

## Process assessment: the BOOTSTRAP approach (18 citations in Feb. 2013)

G R Koch (1993)

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Group B

### Introduction

The writer of the process assessment paper is Günter Koch. He was born on the 4<sup>th</sup> of June 1947 in Germany and is now a professor at the Graz University of Technology. In his career, he has made over 100 publications on multiple topics (Execupery, sd.).

As stated by Koch (1993), the BOOTSTRAP approach is a method which main goal is to provide an advanced process assessment methodology in order to get an organization to another and better level. The method has been funded by the European Commission within the ESPRIT program and is monitored by the BOOTSTRAP Institute to continue the development and promotion of the BOOTSTRAPs method (Dublin City University, sd.).

The BOOTSTRAP method provides instruments for problem identification, i.e. for precisely describing where an organization currently stands and what gradual changes are necessary. The BOOTSTRAP assessment focuses on the processes of a software engineering/producing unit (SPU) and is carried out in three steps (Koch, 1993). These steps are shown in Table 1. The first step (1a, 1b) defines the target organization, the SPU. The next step (2a, 2b) of the assessment measures the maturity of SPU. The last step (3) helps the organization in getting to another level.

| Stages |   | Steps   | In order to  |
|--------|---|---|--|
| 1      | a | The target area of interest                                       | Define the scope of the assessment   |
|        | b | The structure and behavioral description                          | Model the processes of the targeted SPU  |
| 2      | a | The scaling of the organization                                   | Rank process oriented software engineering organizations   |
|        | b | Metrics for 'measuring' the organization                          | Measure the (quality) maturity level to discover strength and weaknesses of the SPU and make a profile of it |
| 3      |   | The process of changing the organization towards a 'better' state | Gradually change an organization by change of management   |

**Table 1 Process of the BOOTSTRAP method with the used instruments (Koch, 1993)**

As stated by Koch (1993) in the paper, BOOTSTRAP defines attribute trees to cover three major aspects: Organization (O), Methodology (M) and Technology (T). The aspects include 17 key attributes and are prioritized as follow: O > M > T. The quality attributes of the aspects are measured by means of the questionnaire, which is taken in step '2b' of the BOOTSTRAP method.

## Related literature

The BOOTSTRAP method uses multiple models in order to make an assessment of an SPU (Kuvaja et al., 1993).

| Instrument used                            |
|--|
| Classical software life-cycle model (ESA)  |
| Five level capability maturity model (SEI) |
| Questionnaire (based on the ESA model)     |
| Kaizen                                     |

ESA - The classical software life-cycle model is used in the BOOTSTRAP method to model the software development as a linear flow of activities, which form the life-cycle (ESA, 1991). The ESA model is used in step '1b', where the processes of the SPU are being modeled.

Next to that, the standards of the ESA model play a major role in the structure of the questionnaire, which is assessed in step '2b' in order to make a strength and weaknesses profile of the SPU.

SEI - The five level capability maturity model (CMM) was designed to help developers to select process-improvement strategies by determining the current process maturity (Paulk et al., 1993). The CMM in the BOOTSTRAP method is used in step '2a' in order to rank the maturity level of an SPU.

Kaizen - The Kaizen style of changing the SPU is used in the last step of the BOOTSTRAP method. It helps gradually changing the organization by focusing on the people of the company (Huda et al., 1992) (Feldman, 1992) in a cyclic way (Koch, 1993).

As stated before, the BOOTSTRAP Institute has been established to make sure that the BOOTSTRAP method keeps developing. As an example, the attributes for assessing process maturity continued to evolve (Haase, 1994).

Next to that, the BOOTSTRAP assessment model was updated to align with the ISO 12207 life-cycle. The ISO 12207 life-cycle is a more complete model to describe the processes of an SPU (Kuvaja, 1999).

