

# Software process improvement at ABB

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Software is of paramount importance for ABB's success. It is at the heart of ABB's products and it delivers added value. In our Industrial<sup>IT</sup> architecture, software is the glue that holds different applications and systems together. Software spans all levels of this architecture, from the Aspect Objects representing real plant objects to enterprise applications based on the Skyva platform. While the importance of software is growing in our classical products, we are also developing pure software solutions for new domains, like the evolving liberalized energy market. Closer to home, software systems are vital to ABB's internal processes. No fewer than 15,000 ABB software engineers are working in distributed, international software projects to deliver these products and applications.

In 1992, ABB was among the first companies to realize the importance of repeatable software processes for timely delivery of high-quality software products. Since then, the company has introduced a rigorous program to harmonize software development and create a culture of self-improvement in its software factories. Central to this is the Capability Maturity Model, developed by Carnegie Mellon University, and the ABB Software Process Initiative (ASPI).

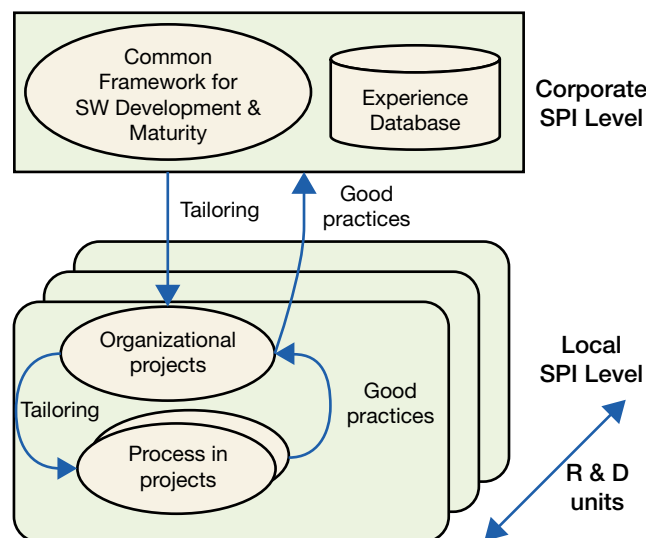
## ABB Software Process Initiative – ASPI

ABB started the company-wide ASPI initiative in 1999. What it does is bundle local improvement projects, speed them up and establish common processes. ASPI stresses business and project management issues and links software

process improvement activities to business goals. In particular, ASPI has been working intensively towards two goals in R&D software development:

- Harmonize processes, methods and tools to be used throughout ABB inside a common framework.
- Create a culture of continuous self-improvement with the goal of being able

### 1 Company-wide and local Software Process Improvement (SPI)



to work on an efficient and mature process level.

ASPI was started as a research project by ABB's Corporate Research organization. To establish software process improvement as a permanent function in ABB, a unit in ABB's group-wide process organization has been created to take ownership of the improvement activities and ensure consistent implementation of process standards across the company. Currently, more than 1200 ABB software product developers work according to ASPI principles.

### Common Framework for Software Development and Maturity

The ASPI approach is both top-down, through an ABB-wide Common Framework, and bottom-up, through support of local process improvement projects, as indicated in **1**.

ASPI provides a Common Framework for Software Development and Maturity that consists of the following elements:

- A project control model: This model defines a common language and common procedures for project decision-making and project management.
- A model for execution of process improvement projects: This model defines the phases of an improvement project and supports the systematic planning and tracking of process improvement activities.
- A set of four common metrics for performance baselining, covering time, effort, quality and functionality.

The Common Framework establishes a common language throughout the company and provides common management procedures. Furthermore, it generates management commitment to software process improvement activities by providing a set of tools to support planning and tracking of such activities.

