Managing Environmental Protection Processes via BPM at Deutsche Bahn

FINK: The Information System for Nature Conservation and Compensation

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Abstract

(a) **Situation faced**: The law demands environmental compensation for interventions in nature and landscapes through the Federal Nature Conservation Act. Deutsche Bahn, one of the largest construction facilitators in Germany, encounters several hundred new such compensation obligations per year. Deutsche Bahn plans and develops compensation measures that usually require long-term maintenance. The Federal Railway Authority demands regular reports on the state of these obligations. Prior to the beginning of the case study described here, Deutsche Bahn had no IT system that could meet these requirements.

(b) **Action taken**: In order to create a comprehensive and legally compliant report, Deutsche Bahn initiated the project called *FINK*. Compensation obligations can last 30 years or more as they progress through various of Deutsche Bahn's business units. This life-cycle of a compensation obligation was initially modelled as a process using BPMN and, with the participation of stakeholders, an improved target process was developed. In order to control the transitions of responsibility within Deutsche Bahn and to ensure the quality of data, a web application based on Open Source components was developed, the core of which is a Business Process Management System (BPMS).

(c) **Results achieved**: The *FINK* project was initiated to engage intensively with the process of compensation obligations at multiple levels in Deutsche

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Bahn. Today, committees at both the management level and the user level coordinate the processes across the business units. The result is a uniform understanding of what data needs to be stored for compensation obligations in order to ensure quality-controlled reporting. An interdisciplinary team of environmental experts, process experts, and software engineers developed *FINK* using agile methods. In the spring of 2016, the system was handed over to Deutsche Bahn and began regular operation. It is now used by a multitude of employees at Deutsche Bahn and by many external partners.

(d) **Lessons learned**: Successful BPM projects involve change. Business departments lacking sound competencies in process analysis, process design, and requirements management can build expertise gradually with the help of external experts. Mapping from quality requirements to business rules can largely automate the quality-assurance process, and the notation standards of BPMN and DMN integrate well. The use of a BPMS can also facilitate monitoring, documentation, and verification duties. Finally, a consistent Open Source approach using standard Java components was successful in the project presented here.

1   Introduction

Operating in 130 countries, Deutsche Bahn AG is one of the world's leading passenger and logistics companies. As part of the DB2020 strategy, Deutsche Bahn seeks to remain a profitable market leader and to become one of Germany's top ten employers and an eco-pioneer (Deutsche Bahn AG 2016a, b). One of its environmental goals is to improve nature and species conservation, so when it builds new lines or upgrades old ones, it avoids destroying or even interfering with natural habitat right from the beginning of the planning process. When interventions with landscape and nature cannot be avoided, it creates an acceptable alternative or replacement so natural habitats for endangered species are not lost (Deutsche Bahn AG 2016c).

The handling of these interventions in nature and landscape is regulated by the Federal Nature Conservation Act (Bundesministerium der Justiz und für Verbraucherschutz 2016), which results in that the entity responsible for any intervention is also responsible for the implementation of three phases of 'compensation obligations':

- **Planning**: Nature conservation specialists plan the compensation measure and seek official approval.
- **Implementation**: With the official approval, the compensation measure is established and developed, usually over several years.
- **Maintenance**: In most cases, after successful implementation, the measure must be maintained for up to 30 years.

The spectrum of issues related to such action is broad. Sometimes animals must be relocated to alternative habitats, and even then, construction may proceed only after the animals have settled in successfully at the new location. If the construction of a railway line impacts on the landscape or trees have to be cut down, new trees may have to be planted at a suitable alternative location, and the compensation obligation is fulfilled only if the trees actually grow and are still thriving several decades later.

The compensation obligation is not new, and the business units of Deutsche Bahn have taken responsibility for it for many years. The motivation for the case study presented here was an amendment to the Federal Nature Conservation Act in 2010, which stipulates that a competent authority must monitor the implementation and maintenance of compensation obligations and that the intervening party must provide a comprehensive report to that authority. The Federal Railway Authority, Deutsche Bahn's supervisory authority, requires an annual report on the state of all compensation obligations under Deutsche Bahn's control since 1st March, 2010. By the end of 2016, Deutsche Bahn had about 4000 such obligations, with several hundred being added every year. The number continues to grow, as many of these obligations must be maintained for up to 30 years.