## The BOOTSTRAP method modeled

The BOOTSTRAP method will be modeled in this section. The different steps and deliverables of the method are elaborated in a so-called process-delivery diagram (PDD). The PDD is a notation created by Weerd and Brinkkemper (2008) to show processes and deliverables of a method. The method will be shown as a diagram. However, the elements within this diagram will be further elaborated in separate subsections.

## Process-Delivery Diagram

The PDD of the BOOTSTRAP method in Figure 1 has been created using the PDD notation (Weerd and Brinkemper, 2008).

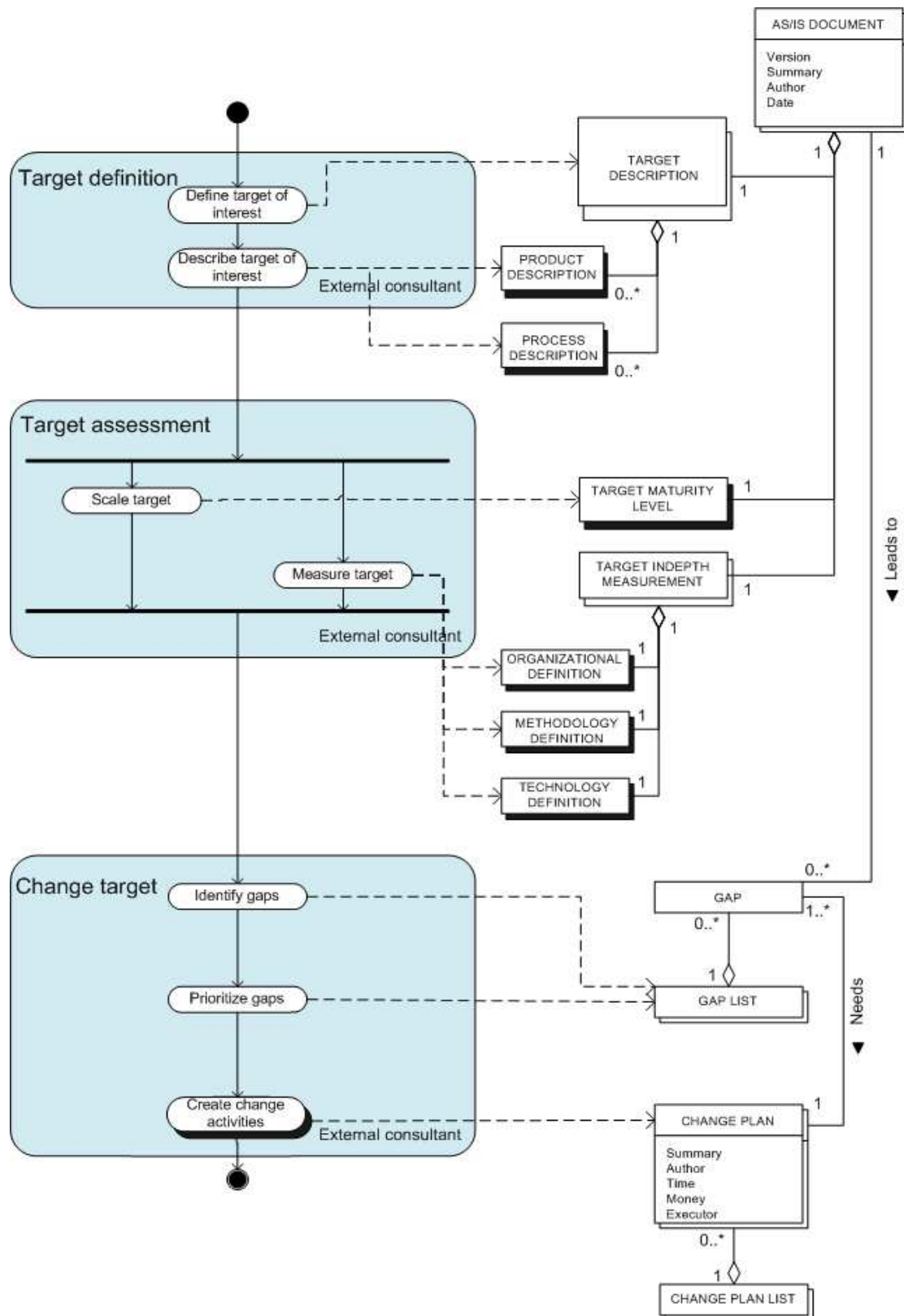


Figure 1 PDD of the BOOTSTRAP method

## Activities

The activity elements in the process-delivery diagram of the BOOTSTRAP method in Figure 1 are described in Table 2.

| Activity          | Role                | Sub activity                | Description   |
|-------------------|---------------------|-----------------------------|---|
| Target definition | External consultant | Define target of interest   | Define the scope of the assessment.   |
|                   |                     | Describe target of interest | Model the products and processes of the target. The products and processes are described using the ESA model (ESA, 1991).   |
| Target assessment | External consultant | Scale target                | Rank process oriented software engineering organizations. This ranking is done with the help of the five level capability maturity model. The model is designed to select process-improvement strategies by determining the current process maturity (Paulk et al., 1993).              |
|                   |                     | Measure target              | Measure the (quality) maturity level to discover strength and weaknesses of the SPU and make a profile of it. This is done by means of interviews. The questions in the interview are based on and structured by the ESA model (ESA, 1991), but are elaborated in the BOOTSTRAP method. |
| Change Target     | External consultant | Identify gaps               | Based on the AS-IS assessment, the target organization is able to identify its gaps.  |
|                   |                     | Prioritize gaps             | It is necessary to handle the right gaps in the right order at the right time to get to the next level of maturity.   |
|                   |                     | Create change activities    | A change plan has to be created to gradually change the targeted organization to the preferred maturity level. The change activities are made with the model of Kaizen (Huda et al., 1992) kept in mind.  |

