was to gather practical experience with the use of the technical infrastructure and parts of the methodology. A summary of this case study is described with the following structure: First, we describe the context and design of the case-study. Second, we elaborate on the results of the case study regarding the above mentioned objectives. Finally, we present an outlook to further evaluation activities.

6.1 Case study context and design

The *IESE as the setting of the case-study* employed about 97 full time employees at the time of the case study. From these, 70 scientists do applied research as well as evaluation and transfer of software engineering knowledge in a broad range of industrial and publicly funded projects. IESE's knowledge management is performed by the CoIN-team (Corporate Information Network). They maintain the components and the content of the indiGo infrastructure mentioned in the previous section. As applied research is the core business of IESE, process models about research and project execution are central and affect most of IESE's staff. It is vital that they accept and "live" the process models and cooperate to continuously improving them. Due to the variety of projects, the processes can reasonably be captured at an abstract and decontextual level only. That means, the execution of an abstract process models is knowledge-intensive.

Concerning participation, each IESE member decided on his/her own to participate in the case study. Each IESE member had the opportunity to contribute to the discussion or to answer the questionnaires. The actual participation was voluntarily and supported by the upper management.

The *process models* that were introduced using indiGo were Industrial Project Acquisition and Conference Participation Planning: Industrial Project Acquisition, describes the creation of an offer for an industrial customer. Conference Participation Planning coordinates the attendance of conferences. We choose these processes since they address two important parts of academic and applied research. Furthermore, they have a high potential of uncertainty and con-

flicting interpretations, which implies a need for discussions about these process models. Both process models were created by IESE members experienced with the execution of the process and process modeling skills.

The *design of the case study* was focused on the main objective of examining whether the evaluation of acceptance and perceived quality would improve. To show this effect, the evaluation before the discussion and the evaluation after the discussion (when the result have been integrated into the process model) is necessary. Consequently, a pre-post design was chosen: At the start of the discussion in June 2002, a questionnaire was distributed among the IESE members to give a personal evaluation of each of the two processes. After the improvement suggestions resulting from the discussions were implemented, a second questionnaire with the same evaluation questions was distributed to evaluate the changed process in July 2002. Then results of the participants that completed both questionnaires were compared.

Each questionnaire contained a set of 13 items concerning for each process, for different criterias of acceptance and perceived quality (see Table 2). For each item, a statement was given to which the agreement could be stated on a scale from one (high agreement) to six (high disagreement).

Criteria	**Statement**
1. Comprehension	I understand the content of this process description.
2. Responsibilities	The responsibilities within the process are clearly stated.
3. Completeness	I do not miss any topics about this process.
4. Usefulness	In my opinion, this process description is useful for my job or other tasks I perform.
5. Unambiguousness	The wording of the process is unambiguous.
6. Relevance	The process description does not contain irrelevant information.
7. Practicability	I can apply this process as described.
8. Up-To-Date	The process description is up-to-date (e.g. concerning roles involved, working procedures).
9. Completeness (variants)	This process considers variants of the processes that occur often.
10. Acceptance	I will apply this process as described.
11. Overall support by templates	Overall, I am satisfied with the template support of this process.
12. Overall represen tation	Overall, I am satisfied with the representation of this process (e.g., layout, page structure).
13. Overall content	Overall, I am satisfied with the content of this process.

Table 2 Overview of questionnaire items

Criteria one to nine are about one quality aspect of the evaluated process. Criteria nine determines the acceptance of the process model. Criteria eleven to thirteen are summarizations of criteria one to nine from different views (product support, representation, content). The quality aspects were then condensed

to one measure to facilitate the evaluation: one to nine were condensed to the measure "single quality aspects", eleven to thirteen were condensed to "overall quality aspects".

The first questionnaire answered questions about the availability and usability of the indiGo system and the attitude towards process discussion and experience sharing. The second questionnaire contained one section for each process about the usage of the discussion groups and the satisfaction with the discussion results. In addition, we asked whether the participants would contribute to other discussion and which circumstances would influence their participation. Discussion groups were used in two ways to gather practical experience: First, to give feedback about indiGo and request help. Second, discussion groups were analyzed with respect to the contributing behavior to refine the eModeration Method. This experience was augmented by indiGo-Project members performing process learning roles to gather related lessons learned.

