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A Case-Study about Participative Process Introduction in the indiGo

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A Case-Study about Participative Process Introduction in the indiGo Project

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Abstract: In software engineering, the quality of processes and their models is of utmost importance for the quality of the software products developed. Nevertheless, many organizations neglect these processes and leave the knowledge about them in the heads of their experts. In this paper we present the indiGo method for eParticipative Process Learning based on eDiscussions, Lessons Learned, text mining, and process evolution. indiGo helps an organization to learn about their processes and process modeling techniques, and enables it to collect valuable experiences from process users. Besides presenting indiGo itself, the results of a case study where two processes were introduced using indiGo are described. The results indicate that processes introduced and modeled with process user participation lead to process models with higher acceptance and better perceived quality.

Keywords: Distributed participative process evolution, process introduction, process improvement, process inspection, organizational process learning

1 Introduction

Process models of organizations operating in the software industry are considered major assets for these and range from business to software development process models. Especially in the innovative software market, they are constantly subject to changes caused by changing business, new technology and scientific advances. To survive these changes, process models need to be constantly inspected, evaluated, revised, and improved. Furthermore, they need to be enriched with lessons learned about their application in practice.

The approach of the BMBF-funded project indiGo – called eParticipative Process Learning - is to increase their applicability as well as support their inspection and improvement. indiGo offers members of an organization to engage in moderated discourses about the structure, content or execution of a process model.

As depicted in Figure 1, the process improvement in indiGo starts with a plain 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.

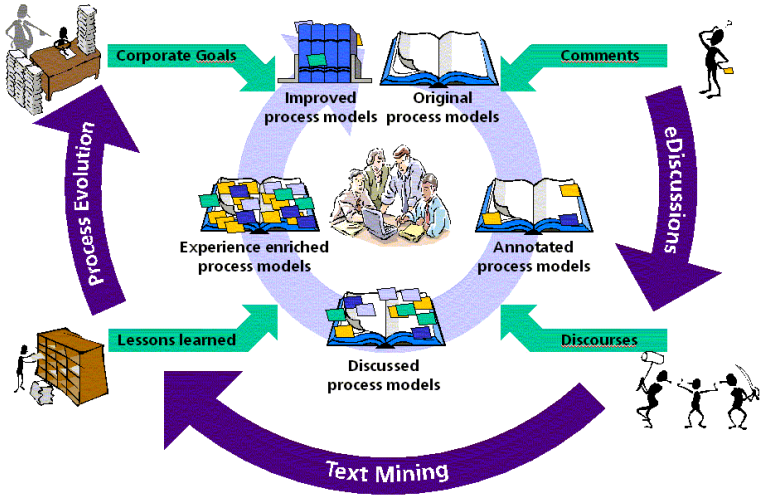

Figure 1: Overview of eParticipative Process Learning

Both the developed methods and the indiGo architecture were evaluated in mid-2002 through a case study at IESE. The main focus of the case study was the participatory introduction of two redefined business processes of IESE.

The next section describes the corresponding technological infrastructure to support this methodology. In the third section, the methodology to enact the above mentioned lifecycle is presented. The fourth section gives an overview of related work. The fifth section – which is the main focus of this paper – is about the case study performed to evaluate the methodology and infrastructure. The paper closes with a conclusion and an outlook to further work and evaluation.

2 Technology of indiGo

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 2 shows the indiGo platform as installed at IESE. The systems mentioned above are connected by the Integrator to provide integrated access to services for a user of a process model. Furthermore, the Integrator allowed 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): CoIN-IQ (IESE Quality Management System) contains the business process descriptions. CoIN-PR (Project Registry) contains data about projects. Finally, CoIN-EF (Experience Factory) contains Lessons Learned captured from past projects.