**Table 2 Activities of the BOOTSTRAP method**

## Concepts

The concept elements in the process-delivery diagram of the BOOTSTRAP method in Figure 1 are described in Table 3.

The template, which can be found in the Appendices, is created for the concepts "GAP", "GAP LIST", "CHANGE PLAN", and "CHANGE PLAN LIST".

| Concept             | Properties | Description  |
|---------------------|------------|--|
| PRODUCT DESCRIPTION |            | A description of all the products that are created by the target organization.                                   |
| PROCESS DESCRIPTION |            | A description of all the processes that are carried out by the target organization in order to get the products. |
| TARGET DESCRIPTION  |            | All the relevant information (history, culture,  |

|                            |  |   |
|----------------------------|--|---|
|                            |  | products and processes) are put together in this concept.   |
| TARGET MATURITY LEVEL      |  | This concept holds the information about the maturity of the organization.  |
| ORGANIZATIONAL DEFINITION  |  | An indepth definition of the organizational structure of the targeted organization.                                       |
| METHODOLOGY DEFINITION     |  | An indepth definition of the methods used in the targeted organization.   |
| TECHNOLOGY DEFINITION      |  | An indepth definition of the technologies that are used in the targeted organization.                                     |
| TARGET INDEPTH MEASUREMENT |  | A combination of the organizational, methodological, and technological definition.  |
| AS/IS DOCUMENT             | Version<br>Summary<br>Author<br>Date           | Based on all the information, this document is created in order to see where the targeted organization currently resides. |
| GAP                        |  | The gap between the AS-IS and the TO-BE situation that is identified for the targeted organization. (Appendix I)          |
| GAP LIST                   |  | A list of all the gaps of the targeted organization. (Appendix I)   |
| CHANGE PLAN                | Summary<br>Author<br>Time<br>Money<br>Executor | A plan that has been made based on the assessment in order to change to another level. (Appendix I)                       |
| CHANGE PLAN LIST           |  | A list containing all the change plans that have been made based on the assessment. (Appendix I)                          |

