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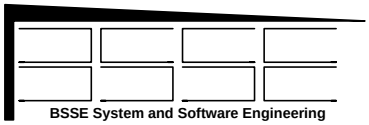

Strategies to Minimise Risks and to Increase Productivity and Quality of Software Development

This article describes strategies applied by BSSE in the context of software development, project management, risk management and quality management.

Proof of Success. BSSE's ultimate goal is to make any process improvements measurable and traceable. Therefore all our methods and related tools provide immediate feedback which in turn guides to the next improvements and prove the achievements in the area of productivity and quality. This proof is given in the document BSSE-results*.pdf which provides – anonymised – qualitative and quantitative results of successfully completed projects.

Automation. For BSSE a fully automated approach in the area of software development is a necessary condition for achieving higher quality and productivity and shorter time-to-market (T2M). These targets can only be reached if all steps between delivery of a specification and execution of the software on the target system are automated so that no manual intervention is required at all. This implies the automation of – apart from coding – testing, verification, integration and documentation, and in addition outmost support of validation by a feedback on the specification. This high degree of automation is our daily business for already more than 10 years.

Measurability. Without measurability no proof and feedback on progress and success is possible. BSSE enforces the quantitative measurability and measurement of quality and productivity for any improvement – for methods, tools and services. The key to obtain sufficient measurability is automation.

Notation. Notations have to facilitate a user's needs. As far as possible a user's familiar notation is used as front-end to an improved process. Tools must relieve the user from the burden of transforming information into complex notations. This task is not a big problem for a fully automated process. If a foreign notation – which may be useful in the context of a method – is imposed onto a user, efficiency and quality decrease, while the fault rate increases.

Incremental and iteratively. Incrementally stepping towards an envisaged goal enables a user to approach the optimum without risks, always able to drop an iteration without loosing too much time, effort and money – when relying on full automation combined with verification and validation support. Then even safe "Last-Minute-Changes" are possible – if standards allow.

Specialisation. Without specialisation (on a certain application domain) full automation is not possible. Only when focusing on a specific domain like distributed / real-time systems or project management, full automation of processes is achievable, in combination with the required set of quality checks and measurement of success through metrics – without constraining or limiting the genericity of the approach in context of the chosen domain. Specialisation opens a large and great potential for optimization of a process, and enables an automaton to take a higher load than in the universal case.

Reusability of strategies and tools enables efficient support of domain-specific methods.

Avoidance of redundant information increases the efficiency through exclusion of inherent, potential conflicts between redundant parts, and reduces the manual effort. Instead, automation derives redundant information in the required form and when needed.

Adaptability of methods and tools is a necessary condition for meeting the customers' needs at little costs and within a short period of time.

Extraction of information. Automated extraction of information and its combination with a method for its transformation, analysis and/or documentation significantly increases the efficiency of processes.

Using Synergies between different processes and domains like technical and organisational matters is a big challenge, which – however – can be mastered by automated processes and structured methods. Such synergies enable a big potential in improving project execution and related processes.

Saving investments. The ultimate BSSE goal for definition of customised processes is their potential for continuous evolution and saving of previous investments by integration with an existing infrastructure.

Risk minimisation. New and revolutionary approaches need to minimise or even exclude risks and should not introduce new or additional risks.

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1. STRATEGICAL ASPECTS

The following theses illustrate some of the strategical aspects which are considered and applied when BSSE identifies new processes and methods.

1.1Tailored at low costs and at an immediate response

Based on a high degree of automation BSSE has the potential to provide tailored processes at low costs and within a short response time.

While usually tailored services like porting of legacy software and feasibility analyses are performed purely manually, e.g. through reading documents or code, BSSE has the capabilities to automate such activities, also in cases where a tailored solution is not available in BSSE shelves. Due to previous activities – aiming a high degree of reuse – BSSE has access to a large spectrum of tools, which allow fast adaptation towards a tailored solution.

Due to our long experience in the area of methods and tools BSSE is in a position to flexibly react on specific needs of customers, at low human effort and costs.

1.2 Scalability in size and complexity

The size and complexity of software products is increasing continuously. In all steps of the software lifecycle the human effort remained still high, although methods and tools are applied. However, conventional tools do not tackle the most critical and labour-intensive parts. Therefore an engineer is still the bottleneck in the software lifecycle regarding scalability in size and complexity. Effort and costs increase overproportionally due to overhead through additional human interaction. Flexibility suffers, time-to-market is high and high quality implies high costs.

Our simple answer is: full automation, i.e. processes running without any human intervention, starting very early in the lifecycle. The following aspects are essential to fulfill the challenging goals (however, this is a non-exhaustive list):

1.2.1 Creativity and inspiration instead of transpiration

To minimize response time and costs the human interaction needs to be limited to creative activities. Following Edison's thesis of "1% inspiration, 99% transpiration" this shall lead to an essential increase of productivity and reduction of development costs and T2M.