This case study describes how Deutsche Bahn met these requirements as part of a Business Process Management (BPM) project and how, in the spring of 2016, the project culminated in the launch of the Information System for Nature Conservation and Compensation (*Fachinformationssystem Naturschutz und Kompensation*), known as *FINK*. The core of this web-based application is a BPM System (BPMS).

2   Situation Faced

The requirements for quality-assured implementation and ongoing maintenance of compensation obligations and their annual reporting to the Federal Railway Authority led to the establishment of a new project that Deutsche Bahn called 'Compensation Obligations'. The members of its steering committee knew that the topic had to be anchored strategically within the organisation in order for the project to succeed. Even though they were not yet familiar with Dumas et al.'s (2013) Process Life-Cycle model, the steering committee started the *Process Identification* phase, as one work package was exclusively dedicated to the target process. Later in the project we took the stakeholders systematically through all phases of the model: the *Discovery*, *Analysis*, *Redesign*, *Implementation*, *Monitoring*, and *Controlling* of business processes.

At the time, there were few corporate compliance guidelines for compensation obligations. Each of Deutsche Bahn's business units was developing its own protocols, and processes were defined only for certain segments of work. No end-to-end process was described, from initial planning to ongoing maintenance in any of the business units involved, largely because Deutsche Bahn's responsibilities for any one compensation obligation change over time and many stakeholders are involved. We identified Deutsche Bahn's internal stakeholders as builders,

planners, property agents, purchasers, property dealers, maintenance contractors, and nurturing partners, and its external stakeholders as regulatory authorities, nature conservation authorities, planners, landscape constructors, commercial real estate agents, eco-point vendors, landowners, and conservation partners.

As none of the Deutsche Bahn's business units had software to keep track of the company's obligations systematically, all documentation for planning, implementation, and maintenance of compensation obligations was paper-based. Environmental planning documents were not kept separate but were part of the technical files and were stored in filing cabinets after the project conclusion.

The specialist department for environmental issues in Deutsche Bahn, DB Environment, is the main contact for the Federal Railway Authority in terms of reporting, and it acts as the central interface with Deutsche Bahn's business units. Neither the Federal Nature Conservation Act nor any other German law specifies how to manage and report on environmental compensation obligations, so one of the first project tasks was to define the content and format of future reporting in conjunction with the Federal Railway Authority and the various Deutsche Bahn stakeholders. It became clear early in the process that an efficient software platform was needed to fulfil this reporting commitment.

In order to produce the initial report by the end of 2012, an interim solution based on Microsoft Access was introduced. DB Environment distributed the application on CDs and consolidated the collected data in a central database, which took several months. Reports were created as PDFs and Excel files and delivered to the Federal Railway Authority, but the final results were not satisfactory to any of the parties involved. The data acquisition process was time-consuming, expensive, and error-prone, and the Federal Railway Authority could not use much of it because of the quantity and the data structure's complexity. From this process, we learned several important lessons:

- All data collected regarding compensation obligations must be recorded digitally from the start. While information was being collected for the first report, many of the associated projects were already completed, and not all of the various parties involved were available any longer. As a consequence, accessing information on particular compensation obligations and their ongoing changes during planning and construction was cumbersome and laborious.
- External planners must be able to enter data without discontinuity of media. In construction projects, environmental planning is usually assigned to external planners, who also provide the bulk of the data needed for the first report. Since these external partners usually have no access to the Deutsche Bahn intranet, a solution had to be found whereby they could contribute data easily.
- Before being given to the Federal Railway Authority, the report must undergo an internal data-quality check and gain the approval of the responsible Deutsche Bahn business units.

3   Action Taken

In view of the situation faced, Deutsche Bahn decided on an action plan with three project phases:

- Creation of a preliminary study (econauten 2016) to provide recommendations for process redesign, a suitable IT-infrastructure, and key requirements of the IT system.
- Development of a proof-of-concept to demonstrate the chosen system architecture's feasibility.
- Development and rollout of the productive system.