6.2 Case study results

The presentation of the case study results is divided into two parts: First, the differences in acceptance and perceived quality are presented. Second, the main practical experiences and findings are presented. Both parts rely on the distribution of participants that is presented in Table 3. In particular, the difference in acceptance and perceived quality are based on the participants that completed both questionnaires, which are about 16% on the total of all IESE members.

Participant in	**No. of participants**	**≈ % (from 97)**
1st questionnaire	24	25 %
2nd Questionnaire	26	27 %
1st and 2nd Questionnaire	15	16 %
Discussion	21	22 %

Table 3 Distribution of participants

For the measurement of *acceptance and perceived quality* (single quality aspects overall quality aspects), two major findings hold for both processes: When the results of the pre-phase (1st Questionnaire) are compared to the ones in the post-phase (2nd Questionnaire), the median of all results improves. The only exception is the median of acceptance for Conference Participation Planning, which remains stable. Furthermore, the bandwidth of results decreases, i.e., participants evaluate the process in the pre-phase more differently than in the post-phase. In other words – assumed that these effects are caused by the process discussion – the resulting processes is evaluated better and more consistently with respect to the acceptance and perceived quality.

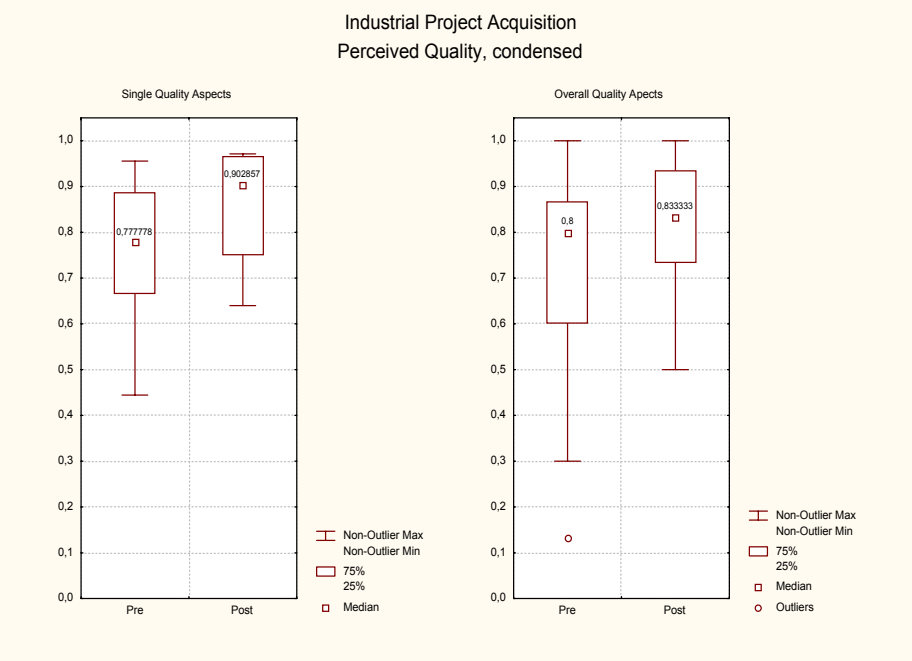

Figure 6 Pre-Post Evaluation of perceived quality for Industrial Project Acquisition

