Using SPICE Models for Flexible and Scalable Assessments

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Abstract— **System and software development and testing have become more and more complex on the one hand and cost and time sensitive on the other. The capability to execute processes in an organized manner, as well as to be flexible and customer responsive, is key to business success. One challenge for those who want to manage the capabilities of their processes is that lots of capability and maturity models are in the market. This makes it hard to understand their business value and the impacts of improvement campaigns. This paper describes an approach how to deal with this problem.**

Keywords-Measurement Framework; Automotive SPICE; TestSPICE; SPI Manifesto; ISO/IEC 33020;ISO/IEC 33003; Process Capability; Capability Model; Process Improvement; Process Integration; ISO/IEC 15504 Part 5; ISO/IEC 15504 Part 6.

I. INTRODUCTION

Software Process Improvement and Capability dEtermination (SPICE) has been an Information Technology (IT) topic for over 20 Years. With the exception of Automotive SPICE [1] in the automotive domain and ISO/IEC (International Organization for Standardization/ International Electrotechnical Commission) 15504 Part 6 in the Dutch infrastructure industry [2], it does not seem like ISO/IEC 15504 / ISO/IEC 330## (SPICE) and Capability Maturity Model Integration (CMMI) have a lot of visible impact in modern system, software and testing businesses. One observable key point is that, by focusing on formal points and capability levels, the original message got lost. Process improvement drives business success. The influence might be direct, e.g., change of effort structure by reducing budgets and capacity for error correction and expanding the budget and capability to deliver new features. Or the influence may be indirect, by reducing business risks rising from poor quality of deliverables or delay of the delivery itself.

As the benefits are so clear, why are SPICE Assessments not as common as it could be expected? The answer is that, often, process knowledge is concentrated in so called Software Process Engineering Groups (SEPG), which have an observable tendency to create an ivory tower. These ivory towers have the tendency to create complete, cumbersome process models which are frustrating practitioners and are not maintainable or adaptable at all. These models were always criticized [3].

Another challenge is the cost consuming approach of capability analysis. As there are lots of models on the market, an organization might try to extract the building blocks of the relevant models and recombine them to define the individual analysis and improvement approach [4], but this approach might create a constant research program that will never pay back on individual organization level. Or, an organization might run lots of uncoordinated assessment and improvement campaigns which might create misalignments and disorganization at working and management level.

One of the drivers behind this challenge is that lots of SPICE Models like ISO/IEC 15504 Part 6, Automotive SPICE and TestSPICE [5] are very focused on a defined topic. As a consequence, an organization might have to pay for many assessments which have overlapping topics and overlapping findings.

One of the proposed benefits of every capability measurement framework is that the capability of processes will be measured in a comparable way, allowing organizations to define targets for process capability that support business benefits.

By using the original ideas of the SPICE model, to abstract process content from capability measurement, an approach can be created that combines the business relevant processes of all models and brings them into one complete model. To safe cost and to focus on the real important points, the approach also contains scalability features.

The rest of the paper si structured as follows.

II. SETTING THE CONTEXT

In 2010, the SPI Manifesto [6] was launched. It shows the modern thinking of Process Improvement (PI) describing core values and principles, as indicated in Figure 1.

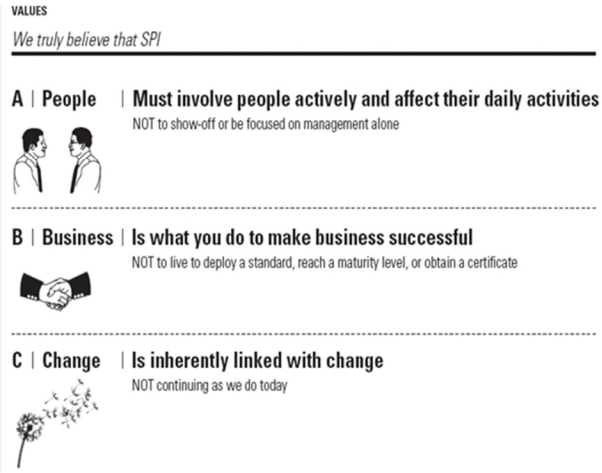

Figure 1. The values of the SPI Manifesto

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These values are explained by a set of principles (see Figure 2.) that give guidance to improve the achievement of these values. Each principle is explained in detail in a later section of the SPI Manifesto.

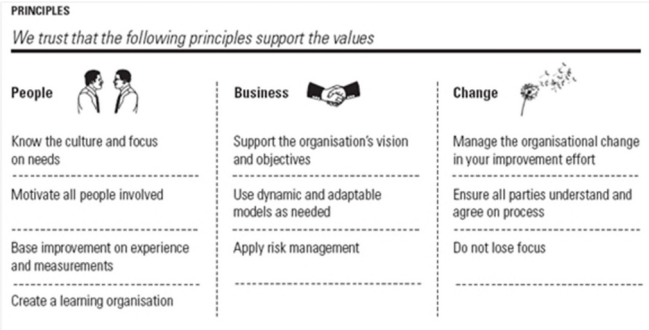

Figure 2. SPI Manifesto Principles

The presented approach is based mostly on the principle "use dynamic and adaptable models as needed". By doing this, the approach also contributes to the principle "support the organisations vision and objectives".