3.1   Preliminary Study: First Half of 2013

To be able to define the target process across the company, Deutsche Bahn's participating business units had to develop a common understanding of the tasks necessary to fulfil compensation obligations. The econauten, a team of external experts who specialise in digitising business processes, led the effort to improve the status quo (*process discovery*) and the search for weaknesses and potential remedies (*process analysis*).

In the initial workshop with stakeholders from all Deutsche Bahn business units involved, the econauten developed a BPMN 2.0 model (Object Management Group 2011) of the current end-to-end process. BPMN proved to be suitable for visualising the various stakeholders' perspectives such that who does what in the process was clear to all through the model. The stakeholders' roles were reflected in the model's swim lanes, which also captured communication flows, decisions, documents, and the systems involved. The standardised and formalised presentation of the process helped workshop participants to comprehend which processes were unique for particular departments and which were essentially the same activities with different titles. The modelling work motivated the departments to agree on a common language and a standardised process.

In a second workshop, large-format prints of the current process formed the basis for a qualitative process analysis. Reporting to the Federal Railway Authority required analysing when and from where the required data was produced and in what quantitative distribution, which led to a redesign of the target process. We noticed that much of the data had to be recorded (on paper at that stage) when planning the measure and submitting the approval documentation to the Federal Railway Authority. Not much more data had to be added later in the process, during implementation and maintenance. Visualising the overall process made where else this data would be needed apparent.

The modelling also made clear that the compensation obligation process is a long-term process. From initial planning to actual implementation, a compensation measure can take years. An external planning office usually does the planning, and a public authority is responsible for the approval. These measures must often be

maintained over several decades. As part of an analysis, participants evaluated the individual process steps and used User Stories (Cohn 2010) to highlight data-quality assurance and legal-related procedures, including regulatory approval and acceptance and transitions of responsibility between the business units, as critical to business value. Knowing that the measures are based on validated data proved to be an important requirement for the target process and a prerequisite for legally compliant reports to the Federal Railway Authority.

Inter-organisational processes were also clarified. An open and constructive dialogue began with the Federal Railway Authority, one of the key external stakeholders, on how best to fulfil the reporting requirements for both parties. Over several meetings, misunderstandings were clarified and participants described the difficulties they had experienced in the review and verification of the first report. As this first report was delivered in paper form and as an Excel spreadsheet, a systematic review was all but impossible. Therefore, the Federal Railway Authority decided to build its own IT system for storage and analysis of the data. On econauten's recommendation that all of the report data be defined as stipulated in an XSD schema, both Deutsche Bahn and the Federal Railway Authority familiarised themselves with XML, a data-exchange format that is understandable to both humans and machines.

Several key requirements for the IT system were derived from specialist workshops in conjunction with evaluation by Deutsche Bahn's legal department:

- Compliant, legally secure recording, storage, and provision of all necessary environmental data.
- A role-based access concept that enables Deutsche Bahn's internal and external users to access the system.
- Direct mapping of identified target processes in the system, where possible.
- Highly flexible and changeable processes that can be changed (preferably) by the department itself.
- Automatic monitoring of data quality.
- Quality checks with approvals by authorised process participants.
- Clear delegation of tasks and automated alerts.
- Automatic reporting to the Federal Railway Authority directly from within the system.
- Good price-to-performance ratio.

Such an application was not available at the time of the preliminary study either in the software pool of DB Systel GmbH (the IT subsidiary of Deutsche Bahn) or on the free market of environment specialist IT systems. A completely new IT system had to be developed from the ground up with three primary characteristics:

- **Web-based**. Nearly all professional applications run by Deutsche Bahn operate exclusively inside the company's own network. A Deutsche Bahn computer is usually necessary to access these applications, but external consultant are contracted for the majority of environmental planning at Deutsche Bahn. Access

to the new system had to be made available to these planners without providing everyone with a Deutsche Bahn computer, so the new system had to be designed with a web interface that required a user to have only a modern web browser to gain access. The application would then be available to external users via a proxy server with a suitable firewall in place.