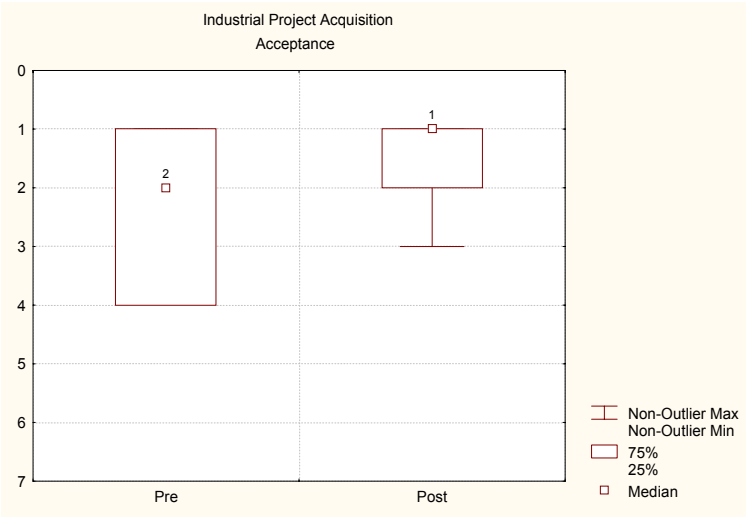

Figure 7 Pre-Post Evaluation of Acceptance for Industrial Project Acquisition

These effects are depicted exemplarily by the results of Industrial Project Acquisition in Figure 6 and Figure 7. For the single quality aspect measure shown in Figure 6, the median increased from about 0,77 to 0,90 (with 1,0 being the best possible result for this measure). The overall quality aspect measure (also shown in 0) increased from about 0,8 to 0,83 (again 1,0 being the best possible result). As depicted in Figure 7, the median of acceptance measurement in-

creases 2 to 1 (with 1 being the best and 6 being the worst measure). The decreasing result-bandwidth is shown graphically by smaller boxes (25% - 75%) and the distance between the non-outlier min and non-outlier-max (see legend for details) between the pre- and post-phase.

The *practical experiences* gathered about indiGo add to the above findings: The major findings concerned the indiGo technical infrastructure, the process learning method, and the eModeration method.

For the indiGo technical infrastructure, discussion groups about indiGo itself were the most important source of improvement suggestions. From 36 contributions, 26 improvement suggestions could be deduced, which are currently under development. In addition, four improvement suggestion were issued in process-related discussion groups and were directly implemented. From the first questionnaire, a sufficient usability and availability could be deduced.

Concerning process learning, 25 improvement suggestions could be deduced from 120 contributions in four weeks. 15 of them were implemented. . One example of these improvement suggestions was a document used for the clarification of customers expectation during the start-up phase of a project. This document was only "recognized" based on the discussion and is now a valuable part of the industrial project acquisition process. Another – controversially discussed – implemented improvement suggestion was the time of involvement of the project manager in during acquisition. It changed from a late point in the process to the earliest possible one.

The first questionnaire revealed a generally positive attitude towards process discussions and experience sharing. Asked about their participation in the future, six participants of the 2md questionnaire answered that they won't participate. Nineteen participants stated that they would participate in future discussion. The most important factor for future participation is relevance of the topics and processes discussed.

The eModeration Method was improved by several lessons learned from the case study. For example, the role of the Moderator and Process Author should not be performed by the same role. Furthermore, most of the participants in the 2nd questionnaire were satisfied with the relevance, results and moderation of the discussions.

Simplified, the case study showed the following: acceptance and perceived quality increases by process discussion. indiGo supports this discussion well. Due to the (potential) involvement of all organizational members, improvement suggestions about the processes could be collected, that would not have been (practically) collected compared to classical, workshop-based process modeling.

7 Summary & Outlook

indiGo has shown to be a valuable system for a process-related discussion to introduce, inspect, and improve processes. Moderated eDiscussions are used to enable teamwork in order to identify and record experiences from participants of discussions that are feed back and preserved in an organization-wide experience base. Through indiGo's process learning method, stakeholders of a process can decide which issue should be discussed within a selected team of people to collaboratively adapt or improve a process model. The structured and goal-oriented execution of those discussions is ensured by the Moderator who is supported by a method to coordinate the participating team and resolve occurring conflicts.

In 2002, indiGo had been evaluated within a case study carried out at Fraunhofer IESE in Kaiserslautern, Germany. Beside improving the discussed process models we received valuable feedback for all the described methods and technologies of indiGo. A positive effect on the acceptance and perceived quality was observed. Furthermore, the opinions of participants about a process model were higher and less distributed than before the discussion. From 120 contributions about the two processes, 25 improvement suggestion could be deduced. Fifteen of them were implemented.

Acknowledgements

indiGo (Integrative Software Engineering using Discourse-Supporting Groupware) is funded by the German "Ministerium für Bildung und Forschung" (BMBF) under grant number 01 AK 915 A [see http://indigo.fhg.de/].