So far a human being is still too deeply involved in the "transpirative" activities of development. According to our experience, developers themselves are often responsible for this, as many of them wrongfully see these activities as their challenge and their only chance to excel. However, such transpirative, labour-intensive activities may be covered by full automation – provided a process is properly organized. The feasibility of such an organization BSSE has proven already 10 years ago.

In the context of the software lifecycle this means, e.g., that after delivery of a specification and acceptance of the product no manual intervention is needed anymore. A description of this approach can be found in BSSE-Modelling-VV*.pdf or in BSSE-ISG-flyer*.pdf.

1.2.2 Automation instead of training and certification

Usually, training and certification of engineers and processes are considered as the key to success regarding higher productivity and quality. However, high manual productivity is in conflict with high quality – currently, in a human-centric, labour-intensive scenario of development. High quality implies more care and – in turn – high effort. References found in the literature (e.g. Fenton) suggest that fault rate can be reduced by about one order of magnitude due to better education of engineers (training, certification), while the related increase of effort is not studied. Other references suggest, that the human effort will increase by about one order of magnitude, too.

Proceeding more carefully after training and certification will increase quality, but also effort and T2M. However, full automation can solve this conflict – as already known from manufacturing with robots. Full automation de-couples the amount of produced and related human effort. This is confirmed by results derived from BSSE projects based on full automation.

Through the reproducable automated generation of code, the quality of the final product – the software system – becomes more decoupled from the "form on the day" of a developer. Due to practical and

measurable feedback on the generation process its performance and quality can continuously be improved. Statistical deviations of quality do no longer occur.

1.2.3 Measuring performance instead of hoping for it

An essential aspect for the assessment of productivity and quality is the measurability of a process' properties, i.e. a possibility for an objective assessment. Quality assessments based on manual review of documentation or results of manually driven testing merely allow for a subjective feeling, but are not sufficient. BSSE's asserts that quantitative measurability of quality is a necessary condition and therefore enables its tools to provide such measurement, so that the performance can be directly derived from numbers and quantities.

Measurement of only some properties is not sufficient. For a thorough assessment all relevant properties of a software product must be measured. In many projects BSSE could identify faults even after other tools for quality-assessment and –improvement had been applied. However, these other tools did only support measurement of some properties, allowing faults to remain hidden.

1.3 Process optimisation through measurements and metrics

The conversion of an idea to an optimised process requires measurements of its characteristics and properties (see Fig. 1-1) like

- turn-around time,
- number of manual interventions and decisions,
- absence of faults in the process' implementation,
- degree of scalability,
- supported complexity.

