Andreas Birk: **A Knowledge Management Infrastructure for Systematic Improvement in Software Engineering**

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Kurzfassung:

Present improvement approaches in software engineering offer very little guidance for informed decision making regarding the identification and selection of concrete improvement actions. Decisions about improvement actions are often either based on the personal experience of software professionals, who are likely to be biased, or triggered by general trends in the software domain (so-called silver bullet solutions or technology hypes). This limits the effectiveness of improvement programmes and even can make them fail.

The objective of this thesis is to develop a knowledge management infrastructure through which experience about improvement actions can be made explicit, accumulated, and offered for informed decision making. The infrastructure shall help establishing systematic improvement processes and overcoming ad hoc practices and decisions.

Based on the Experience Factory / Quality Improvement Paradigm (EF/QIP) [BCR94a], a knowledge management framework is to be set up for managing experience about software engineering technologies and about the effects and context dependencies of technology application. This shall provide the empirically validated information needed for supporting the identification and selection of improvementactions for given improvement goals and context characteristics of a software organisation.

Contributions

The EF/QIP makes software development and software engineering improvement more systematic by supporting the learning and reuse of relevant experience. This thesis refines and extends the EF/QIP for the specific case of technology-related experience reuse in systematic improvement. In particular, the thesis provides:

- An extended approach to software process modelling that includes an explicit concept of software engineering technologies, relates the process with the developed products, and describes the impact that the context of software development has on technologies, processes, and products.
- A knowledge representation schema for modelling technology experience packages (TEPs) and for organising them in the form of technology experience bases (TEBs). TEPs represent the core knowledge items of the approach. They store experience relevant for the application of software engineering technologies. TEBs are knowledge repositories that contain and organise collections of technology experience packages.
- Knowledge management processes for the acquisition, deployment, and evolution of TEPs:
- A knowledge acquisition method collects and models distributed experience about the application of technologies.
- A systematic technology selection method deploys TEBs (and the contained TEPs) for supporting the planning of software projects and improvement programmes.
- A TEP evolution method analyses software projects in which a technology of interest is applied and suggests modifications or refinements of the technology's TEPs.

These contributions establish a refinement of the EF/QIP for the specific case of experience about the effects and context dependencies of software engineering technologies. In addition, concrete patterns of the effects and context dependencies of software engineering technologies have been identified. These patterns can be used for supporting decision making for the identification of improvement actions.

Scope and Emphasis

The required first steps for setting up the knowledge management infrastructure in a software organisation are the installation of a TEB and its population with organisation-specific TEPs. In order to support this bootstrapping of TEBs, the thesis places particular emphasis on the development of the knowledge representation schema and the knowledge acquisition method.

Application and validation

The approach has been applied several times in the context of industrial software projects. The experience from these applications support that the approach is well applicable in industrial settings and that it effectively contributes to the enhancement of systematic improvement practices.