Thanks goes to Astrid Haas for her work on eModeration and Torsten Willrich as well as Markus Nick for their help in the development of indiGo. We also thank our students for their work on the first protoypes of the indiGo technical architecture and process model processing framework.

References

[Alth+02] Althoff, K.-D.; Becker-Kornstaedt, U.;Decker, B.;Klotz, A.;Leopold, E.; Rech, J.; Voss, A.: The indiGo Project: Enhancement of Experience Management and Process Learning with Moderated Discourses. In P. Perner (Ed.), Data Mining in Marketing and Medicine, Springer Verlag, LNCS, 2002.

[Alth+01] Althoff, K.-D., Decker, B., Hartkopf, S., Jedlitschka, A., Nick, M. Rech, J.: Experience Management: The Fraunhofer IESE Experience Factory. In P. Perner (ed.), Proc. Industrial Conference Data Mining, Leipzig, Institut für Bildverarbeitung und angewandte Informatik, July 2001, pp. 24.-25.

[AnPf02] Angkasaputra, N.; Pfahl, D.: The CORONET System - A Methodology-Driven Infrastructure for Collaborative Learning at the Workplace. Proc. Of LLWA2002 (ILLS), Hannover, Germany, http://www.iese.fhg.de/coronet/documents/ publications/pub_coronet_ills02.pdf, 2002, Link checked on 21.1.2003.

[Basi+94] Basili, V.R.; Caldiera, G.; Rombach, D.: Experience Factory. In Marciniak, J.J. ed., Encyclopedia of Software Engineering, vol 1, John Wiley & Sons: 1994, pp. 469–476.

[Beck+99] Becker-Kornstaedt, U.; Hamann, D.; Kempkens, R., Rösch, P.; Verlage, M.; Webby R.; Zettel, J.: Support for the Process Engineer: The Spearmint Approach to Software Process Definition and Process Guidance. In Proceedings of the 11th Conference on Advanced Information Systems Engineering (CAISE '99), Heidelberg, Germany, June 1999. Lecture Notes on Computer Science, Springer–Verlag, 1999.

[Berg01] Bergmann, R.: Experience management - foundations, development methodology, and internet-based applications. Postdoctoral thesis (Habilitations-Schrift), Department of Computer Science, University of Kaiserslautern, 2001.

[Comp03] Compendium. Compendium Institute, http://www.compendiuminstitute.org/ tools/compendium.htm, link checked 22.1.2003

[Feld+00] Feldmann, R. L.; Frey, M.; Habetz, M.; Mendonca, M.: Applying Roles in Reuse Repositories. In Proceedings of the Twelfth Conference on Software Engineering and Knowledge Engineering, Kaiserslautern, Germany, July 2000. Knowledge Systems Institute, Skokie, Illinois, USA, 2000.

[D3E03] Digital Document Discourse Environment (D3E), http://d3e.sourceforge.net/, link checked on 22.2.2003

[Deck+01] Decker, B.; Althoff K.-D,; Nick, M.; Jedlitschka, A.; Rech, J.: Corporate Information Network (CoIN): Experience Management at IESE. In Proceedings of Knowtech 2001 conference, http://www.community-of-knowledge.de/pdf/f27.pdf, 2001, Link checked on 21.1.2003.

[Deck03] Decker, B.: IndiGo: Fallstudie Prozesseinführung (to appear, German), http://indigo.fhg.de, 2003, Link checked on 21.1.2003.

[GoKa97] Gordon, T.F.; Karacapilidis N.: "The Zeno Argumentation Framework.". In Proceedings of the Sixth International Conference on Artificial Intelligence and Law, 1997, pp. 10-18.

[HaWa99] Haake, J. M.; Wang, W.: Flexible Support for Business Processes: Extending Cooperative Hypermedia with Process Support. In: Information and Software Technology, Vol. 41, No. 6, pp. 355-366, 1999. ftp://ftp.darmstadt.gmd.de/pub/concert/ publications/IST98.pdf, link checked on 21.1.2003.

[ARIS03] ARIS collaborative suite. IDS-Scheer AG, http://www.ids-scheer.com/ link checked on 22.1.2003

[Joac98] Joachims, T.: Text categorization with Support Vector Machines: Learning with many relevant features. In Proc. of 10th European Conference on Machine Learning (ECML 98), LNCS 1398, Springer Verlag, 1998. pp137-142.