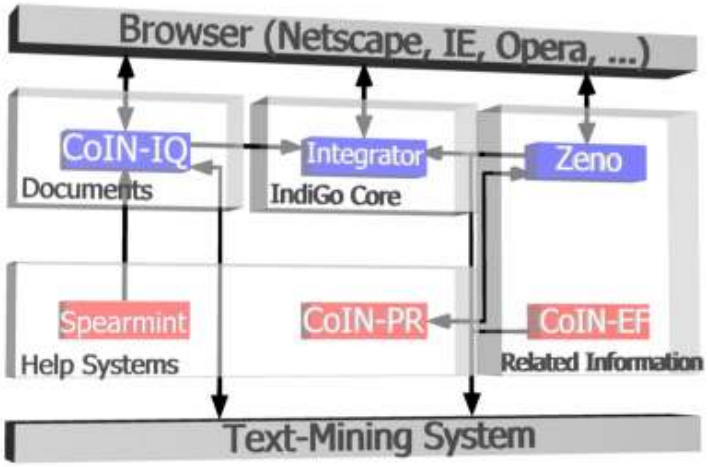

Figure 2: Information flow in the indiGo platform

The business process model repository CoIN-IQ [Deck+01]– which is edited and created using Spearmint® - acts as the document source. Using CoIN-PR via the Integrator, a user can select the project that he/she is currently working on or which is of other relevance to him/her. 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 (built with INTERESTS) from a certain business process descrip-

tion. CoIN-EF then uses Case-based Reasoning [Kolo93] to retrieve lessons learned from similar projects and processes.

3 Methodology of indiGo

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 Method encapsulates the eModeration-, Text-Mining- and Process-Evolution-Method by providing a framework for initialization and result handling. The process learning method and process evolution method themselves are described as processes, so that they can be adapted and improved using indiGo. Each method is described in one of the following subsections.

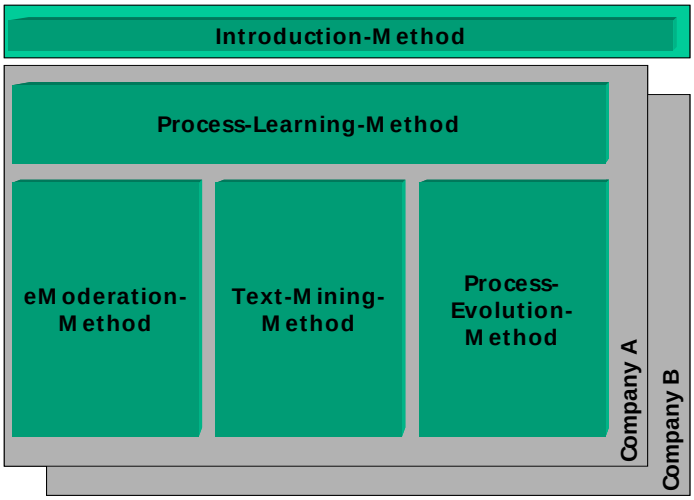

Figure 3: Overview of the indiGo Methodology

3.1 Introduction Method

The task of the Introduction Method is the instantiation and adaption of the other methods to the needs of a certain organization. This enables a quick, but controlled start of process learning in order to use the dynamic of change in the beginning. On the content level, the Introduction Method first takes care of 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.

3.2 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. In particular, it is introduced by bootstrapping: By discussing the processes of this method, organization member responsible for processes learn about the indiGo methodology and technological platform in a productive pilot.

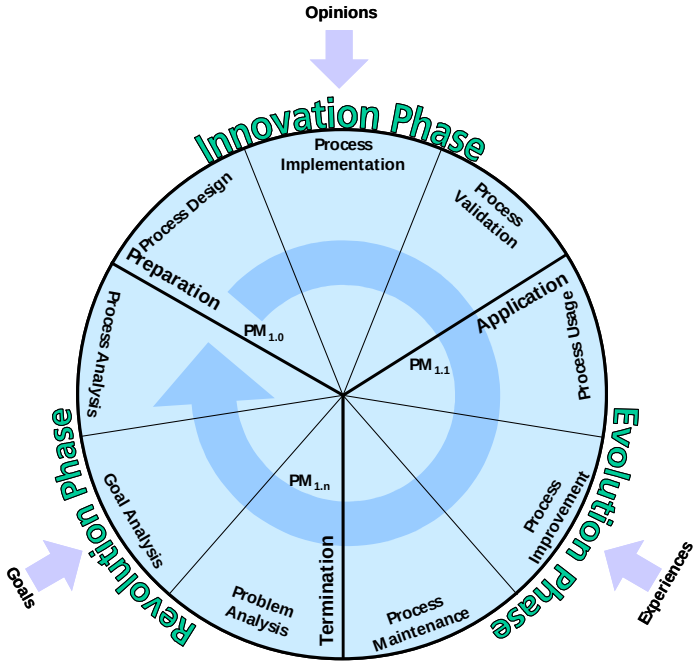

Figure 4: Overview of the indiGo process lifecycle

Presenting the Process Learning Method in detail is not possible in the course of this paper. Therefore, the underlying lifecycle of this method as depicted in Figure 4 is described instead.