- **Open Source**. To develop an IT system within the available budget, the preliminary study recommended reliance on Open Source components as much as possible. Deutsche Bahn already had a Java standard operating environment based on Linux that contained the Open Source portal *Liferay* as the standard user interface. The company chose the JSF Library *Prime Faces* to provide a richer user experience.
- **Process Automation**. Because of the requirements' obvious process nature, it made sense to use a BPMS, which made operating asynchronously and handling processes in the background possible. Users can enter data into the system without waiting for further processing or delegation, and the BPMS automatically manages and forwards tasks to the user via a task list. Because a number of processes had already been modelled in BPMN, closer attention was paid to systems that could execute native BPMN 2.0. The decision was made to use *Camunda BPM*, which promised to be highly flexible and developer-friendly. To complete the software stack, *Drools* was selected for executing business rules.

3.2   Proof-of-Concept: September 2013 Until July 2014

After the preliminary study, it was necessary to set up the IT project to address the requirements. DB Systel GmbH, which would later operate the system, took over the project management. Although analysis and a preliminary study had already delivered important insights into how the future application should be designed, many of the requirements were still too vague for technical implementation. It was clear that some requested details would be able to be described accurately only weeks or months ahead. An in-house decision committee was created to manage coordination of important decisions with all business units.

As the next report to the Federal Railway Authority was due, we could not delay the project any longer, even though not all requirements had been fully defined. Therefore, DB Systel opted for an iterative approach based on the agile method Scrum (Pichler 2008). Using *Sprints*, which are fixed-term (often fortnightly) working periods, a defined number of functions are implemented and (ideally) presented in a working order. This method produces in advance no comprehensive specification sheet that defines all functions.

Organisational and technical prerequisites were established in order to apply Scrum in a practical manner. The participants met at a kick-off event in Berlin, where the typical Scrum project roles were discussed and assigned as follows:

- **Product Owner**—Product owners represent the business side of the system and define its functional properties. DB Environment took over this role,

representing the involved DB business units. Two employees from DB Environment were allocated to focus specifically on this project.

- **Scrum Team**—The Scrum Team is made up of software developers and architects. Ancud IT, a company that specialises in Open Source and Java projects, was commissioned to do the software development. Over the course of the project, the size of the team varied from one to three software developers, plus additional resources for project management.
- **Scrum Master**—Scrum Masters monitor compliance with the method and ensure that the Scrum Team is supplied with a sufficient number of clearly defined functional descriptions for each Sprint. These specifications are described in Scrum as User Stories. A project leader from DB Systel GmbH took the role of Scrum Master.
- **Product Owner 'Proxy'**—The role of product owner 'proxy' is not explicitly described in Scrum, but in this case it linked the environmentally competent Product Owner and the IT-technically competent Scrum Team by specifying the requirements in such a way that the Scrum Team could implemented them consistently. This role was occupied by the econauten, a team of three specialists who had chaired the requirement workshops and developed the preliminary study.

The preparations for the technical project included the installation of a number of project management tools. Of particular interest were a ticket system in which the to-be-converted User Stories were described and managed in a scrum board, and a project wiki in which detailed conceptual notes and mock-ups of individual functions were recorded. Because the team would be working from a variety of geographic locations, the entire project infrastructure had to be available securely via the web.

After the kick-off in Berlin, all of the parties to the Scrum project started their work. The preliminary study had supplied a rough outline of the system architecture that had been refined, and the Scrum Team then began building this architecture. A web application based on *Liferay* was developed, and custom-designed input forms allowed users to input data regarding compensation obligations. This information was stored in a database in the background. In the next step, the BPMS Camunda was connected to the portal.

Meanwhile DB Environment and the econauten concentrated on clarifying the requirements. In a new round of workshops, representatives from all of the business units involved were asked to write User Stories in which they stated in which role they needed a specific feature and how they would benefit from it.

Over the following weeks, the new IT system was developed in 2-week sprints. After the end of each sprint, the Product Owner examined the implemented functions and processes via a test system. To collect feedback from future users as quickly as possible, selected users were able to enter test data using the first release on an additional proof-of-concept system after only a few weeks. Release 1.0 was presented to the decision committee with the following results:

- All data collected in 2012 via MS Access could be imported into the new system.
- The technical path adopted was effective, and a base system was set up in a relatively short time for users to log on and enter data via a web-interface.
- The key business process, collecting data and submitting an annual report in XML format to the Federal Railway Authority, had been automated.