III. TAKING THE SOURCES OF THE APPROACH: INCORPORATED MODELS AND CAPABILITY FRAMEWORKS

The presented approach incorporates the following models as a source:

1) ISO/IEC 15504 Part 5 [7]
2) ISO/IEC 15504 Part 6
3) Automotive SPICE 3.1
4) TestSPICE 4.0

It also incorporates ISO/IEC 33020 [8] as capability measurement framework

A. ISO/IEC 15504 Part 6

ISO/IEC 15504 Part 6 (Systems Engineering) was developed with a strong view on the organisations capacity to deliver large scale projects. Therefore, this model always had a strong focus on the business environment. The assessment model is based on ISO/IEC 15288 [9] as process reference model and incorporates the ISO/IEC 15504 Part 2 [10] as measurement framework. Due to the architecture of the whole SPICE approach, this can be easily replaced by ISO/IEC 33020.

The model shows the typical structure of process groups and processes. This structure makes it easier to understand the model and to set the right scope for process assessments.

The model contains the following process groups:

- Organisational Project Enabling Processes
- Agreement processes
- Project Processes
- Technical Processes
- Tailoring Processes

The whole model is presented in Figure 3.

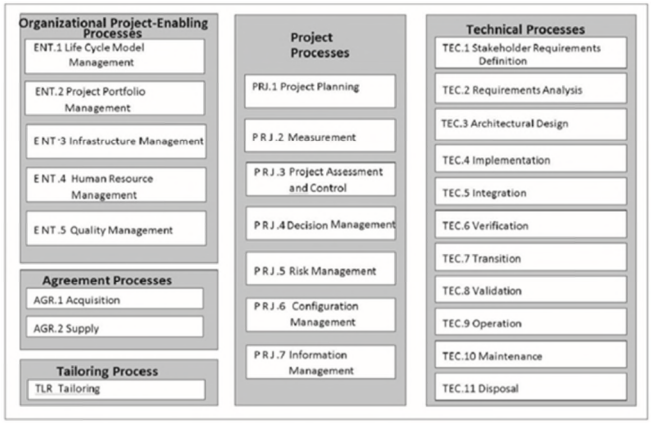

Figure 3. The process model of ISO/IEC 15504 Part 6

Reviewing modern literature about business agility, portfolio management is reported as one cornerstone of success [11].

B. ISO/IEC 15504 Part 5

ISO/IEC 15504 Part 5 (Software Engineering) was developed with a strong view on the capacity to deliver software projects of all types. Therefore, this model always had a strong focus on the software development lifecycle. The assessment model is based on ISO/IEC 12207 as process reference model and incorporates the ISO/IEC 15504 Part 2 as measurement framework. Due to the architecture of the whole SPICE approach, this can be easily replaced by ISO/IEC 33020.

The model has the highest level of completeness regarding systems and software development.

The whole model is presented in Figure 4.

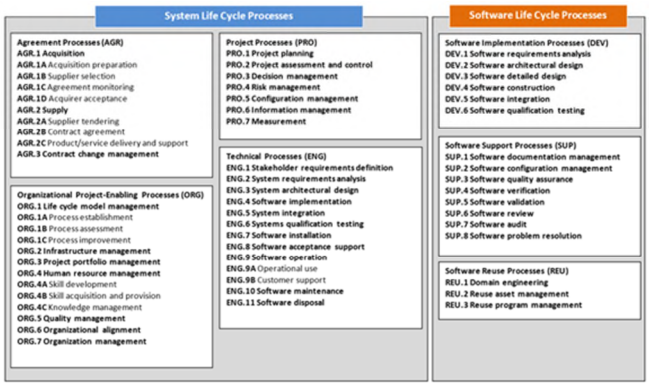

Figure 4. The process model of ISO/IEC 15504 Part 5

The model is -as ISO/IEC 15504 Part 6- Departed in Process groups and processes.

The following process groups are included:

- Agreement Processes
- Organizational Project Enabling Processes
- Project Processes
- Technical Processes

- Software Implementation Process
- Software Support Process
- Software Reuse Process.

C. *Automotive SPICE (3.1)*

Automotive SPICE (newest version 3.1) is the process assessment model of the German automotive industry. While having incorporated the system and software development processes of ISO/IEC 15504 Part 6, the model has a strong emphasis on the acquisition processes. They are much more detailed than in ISO/IEC 15504 Part 5 or Part 6. In addition, the German Verband der Automobilindustrie, Qualitäts Management Center (VDA QMC) developed a rating guideline for Automotive SPICE which highlights many interdependencies between the process components of each level.

Automotive SPICE uses the ISO/IEC 33020 as capability measurement framework. Earlier versions used ISO/IEC 15504 Part 2.