In the *innovation phase*, either a new process model is created from scratch or an existing process model is reworked. The Process Learning Method describes which processes are subject to discussion (e.g., processes affecting the strategy of

an organization). Furthermore, the Process Learning Method takes care of the proper instantiation of the eModeration Method, e.g., with open questions from process modeling or the target group of the discussion. Afterwards, the process model is discussed in theory, i.e., what will happen if the process model is enacted as described. The main objective of this phase is to gain consensus about the process model and its execution. Additionally, when participants describe their experience in performing process-related actions, these contributions are processed to Lessons Learned. As a result, the changed process model is released for practical use.

In the *evolution phase*, the process model is applied in daily work. Experiences – in particular problems and their solutions – are discussed on demand. The Process Learning Method clarifies which member of the organization acts as initial contact point for these contributions. This member – in most cases the process owner or author – initiates further discussions if needed. Furthermore, the Process Learning Methods clarifies which additional problem reporting channels are considered to trigger process-related discussion. The process model itself is subject only to minor changes (process maintenance).

The *revolution phase* is entered when several problems have accumulated over time or when the process has to be revised due to organizational or environmental changes. The process is then discussed retrospectively: Known problems are discussed and analyzed. These problems guide the subsequent revision of the process model, based on the goals of the organization.

3.3 eModeration Method

eModeration is the part of the indiGo methodology that keeps the eDiscussions going in order to focus the discourse on the predefined goals and elicit experiences from the participants. 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, for whom and for what the process is created or changed. Based on this information, the eModeration Method takes care of the full eModeration lifecycle. The lifecycle starts with the design of the discussion. The next tasks of the moderator are to start the discussion as well as to keep it going and focused. As the final 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. (For further details about this method, refer to [Alth+02].)

3.4 Text-Mining Method

In indiGo, the available data is comprised 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* will be 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] can enhance the presentation of textual data in order to support the moderator in formalizing contributions as reusable experiences or cases. *Text Summarizations* will be applied to the whole discourses or to single lengthy contributions to facilitate reading them or to be the starting point of a manual discussion. The Text-Mining itself and the underlying techniques are currently subject to development and will be evaluated in future applications of indiGo.

3.5 Process Evolution Method

The Process Evolution Method ensures 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.

4 Related Work

One central issue in knowledge management 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 user's 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 solution is built upon established base technologies like process modeling tools, discussion group software, and case-based reasoning. These technologies are integrated to provide easy access to discussions and Lessons Learned services. Furthermore, Text-Mining techniques are a substantial part of indiGo (a) to lower the cost of experience acquisition by summarizing discussions to lessons learned and (b) by providing overviews of discussions. The methodology ensures that the organizational aspects of eParticipative Process Learning are considered as well and thus, that the platform is integrated into the flow of work in an organization.

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 these areas 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 new-servers, examples are only given for systems specializing in one of the sub-areas. For consensus building, i.e., deciding about a disputed topic, the German town Esslingen acts as an example for eGoverment [Märk+02]. Concerning collaborative problem solving, i.e., several people working on solving a problem, there are examples from general decision-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 allow to discuss adocument 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, *lessons learned*-based decision support systems capture experience. Examples that capture experience from software engineering projects are CoIN-EF [Deck+01] and the Lids System from Daimler Chrysler [vHun00].

5 Evaluation of indiGo: The Case Study

The methodology and technical system developed for indiGo were evaluated through a case study, which was performed at the Fraunhofer Institute for Experimental Software Engineering (IESE) starting in the summer of 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. Another objective was to gather practical experience with the use of the technical infrastructure and (parts of) the methodology. A summarization of this case study will be described with the following structure: First, the context and design of the case study will be described. Second, the results of the case study regarding the above mentioned objectives will be presented. Third, an outlook to further evaluation activities closes this section. A more detailed description of the results is available in [Deck03].