3.3 System Development: September 2014 Until Spring 2016

After seeing the proof of concept, the decision committee approved the further development of the system. User Stories were written, prioritised, and implemented by the development team, and pilot users' experiences were used to improve the reporting process, masks, and the data model itself. Based on the User Stories and the high-level target process developed earlier, five additional processes were identified for automation in the new IT system:

- Managing requests for DB owned property on which a compensation measure is possible.
- Generating the *Maßnahmenblatt* (obligation fact sheet) exclusively via the system to summarise the data on which the project gains approval from the authority.
- Controlling the transition from the planning phase to the implementation phase, based on regulatory approval.
- Planning and documenting nature conservation approvals.
- Coordinating transitions of responsibility for a compensation obligation from establishment and development to maintenance.

Before the roll-out of the productive system in the spring of 2016, the project team and future users tested the system. Today the Information System for Nature Conservation and Compensation (*Fachinformationssystem Naturschutz und Kompensation*, or *FINK*) is available to all who deal with nature conservation and compensation obligations at Deutsche Bahn.

4 Results Achieved

Looking back at the initial situation, the most important goal was to create an IT system that could submit compliant data on compensation obligations to the Federal Railway Authority. In order to meet this goal, it was necessary to manage compensation obligations in this IT system consistently throughout the DB Group in Germany. With the launch of *FINK*, the original goal was achieved and some expectations were even surpassed.

FINK is a hybrid of a BPM system and a web-based data application. Internal staff from all of the DB business units that are responsible for compensation obligations now have full access to *FINK*, as do their external consultants. The

implementation of a roles and rights concept ensures that users can access only the system functions that are specific to their entitlements. DB Environment stipulated that the user management be based largely in the business units themselves. Today, segment administrators manage all accounts within their business units, setting up new users and assigning appropriate roles.

The demand for an IT system was the starting point for the project. While this demand could have been satisfied with classic software development, the experts opted for a software architecture in which a BPMS runs as the core application. The key concept of a BPMS is to execute logic described in business process models that can be changed easily, so system behaviour can be changed whenever business processes change, whether the system is in development or in operation. The model was improved with every iteration of the report process, and the application in operation reflected these changes soon after. All of these steps led toward an effective target process. Analysis of the most recent version of the report process and the effort to get there made clear that fewer resources were required as time went on; by that stage, the processes' inherent flexibility had paid off because knowledge was represented in the models instead of being hidden in software code.

Today the report process is started by the individual nature conservation experts whose job it is to submit data on compensation obligations to the Federal Railway Authority. The process invokes a rule set that compares the data entered in the system with predetermined quality rules. The results are immediately displayed via the user interface, where each test result highlights the exact data mask on which the quality problem was found. Thus, users can gradually correct the data until the desired quality is reached. The process then delegates the task of approving the pre-validated data to the task list of the person responsible for releasing the report to the Federal Railway Authority.

Only after this person has approved the data can the process engine initiate the conversion of the data in XML format. This procedure is run through all of the Deutsche Bahn business units involved. Then, in a final step, the process renders the actual report, including the XML input from all business units, which is then sent to the Federal Railway Authority.

FINK can do more than generate reports on compensation obligations. What users particularly like about *FINK* is that it supports their specific work contexts. For example, the system helps them to coordinate the transition of responsibility between the business units involved. They appreciate that processes guide them through their tasks over several masks on which all important contextual information is readily available. *FINK* is an expert system; the goal was not to automate everything with the BPMS but to use *FINK* to help expert users deploy their knowledge in the best possible way via intelligent processes and business rules. Human knowledge and interaction will continue to be significant when it comes to dealing with compensation obligations.

The BPM project initiated a more holistic approach with regards to compensation obligation processes throughout the DB Group in Germany. The visualisation of the processes, roles, and decisions involved, as well as the underlying data, message flows, and systems involved were all central to a consistent perspective on

the status quo for all stakeholders. BPMN has proved its worth as a notation standard. Even people with little experience in analysing and visualising business processes found the diagrams easy to understand, as long as they were created with a limited number of modelling elements (Freund and Rücker 2012) One participant on the steering committee wrote: "Compared to the mapping of processes in other software, I find the representation in swim lanes much easier to understand." In this project, the BPMN model of the target process became the basis for a new corporate guideline at Deutsche Bahn.