### Sharing experience

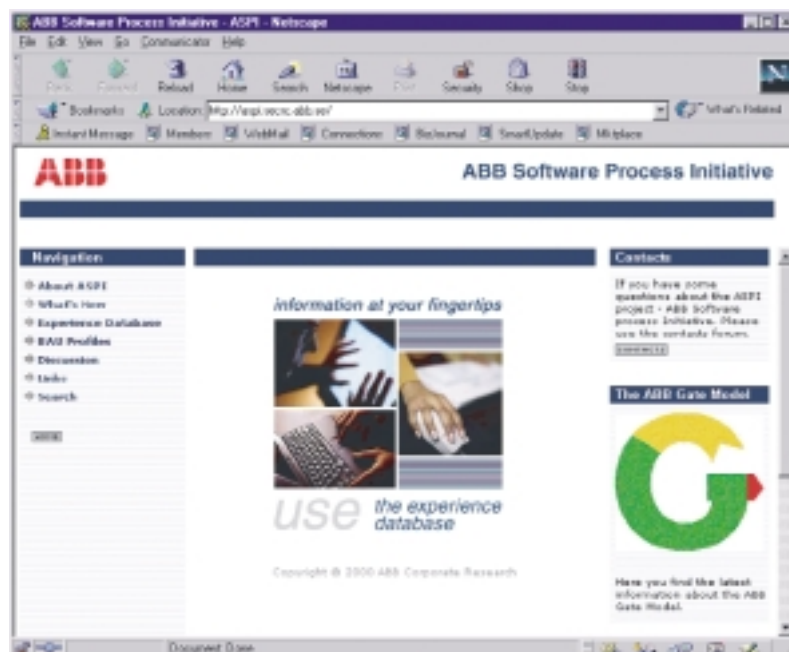
Another key element of ASPI is the Experience Database (EDB), shown in **2**. The goal of the EDB is to facilitate sharing and re-use of experience. In the EDB, experience is represented using a structured template which captures preconditions, expected impact, success factors and cost/benefit evaluations concerning the experience. An editorial board reviews each experience prior to

publication, ensuring the EDB content is of high quality.

The EDB can be accessed by every ABB employee through a portal which contains the Common Framework, experience, discussion groups, announcements, etc. The main intended users are, however, process consultants and change agents. These users apply the experience when supporting improvement projects in the R&D units. In this way, they actively spread software engineering best practices throughout ABB.

The ASPI team keeps the users interested in the EDB and ensures that new experience is constantly added. ASPI publishes additions to the Common Framework, announcements and articles regularly on the EDB web site.

**2** Experience Database – a valuable resource for ABB employees



### Improving the maturity of software development units

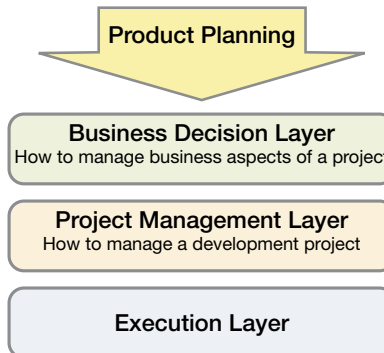
ASPI coordinates and supports software process improvement activities within the different R&D units. ABB has a long tradition of applying the Capability Maturity Model (CMM) in such projects.

ASPI stresses business-goal-driven process improvement. In a dialog with local management, process improvement goals are derived from business goals at the start of each improvement project. CMM assessments are performed to clarify the current level of software engineering maturity of the R&D unit.

In cooperation with research partners at Carnegie Mellon University (CMU) and consultants, ABB has developed a toolbox of different kinds of assessments suitable for units of different sizes and maturity levels. These range from a project-oriented improvement process starting with a one-day assessment to a full assessment addressing all CMM levels.

It is important that assessment results lead to concrete improvements. Therefore, a performance plan is created for the R&D unit which defines improvement goals and actions, based on the results and business goals. The feedback from the local projects to the company-wide improvement initiative is secured by experience collection during the improvement project. The collected experience subsequently becomes available through the EDB and can be used to help projects in other units, or even contribute to future process products generally used in ABB.

### 3 Layers of ABB's model for controlling R&D projects



Currently, there are 23 ABB software development units that systematically run business-goal-driven and CMM-model-based process improvements.

### Business-focused software management

#### Project control model

At the heart of the Common Framework for Software Development and Maturity is a model for control of R&D projects. The goal of this model is to define common elements for the different processes involved in product development and establish their connections. The model consists of four layers, as shown in 3.