5.1 Case Study Context and Design

To give an impression of how the case study was executed, its context and design are presented in this section. First, IESE and the used process models as context of the case study are described. Second, design and tools used for the evaluation are presented.

The *IESE as setting of the case study* employed about 97 full time employees at the time of the case study. Of these, 70 scientists work on applied research as well as in the 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 improve 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 model 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. Actual participation was voluntary and supported by 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 at conferences. The main reasons for selecting these processes was their importance for IESE: They address the research as well as the application part of applied research. Furthermore, they have a high potential of uncertainty and conflicting interpretations, which implies a need for discussions about these process models. Both process models were created by IESE members experienced in the execution of the process and possessing process modeling skills.

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 concerning 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-Dateness	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 representation	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 1: Overview of questionnaire items

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, evaluation before the discussion and evaluation after the discussion (when the results 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 via email among all 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. This second questionnaire was again distributed to all IESE members by email. This email also contained a summary of the discussions and the notification that the accepted changes were implemented. Then the results of the participants who completed both questionnaires were compared.

Each questionnaire contained a set of 13 items concerning each process concerning acceptance and different aspects of perceived quality (see Table 1). For each item, a statement was given to which agreement could be stated on a scale from one (high agreement) to six (high disagreement). Criteria one to nine are about one quality aspect of the evaluated process. Criterion ten 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 evaluation: one to nine were condensed to the measure “single quality aspects”, eleven to thirteen were condensed to “overall quality aspects”.

The other objective of the case study – gathering practical experience with indiGo – used these questionnaires and the indiGo discussion groups. 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, the question was asked whether the participants would contribute to other discussions and which circumstances would influence their participation. Discussion groups were used in two ways to gather practical experience: First, discussion groups were used by participants 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.

5.2 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 2. In particular, the differences in acceptance and perceived quality are based on the participants who completed both questionnaires, who are about 16% of all IESE members.

None of the participants who completed the 1st and 2nd questionnaire were part of the project members of indiGo. Since the absolute number of participation is quite small, transferring these results to other organizations should be done with caution. Based on the case study, further evaluations will be performed at IESE and in future projects. Nevertheless, the results of this case study give hope that the effects observed can be replicated in these future evaluations. (Threats to validity are discussed in detail in [Dec03].)

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 2: Distribution of participants

For measuring *acceptance and perceived quality* (single quality aspects and 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 – assuming that these effects are caused by the process discussion – the resulting processes are evaluated better and more consistently with respect to acceptance and perceived quality.

These effects are depicted exemplarily by the results of Industrial Project Acquisition in Figure 5 and Figure 6. For the single quality aspect measure shown in Figure 5, 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 Figure 5) increased from about 0.8 to 0.83 (again, 1.0 being the best possible result). As depicted in Figure 6, the median of acceptance measurement increased 2 to 1 (with 1 being the best and 6 being the worst measure). The significance of the difference – i.e., whether the difference is caused coincidentally or has a statistical significance – was investigated using the Wilcoxon matched pair test [Shes01]. For case studies like these, a level of significance or P-value of 10 % or lower [Bria+99] is an acceptable indicator of significance. The P-values for this test are given in Table 3, where N indicates the number of participants who provided data for a measurement. Values where the test was successful (i.e., the P-Value is below < 0.1) are formatted in bold.