[Kell+98] Kellner, M. I.; Becker-Kornstaedt, U.; Riddle, W. E.; Tomal, J. Verlage, M.: Process Guides: Effective Guidance for Process Participants. In Proceedings of the Fifth International Conference on the Software Process, Chicago, IL, USA, June 1998. ISPA Press. pp. 11–25.

[Kind+01] Kindermann, J.; Paaß, G.; Leopold, E.: Error Correcting Codes with Optimized Kullback-Leibler Distances for Text Categorization. In Proceedings of the European Symposium on Principles of Data Mining and Knowledge Discovery (PKDD'01); 3-7 September 2001 in Freiburg, Germany.

[Koho01] Kohonen, T.: Self-organizing maps. Springer: Berlin, Heidelberg, New York, 2001.

[Kolo93] Kolodner, J. L.. Case-Based Reasoning. Morgan Kaufmann, 1993.

[LeKi02] Leopold, E.; Kindermann, J.: Text Categorization with Support Vector Machines. How to Represent Texts in Input Space?. in: Machine Learning 46, pp. 423 - 444, 2002.

[Märk+02] Märker, O., Hagedorn, H., Trénel, M. and Gordon, T. F.: Internet-based Citizen Participation in the City of Esslingen. Relevance - Moderation – Software. In M. Schrenk (ed) CORP 2002 - "Who plans Europe's future?" Wien: Selbstverlag des Instituts für EDV-gestützte Methoden in Architektur und Raumplanung der Technischen Universität Wien, 2002.

[Mehl02] Mehler, A.: Hierarchical analysis of text similarity data. In: Joachims T.; Leopold E. (eds.): Künstliche Intelligenz 2/02, Schwerpunkt Textmining, pp. 12-16, 2002.

[Merk97] Merkl, D.: Exploration of Document Collections with Self-Organizing Maps: A Novel Approach to Similarity Representation, a novel approach to similarity visualization. In Proceedings of the European Symposium on Principles of Data Mining and Knowledge Discovery (PKDD'97), (Trondheim, Norway. June), 1997.

[Scot03] Scott, L.: EPG/ER Empirical Evaluation Method. Technical Report of the University of New South Wales http://www.caeser.unsw.edu.au/publications/ pdf/Tech02_4.pdf, link checked on 22.3.2003.

[ScBe01] Scott, L.; Jeffery, D.R.; Becker-Kornstaedt, U.: Preliminary Results of an Industrial EPG Evaluation. In Maurer, F.; Dellen B.; Grundy J.; Koetting B. (eds.), Proc. 4th ICSE Workshop on Software Engineering over the Internet, Toronto Canada, 12-19 May. 2001. IEEE Computer Society, California, USA, pp55-58. 2001.

[Tau00] Tautz, C: Customizing Software Engineering Experience Management Systems to Organizational Needs. Doctoral Dissertation, Department of Computer Science, University of Kaiserslautern, Germany, 2000.

[Turo+99] Turoff, M.; Hiltz, S. R;, Bieber, M.; Fjermestadt, J.; Ajaz, R.: Collaborative discourse structures in computer-mediated group communications. Journal of Computer-Mediated Communication, 4, 1999.

[vHun00] von Hunnius, J.-P. (2000). WESPI – Web Supported Process Improvement. In Althoff, K.-D.; Müller W. (eds.), Proc. 2nd Internationl Workshop on Learning Software Organizations, June 20, 2000, Oulu Finland, Fraunhofer IESE, Kaiserslautern, Germany, 2000.

[Voss+02] Voss, A.; Roeder, S.; Wacker, U. (to appear): IT-support for mediation in decision making - A role playing experiment. In Märker, O. Trenél, M. (eds.): Online-Mediation. Theorie und Praxis computer-unterstützter Konfliktmittlung. Sigma, Berlin, 2002.

Document Information

Title:	Teamware for Participative Experience-Based Business Process Inspection & Introduction: The indiGo Project
Date:	April 28, 2004
Report:	IESE-031.03/E
Status:	Final
Distribution:	Public