With BPMN it was easy to model who participated in a process, in which particular role they acted, what decisions were necessary, and what tasks had to be completed. However the data on which these decisions were based and how this information had to be displayed on the user interface was not part of the BPMN model. The complex behaviour of the user interface had to be described in other ways through additional text and mockups. Also additional programming was necessary, as this was the only way to deliver an easy-to-use, dynamic interface on which users could manipulate large amounts of data in one process step.

Many of the ideas to improve the system that arose during the iterative development not only touched the process model of the application but also the user interface behaviour and the underlying data model. It was at this point that the customers' expectations regarding easy modification of the system could not be met. A project participant at DB Environment described the situation thus: "I had expected more flexibility, especially when setting up new processes. I had seen prototypes in other projects where it seemed easier to design and change processes. To me, this is very important when further developing the system."

BPM projects usually require an approach that differs from one that is suitable for classical software development projects. Many BPM projects aim to give the specialist departments increased ability to customise the IT systems to their requirements. As such, greater configurability through the departments should be implemented wherever possible, but the additional effort necessary must be balanced with the option of implementing other relevant features.

In the future, and with little extra effort required, the revision of quality rules could be transferred entirely to the specialist departments, which now define the criteria for data quality and document these rules in Excel spreadsheets. These spreadsheets form the basis of the rule definition in DRL, the domain-specific Drools Rules Language. These rules can be documented even better with the relatively new OMG standard DMN for decisions (Object Management Group 2015; Debevoise and Taylor 2016). Like BPMN, this notation is based on an XML scheme that can be executed by suitable systems (i.e., the current version of Camunda BPM). Following the DMN standard, decision tables can be built and filled with rules directly by specialist departments, and the BPMS calls these rules out of a process and executes them. Switching to DMN is planned for a future release of *FINK*.

5   Lessons Learned

For BPM projects to be successful, specialist departments must have sufficient expertise

Specialist departments are typically faced with challenging demands with respect to IT projects, especially BPM projects, as the responsibility for their success lies increasingly with the departments themselves. In order for these specialist departments to work as equal partners with the IT department, they must couple their professional expertise with other kinds of expertise. For example, in addition to having a common understanding of processes in general, the recording and reading of process diagrams requires knowing a modelling language—in this case, BPMN. Although the notation is easy for most people to understand, creating process diagrams, even if only a few modelling elements are used, requires some practice. Competency in process analysis and re-design is also necessary.

Department representatives (in this case, environmental protection and nature conservation representative) must contribute their expert and practical knowledge to completing software requirements. Especially with agile products, considerable responsibility rests on the Product Owners, who represent the business side. The Product Owner is responsible for specification and final acceptance of the various features and their prioritisation and is involved in release planning and cost and risk analysis. If the Product Owner is not sufficiently available or qualified, the whole project can be delayed.

In this particular case, the Product Owner's capacity and knowledge were not equal even at the initial stage to managing this complex IT project. Therefore, an external team supported the environmental experts and ensured the continued availability of a strong Product Owner throughout the development. Expertise was gradually transferred to the department, enabling further independent development in-house. The success of BPM projects also depends on effective communication and cooperation between specialist departments and IT experts. All too often there is a lack of understanding of the other side's tasks and responsibilities. Technical vocabulary can be misinterpreted, and misunderstandings, fears, and prejudices can lead to conflicts.

The parties involved recognise the benefits of BPM only when the depicted processes are relevant to them

In order for an organisation's BPM initiative to fall on fertile ground, the first process to be implemented should be chosen wisely. Those who have had little experience with BPM may not immediately see the benefit in such projects, as much of it can sound abstract and can even be daunting. Immediate attention is paid to such an initiative if it addresses significant issues of those involved. In the present case, the first process to be implemented was the group-wide, quality-assured establishment of a standardised report on compensation obligations to the Federal Railway Authority. Before the introduction of the BPM application, this report process was highly complex, so the prospect of its creation being supported by IT

and obtaining a higher quality report at a lower cost was motivating for the participants.