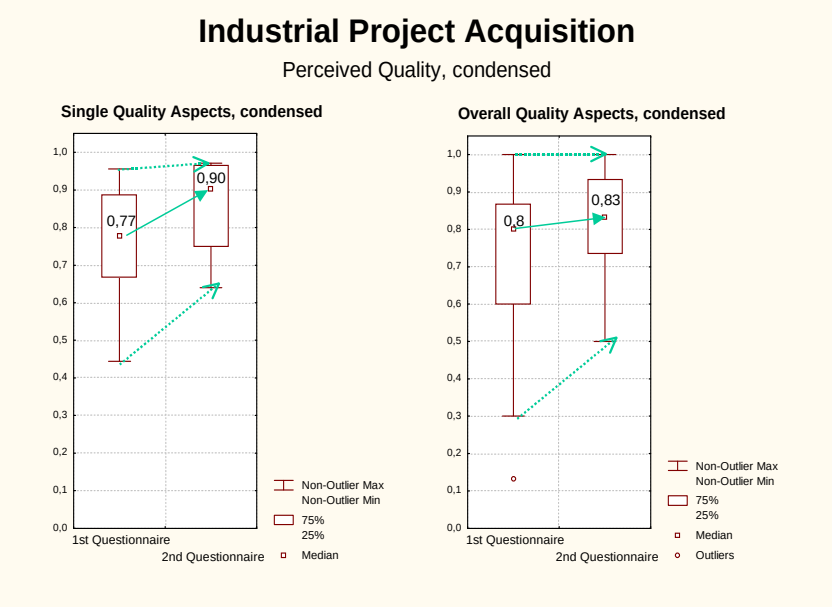

Figure 5: Pre-post evaluation of perceived quality for Industrial Project Acquisition

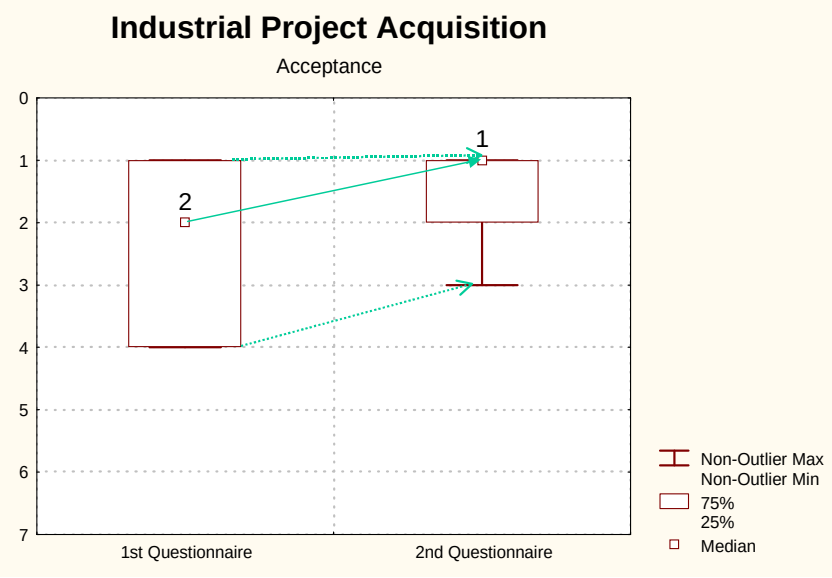

Figure 6: Pre-post evaluation of acceptance for Industrial Project Acquisition

The Wilcoxon-matched pair test was successful for two of the three criteria of each process. The criterion where it failed differed between the two processes: The test for Overall Quality Aspects failed for Industrial Project Acquisition. For Conference Participation Planning, the test failed for the aspect Acceptance. Therefore, the improvement observed has to be checked in future evaluations especially for these aspects with failed tests. Furthermore, due to the low number of participants, the power could not be calculated. Consequently, no statement can be made on whether no difference is in fact present. (For details, refer to [Dec03].)

Criteria	N	P-Value: Industrial Project Acquisition	N	P-Value: Conference Participation Planning
Acceptance	10	**0.051922**	12	0.767099
Single Quality Aspects	14	**0.009637**	15	**0.030335**
Overall Quality Aspects	14	0.401684	15	**0.074745**

Table 3: P-Values of significance

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, sufficient usability and availability could be deduced.

Concerning process learning, 26 improvement suggestions could be deduced from 120 contributions in four weeks. 16 of them were implemented. Since IESE-internal processes were discussed, these improvement suggestions can be described on an abstract level only. Table 4 gives an overview of the improvement suggestions and the number of improvement suggestions implemented and rejected. For each category mentioned in the upper row of the table, an explanation and an example will be given in the following. Information Flow states the number of suggestions concerning documents or other data passed in the course of the process. An implemented example was a set of rules concerning registration for conferences. Role responsibilities are suggestions to change the responsibilities of

a role within the process. A rejected example for this category was late involvement of the Project Manager. Deregulation summarizes suggestions to delete rules mentioned in the process description. An implemented example was changing the mandatory creation of a conference travel report to a voluntary basis. Clarification counts suggestions where parts of the process should be detailed. An implemented example for this category was adding a checklist about customer expectation clarification.