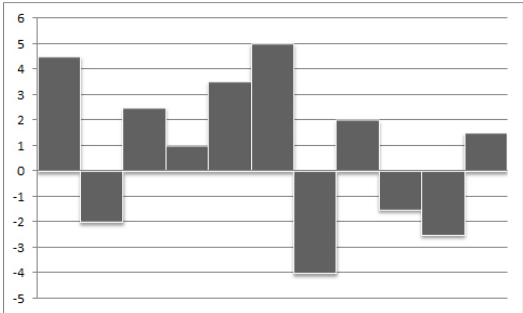
**Table 3 Concepts of the BOOTSTRAP method**

**Example**

A software oriented organization is needed in order to commence the BOOTSTRAP method. As an example the organization *Xample* will be used throughout this section. The first step is to define *Xample*. What is the area of interest and what are its characteristics, i.e. goal, mission, vision, structure, processes, etc.

The next step is to measure the maturity, and make a strength and weaknesses profile of *Xample*. This will be done with a questionnaire. The first stage focuses on the overall maturity level of the SPU. This will be done by scaling the O, M, and T aspects with the SEI model. The second stage focuses on the 17 key attributes.

After the analysis is done, the result can look like the result in Figure 2.



**Figure 2 Example results of a sample profile**

As an example for *Xample*, Figure 2 will be used. It is clear from the figure that the majority of the attributes are positive, however, *Xample* needs to deal with the few negative attributes in order to grow. The attributes in the histogram with the lowest score will have the highest priority to be dealt with. This will result in Figure 3.

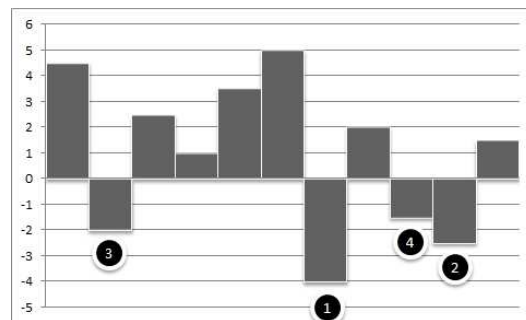


Figure 3 Example prioritized result

Based on the prioritized result, the BOOTSTRAP method allows setting up a course with well-defined actions to bring the SPU, in the example case *Xample*, to another level.

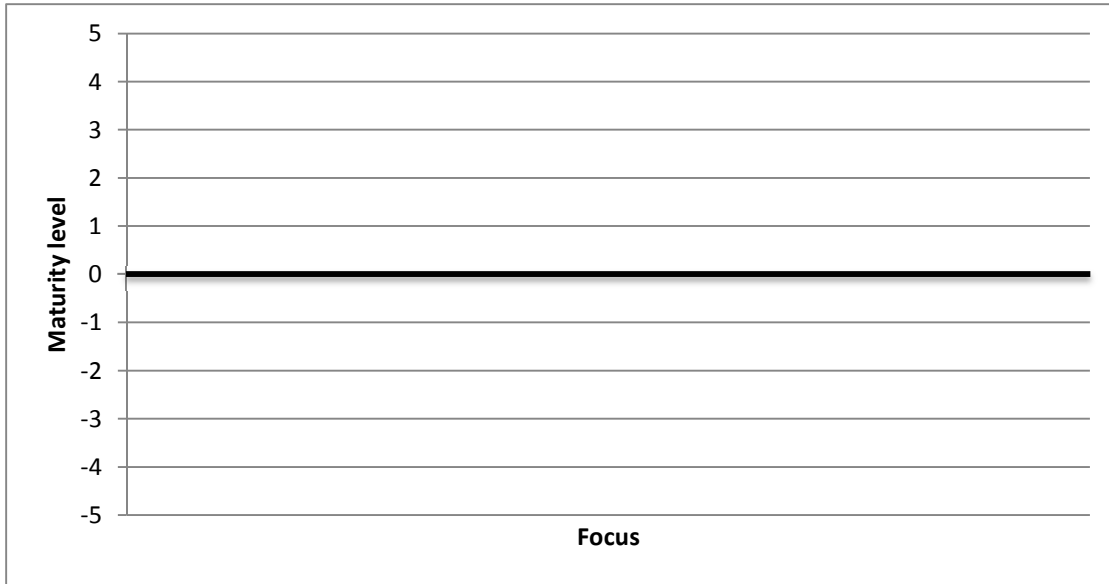
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## Appendix I – Template