- The Product Planning process forms the topmost layer of the model. It serves to systematically plan and manage the product portfolio.
- The Business Decision Layer establishes the connection between product organization and project execution. It gives the product organization good project status visibility and enables timely business decisions.

The decision model used throughout ABB is the ABB Gate Model, which will be described in more detail below.

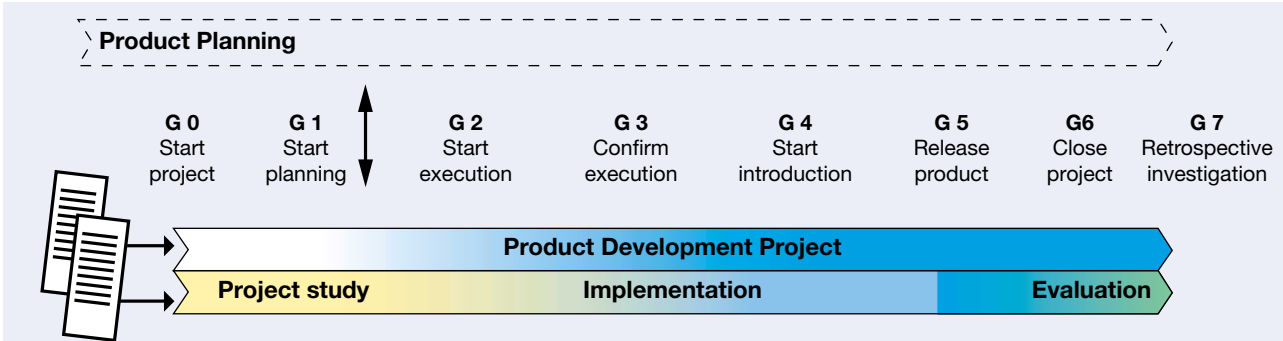
- The Project Management Layer is used to run a project according to the ABB Gate Model and to provide the information required for the gate decisions. It introduces a common terminology for project management activities throughout ABB and establishes ABB-wide procedures for project steering.

- The Execution Layer refers to the actual process used by the R&D unit to construct the (software) product (eg, waterfall model, rapid application development, incremental development model). Due to the great variety of businesses and products in the ABB Group, there is not much potential for standardization on this level. However, good practices from the EDB help the R&D unit to define its development processes.

#### ABB Gate Model

The ABB Gate Model is the interface between the product line organization and the project execution. It makes the project status visible and provides relevant input for business decisions. This is achieved through seven defined decision points (called Gates G0 to G6) during the R&D project's lifetime. One additional check point (G7) after the project termination is used for checking the achievements and collecting experience for process improvement 4.

At each Gate the status of the project and the business opportunities and risks



it presents are discussed in a Gate Meeting. The project is assessed objectively before the meeting. Based on a concise assessment report, the Gate Meeting is a focused business decision meeting. It results in the decision to continue, stop or re-direct the project.

By enabling timely business decisions the Gate Model helps ABB's R&D units to adapt quickly to the needs of today's rapidly evolving markets. The standardized gates and checklists establish a common language throughout ABB's distributed projects and organizations. The Gate Model addresses all functions in the development organization, including marketing, sales, product management, production, service, training and quality assurance. This holistic view improves the product quality and the readiness of the organization to support and maintain each released product.

The Gate Model helps ABB R&D units to make the right business decisions while ensuring consistent quality for every customer. Since March 2001 the Gate Model is mandatory for all

hardware and software product development projects in every ABB division. Even ABB Corporate Research is about to introduce a tailored version for research and prototyping projects.

**ASPI – foundation for the future**

Success in software engineering rests on three foundations:

- Adequate technology
- A skilled software team
- A repeatable and defined process accepted by the team

ABB started considering these as early as 1992. Since 1999, ASPI has been applied to harmonization and improvement of software development processes. While the focus of former initiatives was to improve local processes, ASPI is a company-wide initiative focusing on product and business-driven improvements.

Although ASPI has not yet been completed, the following can be said: Because ASPI is a top-level management-driven program, it is visible throughout the company and has been recognized

as an important endeavor. This is a prerequisite for developing and implementing common processes in a multinational company. Moreover, the initiative has established central coordination of local process improvement activities in the ABB organization, which makes them sustainable.