Process	**Implemented ?**	**No of suggestions**	**Information Flow**	**Role Responsibilities**	**Deregulation**	**Clarification**
Conference Participation Planning	Yes	9	3	2	2	2
	No	2	1	0	0	1
	All	11	4	2	2	3
Industrial Project Acquisition	Yes	7	2	2	1	2
	No	8	1	5	1	1
	All	15	3	7	2	3
Both	*Yes*	*16*	*5*	*4*	*3*	*4*
	No	*10*	*2*	*5*	*1*	*2*
	All	*26*	*7*	*9*	*4*	*6*

Table 4: Overview of improvement suggestions by categories

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 2nd questionnaire answered that they would not participate. Nineteen participants stated that they would participate in future discussions. 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 person. 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 with process discussion. indiGo supports this discussion well. Due to the (potential) involvement of all organizational members, improvement suggestions concerning the processes could be collected that would not have been (practically) collected in classical, workshop-based process modeling.

5.3 Resulting Actions

The case study mentioned above is the starting point for the further evaluation of the indiGo method. Experiences and data will be collected during the next applications of indiGo at IESE and industrial customers. By using the infrastructure set up by the case study, further introductions of processes via indiGo will be evaluated. The next evaluation in this series is currently in progress (May 2003). Furthermore, the evaluation will be extended to the full process lifecycle, i.e., the operational and review phase.

Of particular interest in the operational phase will be collaborative problem solving during process execution. To collect sensible data, these processes need to be in operation for a longer period of time (e.g., six months). However, several processes that were not subject to the case study were enriched by experiences captured in several discussion groups. These processes showed that the opportunity to attach and discuss experiences is widely used and accepted by the process users.

6 Summary & Outlook

indiGo has shown to be a valuable system for a process-related discussion to learn about and improve an organization's processes. It is used to identify and record experiences from participants of discussions in order to feed them back in to an organization-wide experience base. Applied in a distributed environment, it can be used at the same time for distributed inspection (i.e., eProcessInspection). indiGo is designed to support all kinds of knowledge that have been identified as being important for organizational process learning. These knowledge units are process models, experiences from real projects, discourses in several goal-oriented groups, and private annotations to process models.

Starting in May 2002, indiGo was evaluated in a case study carried out at Fraunhofer IESE in Kaiserslautern, Germany. Two new processes were introduced for the whole institute with the indiGo technical infrastructure as a platform. Besides improving the discussed process models, we received valuable feedback for all the described methods and technologies of indiGo.

Through indiGo's process learning method, stakeholders of a process can decide which issue that attracted their attention should be discussed within a selected group of people. The technical infrastructure enables the organization of parallel discussion groups. The structured and goal-oriented execution of those discussions is ensured by the eModeration Method.

In the corresponding case study, a positive effect on the acceptance and perceived quality was observed. Furthermore, the participants' evaluation of a process were less distributed than before the discussion. From 120 contributions about the two

processes, 26 improvement suggestions could be deduced. Sixteen of them were implemented. However, in future evaluations, where all members of an organization take part, a higher number of participants should be reached. In particular, the number of participants should be equal to or higher than 20, since then more elaborated statistical techniques can be employed (e.g., parametrical procedures). To facilitate participation, a questionnaire feature was integrated into the technological platform, allowing ad-hoc evaluation of a process model.

The future work within the scope of the indiGo project is the improvement of the methodology and the platform, which are based on the results of the case study. The main topics for 2003 as the last year of the project will be the Text Mining method and infrastructure. Using the contributions from the case study, text-mining techniques for classification, clustering, and summarization will be evaluated to support the eModerator and the participants in process learning.

Beyond the currently running project, we consider the possibility to extend the indiGo approach to applications where process models do not play such a central role. Although a platform for organizational learning should eventually cover all knowledge categories treated in indiGo, the first steps to organizational learning need not necessarily involve process models. An organization can introduce indiGo in a stepwise manner by starting with an experience factory or an eParticipation forum.

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