The chosen process must be relevant to the organisation, but it cannot be too complex or it will quickly overload the participants. Ideally, a large process previously described in BPMN should have sub-processes identified for possible automation, but it is not as useful to specify them to the last detail as it is to deliver still 'raw' but ready to run to the subsequent users. In dealing with processes directly in the BPM system, users can quickly identify where further specification is needed, and the fine-tuning is then based on previously implemented processes. This approach saves both time and resources and establishes an iterative working method right from the beginning. The specialist departments and IT experts concluded that requirements face continuous refinement, and BPM was the right choice for that dynamic environment.

Adding systematic quality checks to processes can easily be achieved using DMN

How can those responsible at Deutsche Bahn ensure that their reports to the Federal Railway Authority conform with agreed quality standards? The two most important answers are:

- Quality must be contextually defined in rules.
- Compliance with these rules must be systematically and automatically checked.

In this example, the goal was achieved by combining processes with decision logic in a Rules Engine. A relatively simple process guides the user through the masks of the automated quality inspection. As per Rules Task, a set of rules is called upon from within the process, against which the collected data is checked. The user sees the identified quality problems prepared in a table and eliminates them one by one until the desired level of quality is reached.

The automatic quality inspection can also be invoked as a sub-process from other processes. Depending on the context, a particular rule set is used, but the basic structure of the inspection process remains the same. Without this approach, the quality assurance in the complex area of nature conservation would not have been possible.

The fulfilment of monitoring, documentation and reporting compensation obligations is significantly simplified with a BMPS

In the context of compensation obligations, the Federal Railway Authority are not the only body to which Deutsche Bahn must report. DB Legal Department requires specific documentation of relevant process steps as well, and Deutsche Bahn itself has employee representation guidelines and monitoring and compliance requirements. Some of these guidelines were initially non-specific but were recognised by the stakeholders as important non-functional requirements. Expectations behind these requirements could be anticipated and translated into concrete functional requirements for the system.

The target process's required procedures and responsibilities were mapped directly into roles, rights, and business rules. Adopting this approach made it easy to extract relevant information automatically for documenting and verifying obligations directly from the BPMS. Proof required in the form of journal entries that document, for example, the results of a completed process instance could be developed cost-effectively.

Another important component of the BPMS in this context is the integrated process monitoring. Each initiated process instance can be traced step by step so bottlenecks and problems that arise during its execution can be identified easily. With an increasing load on the system and a growing number of processes passing through it, patterns and vulnerabilities can be identified and methods continuously improved.

The standard compliant JAVA Process Engine and Portal Solution are good choices in the development and deployment process

The components of the new system were entirely implemented in Java and fitted seamlessly into the standard deployment and operating environment of DB Systel, Deutsche Bahn's IT subsidiary. Development and operation of this BPM application is no different from that of other Java enterprise applications, so the risk of unexpected side effects is predictably low. This prerequisite was important in meeting DB Systel's requirements and competing against the well-established solutions of major manufacturers and their heavyweight components. Easy embedding of the system into the heterogeneous IT landscape was a given, and other well-established technologies of the Java EE standards, such as reporting, monitoring, and logging components, could also be integrated easily into the system, all in addition to the pure operating environment. Since all of the components are Open Source, the risk of a software vendor lock-in was reduced and access to the large Open Source developer community was possible.

Successful BPM initiatives are anchored in the organisation as change projects

BPMS projects are equal parts organisational and IT projects, but IT is no longer necessarily the dominant partner, as it is seen to be on equal footing with other organisational areas. In this project, the necessity of standardising processes across business-unit boundaries was recognised early, and the steering committee assumed responsibility for the strategic implementation of this standardisation across the organisation.

The steering committee also established successful cooperation between the various departments and assisted the BPM development team throughout the project. The business units involved were well aware that they had to provide resources and make decisions over the long term, but the steering committee's and the decision committee's support for the successful implementation of the BPMS project contributed significantly to the project's success.

The steering committee coordinated feeding the results from the BPM project back into the business units and entrenching them. Heavy users of *FINK* regularly exchange ideas at top-user meetings, discussing aspects of the system and the various processes and flagging potential improvements. They share their knowledge of processes and how to work efficiently with *FINK* with users both inside and outside

the DB Group. The ongoing establishment of *FINK* in the DB Group ensures that the processes represented in the IT system stay in sync with the organisation.

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