Two essential success factors are important for ASPI:

- First, there is a clear separation of common management processes that have to be applied in all units and local technical processes that are under the control of each unit. The former establish a common language throughout the company and create a defined communication channel between line organization and project organization, thus providing a better foundation for business-oriented decision-making. The latter means local units maintain responsibility for their technical processes, including required interfaces to and tailoring of common processes.
- Second, the chosen organization (ASPI, the ABB Group Processes

responsible unit and the local organization of the R&D units) guarantees that the common processes are introduced and used, that local process improvement projects are conducted, and that experience and good practices are collected and analyzed.

ASPI currently supports R&D projects developing new products for ABB's Industrial<sup>IT</sup> product family. The initiative

keeps extending and improving the Common Framework for Software Development and Maturity, eg with better support and education for project managers. Finally, as a Corporate Research project, ASPI keeps ABB connected with the state of the art at ABB's strategic university partners, studying for example recent developments at the CMU, like CMMI or the Team Software Process.

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## on the record...



"I'm involved with setting up an ABB development center in India to utilize the strengths of India's globally competitive human resources, especially in software-oriented activities. Like ABB businesses, the

ABB software development environment has a very international flavor, and this puts ABB in the enviable position of being able to pull together the best competitive advantages of different parts of the world.

ABB products, by design and by stated objective, are increasingly software-based and it is intensely exciting to

work with people with deep domain expertise who help in creating software. This, for me, forms an important element in the new paradigm of Industrial<sup>IT</sup>. This software is meant for real-world business and process applications and has years of field experience behind it.

To me, the most exciting aspect of software in ABB is that we provide a true 'blue collar' software expert to the customers, that we serve and help them increase productivity and bridge the gaps in their business chains in the Internet age!"

Bazmi Husain, ABB, India



"As project leader of ASPI, I have plenty of contact with software engineering experts around the world. Together with ABB's strategic university partners, this international team provides knowledge and

experience which does not exist in one, single location.

When supporting different business units regarding ASPI best practices, I learn a lot about their organization, culture and products.

For me, the exciting technical products and solutions delivered by ABB are a strong motivation. It is very rewarding to contribute to software that solves real-world problems."

Peter Fröhlich, ABB, Germany



“At ABB in Germany I’m responsible for the business development and product management of our whole-sale software applications from the USA which cater to the deregulated electricity markets in Europe.

ABB provides us with the ideal environment for swapping experience between different ABB locations. This boosts our success in deregulating markets worldwide.

But it’s not only the exchange of technical knowledge that brings us together; ABB’s spirit of ‘Think Global and

Act Local’ encourages openness and mutual support from colleagues all around the world.

In addition, it’s very noticeable when dealing with customers that they appreciate the way ABB exploits the synergies between different markets.

The internal spirit and the very positive feedback from the customers combine to make my job at ABB very exciting and attractive!”

Peter Gross, ABB, Germany



“I am responsible for ABB Corporate Research in Kraków, Poland, and one of our focus areas is emerging software technologies. We are developing applications for engineering systems like

distributed real-time collaboration environments, eManufacturing diagnostic systems for service needs, or, right now, participating in the development and deployment of ABB’s backbone build-up for our IndustrialIT efforts.

Such implementations are only possible in a global, distributed company like ABB. One of our main driving forces is to implement solutions, not just for one factory but for whole ABB business areas and external customers dispersed around the world. As software development is nowadays a continuous and complex process, it requires creativity and effective management. I think a crucial element of success is a combination of competence, speed, speed, speed and price. This motto creates a unique spirit in our multidisciplinary team!”

Marek Florkowski, ABB, Poland

“In my group in Oakland, California, we’re developing ABB’s software solutions for the fast-changing retail energy market in North America.

Working in a software business as part of ABB is great because much of the work we’re doing dovetails with other business areas where ABB has a strong presence. I feel we

have a real advantage in terms of relating to customers because we’re not just another software vendor, but part of a firm that already has a relationship with them based on trust.”

Beth Reid, ABB, USA