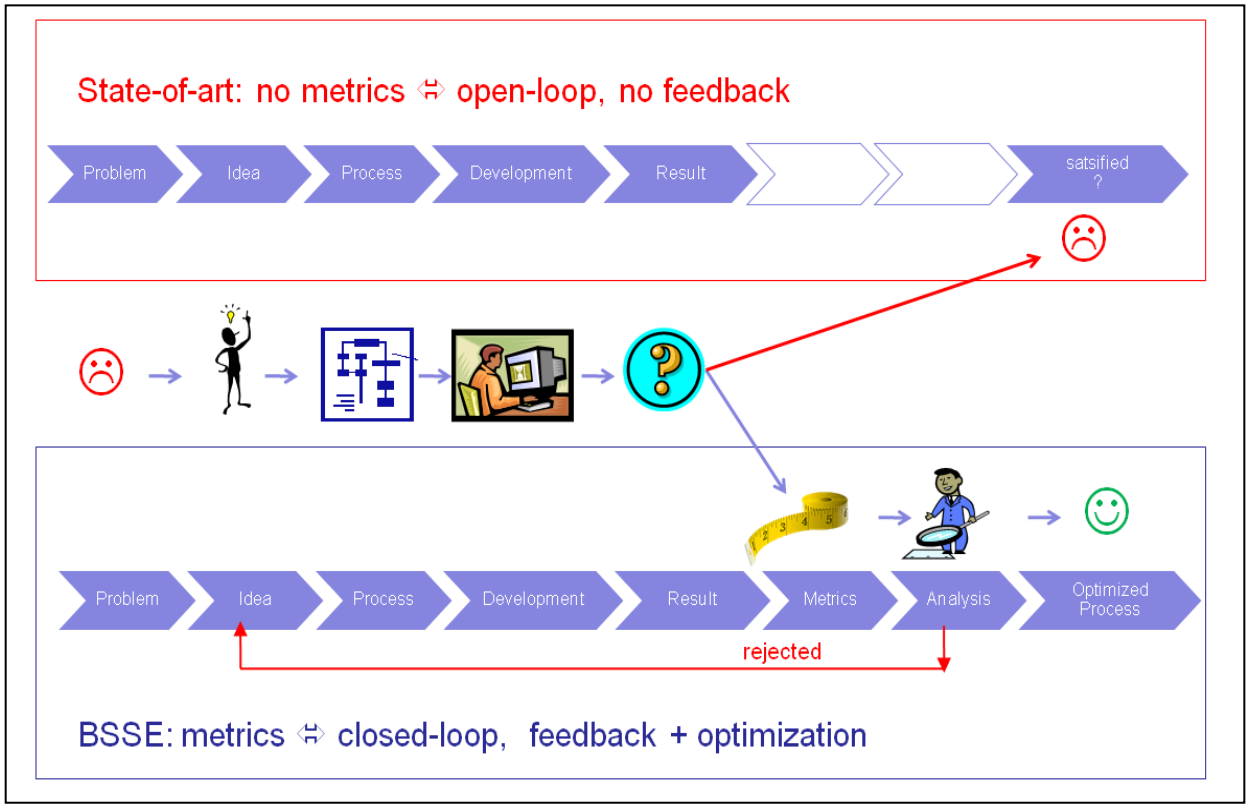

Fig. 1-1: Process Optimisation through Metrics

Measurement of a process' properties is only achievable by use of suitable notations supporting the establishment of valid quality. Without a complete set of metrics neither the determination of the achieved performance and quality nor the decision on improvements and optimization is possible.

1.4 Provision of a tailored process

Fig. 1-2 describes the principal steps of BSSE's approach ("meta-process") to define methods and tools in providing a tailored solution. Possibly, such a tailored solution can be resued in other cases as well, if there is a need and the contractual conditions do allow.

Our principal steps of such a meta-process from a customer's request to availability of the solution are:

1. classification of customer-provided information,
2. definition of the tailored method and a proper meta-model (see BSSE-Modelling-VV*.pdf for further information about meta-models),
3. implementation of the tool, and
4. training and support of a customer.

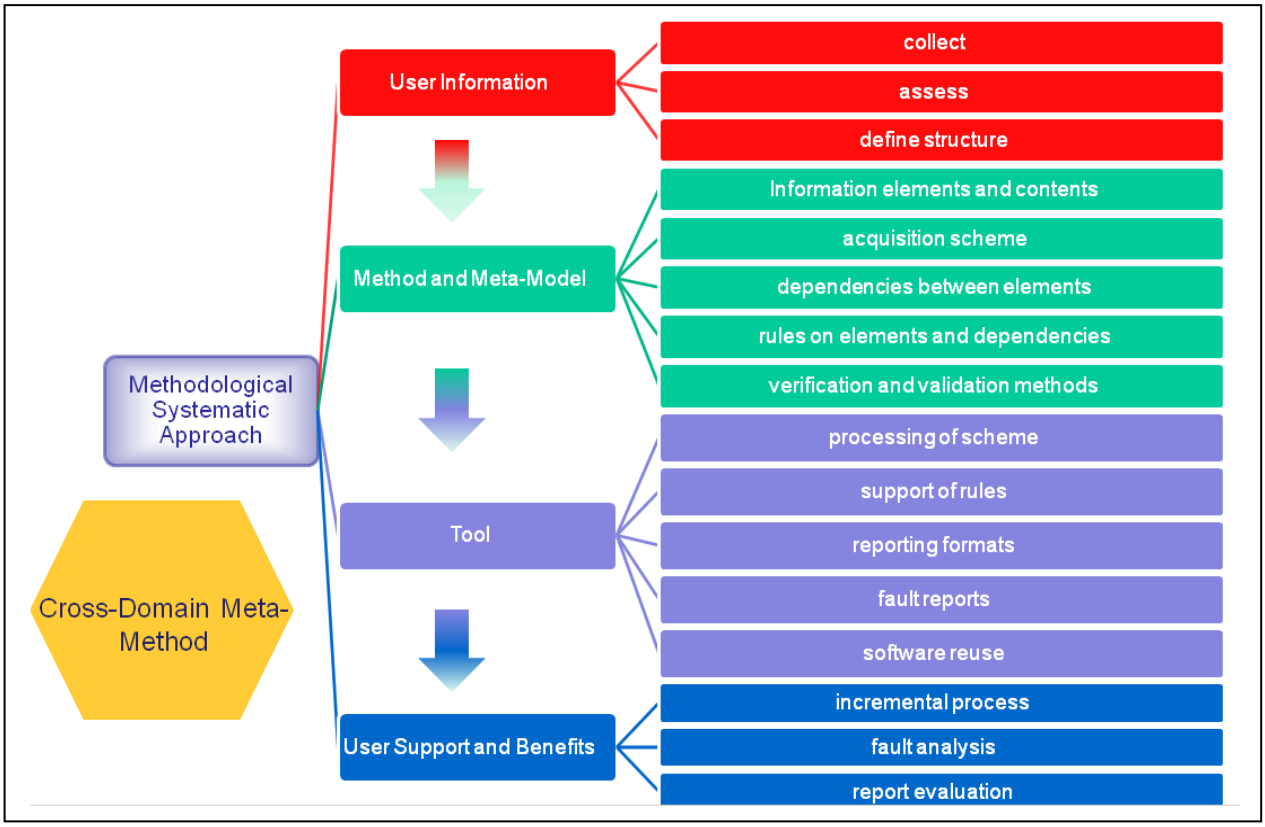

Fig. 1-2: Methodology to derive a Tailored Process