| Aspect              | Category             | Area                     | Focus   | Maturity level     |                          |  |
|---------------------|----------------------|--------------------------|---|--------------------|--------------------------|--|
| <b>Organization</b> |                      |                          | Business Engineering                                    |                    |                          |  |
|                     |                      |                          | Human Resource Management                               |                    |                          |  |
|                     |                      |                          | Infrastructure Management                               |                    |                          |  |
| <b>Methodology</b>  | Life Cycle Dependent |                          | System Requirements Analysis                            |                    |                          |  |
|                     |                      |                          | System Architecture Design                              |                    |                          |  |
|                     |                      |                          | Software Requirements Analysis                          |                    |                          |  |
|                     |                      |                          | Software Architecture design                            |                    |                          |  |
|                     |                      |                          | Software Detailed Design                                |                    |                          |  |
|                     |                      |                          | Software Implementation & Testing                       |                    |                          |  |
|                     |                      |                          | Software Integration & Testing                          |                    |                          |  |
|                     |                      |                          | System Integration & Testing                            |                    |                          |  |
|                     |                      |                          | Maintenance   |                    |                          |  |
|                     |                      |                          | Migration   |                    |                          |  |
|                     |                      |                          | Retirement  |                    |                          |  |
|                     |                      |                          | Life Cycle Independent                                  | Management         | Project Management       |  |
|                     |                      | Quality Management       |   |                    |                          |  |
|                     |                      | Risk Management          |   |                    |                          |  |
|                     |                      | Subcontractor Management |   |                    |                          |  |
|                     |                      | Support                  |   |                    | Documentation            |  |
|                     |                      |                          |   |                    | configuration Management |  |
|                     |                      |                          |   | Quality Assurance  |                          |  |
|                     |                      |                          |   | Verification       |                          |  |
|                     |                      |                          |   | Validation         |                          |  |
|                     |                      |                          |   | Joint Review       |                          |  |
|                     |                      |                          |   |                    | Audit                    |  |
|                     |                      |                          |   |                    | Problem Resolution       |  |
|                     |                      |                          |   | Customer supplier  | Acquisition              |  |
|                     |                      |                          |   |                    | Customer Need Management |  |
|                     |                      |                          |   |                    | Supply                   |  |
|                     |                      |                          |   |                    | Software Operation       |  |
|                     |                      |                          |   |                    | Customer Support         |  |
|                     |                      |                          |   |                    |                          |  |
|                     |                      | Process-Related          |   | Process Definition |                          |  |
|                     |                      |                          | Process Improvement                                     |                    |                          |  |
| <b>Technology</b>   |                      |                          | Technology Innovation                                   |                    |                          |  |
|                     |                      |                          | Technology Support for Life Cycle Processes             |                    |                          |  |
|                     |                      |                          | Technology Support for Life Cycle Independent Processes |                    |                          |  |
|                     |                      |                          | Tool Integration  |                    |                          |  |

Table 4 Maturity levels



**Graph 5 Maturity levels**

| Priority | Action             | Money | Time   | Executor               |
|----------|--------------------|-------|--------|------------------------|
| 1        | descriptive action | xx,xx | x days | function or department |
| 2        | descriptive action | xx,xx | x days | function or department |
| 3        | descriptive action | xx,xx | x days | function or department |
| 4        | descriptive action | xx,xx | x days | function or department |

**Table 6 Priorities**