The whole model is presented in Figure 5.

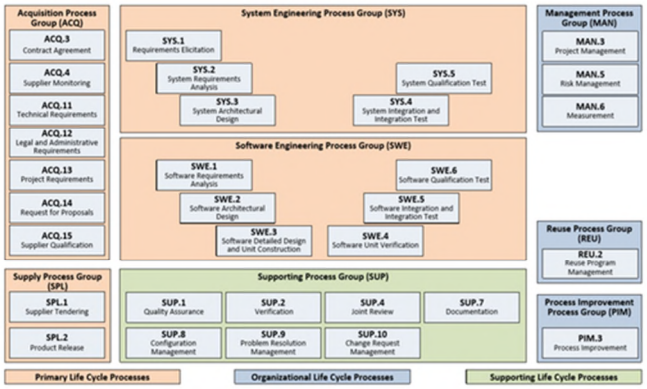

Figure 5. The process model of Automotive SPICE 3.1

The structure of the model consists of processes and process groups. The following process groups are defined:

- Acquisition Process Group
- Supply Process Group
- System Engineering Process Group
- Software Engineering Process Group
- Supporting Process Group
- Management Process Group
- Reuse Process Group
- Process Improvement Process Group.

D. *TestSPICE (4.0)*

TestSPICE (newest version 4.0) is an independently developed process assessment model for testing processes, based on the ISTQB Syllabus and the ISO/IEC 29119 process model.

TestSPICE is completely focused on the testing processes, designed to plug in to other SPICE based process assessment models.

TestSPICE incorporates the ISO/IEC 15504 Part 2 as measurement framework. Due to the architecture of the whole SPICE approach, this can be easily replaced by ISO/IEC 33020.

TestSPICE also includes an agile extension to support the assessment of agile capabilities.

The whole model is presented Figure 6.

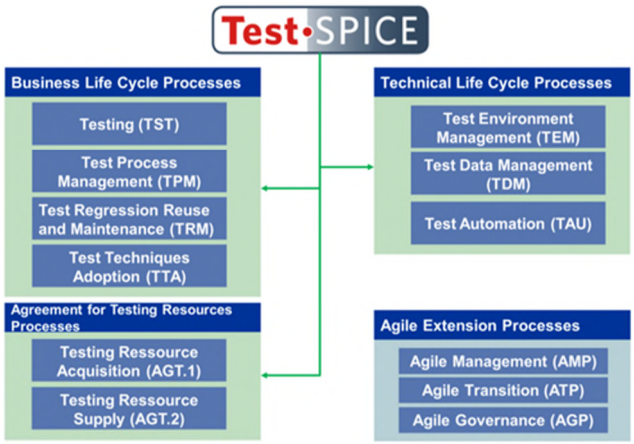

Figure 6. The process model of TestSPICE 4.0

E. *The capability measurement framework ISO/IEC 33020*

The capability measurement framework of ISO/IEC 33020 consists of 6 Levels divided in 9 process attributes.

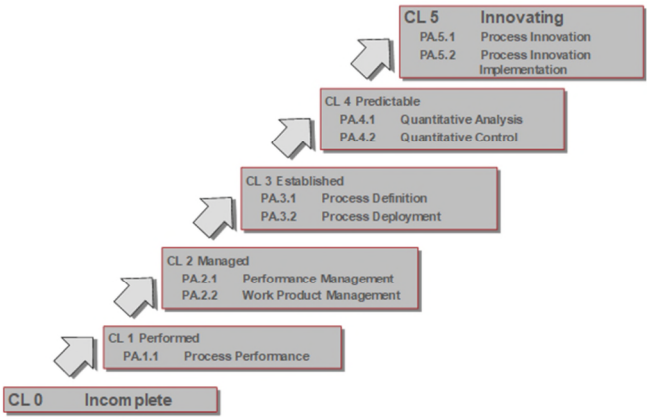

Figure 7. Capability levels and process attributes of ISO/IEC 33020

IV. COMMON COMPONENTS OF SPICE PROCESS ASSESSMENT MODELS

To create a combined approach of several SPICE models, a set of common building blocks is needed that supports adaptability and scalability.

The following components are common in all SPICE models:

- 1 Process Assessment Model
  - o 1 Process Reference Model
    - 1-n process groups
      - 1-n processes (Specific / Overarching)

- 1 purpose
- 1-n outcomes
- 1-n process related indicators
  - Base practices
  - Input/Output Workproducts

o 1-n levels
- 0-n Process Attributes
  - 1 Indicator set
    - 1-n generic practices
    - 1-n generic work products
    - 1-n generic resources

ISO/IEC 15504 Part 5 or TestSPICE 4.0 use overarching processes. An overarching process summarizes a complete process group by using the processes of the group as base practices (or an equivalent mapping). As an example, there is an acquisition process, and there are sub-processes that are linked to the overarching process by name (AGR.1 BP.3 "Select Supplier" to AGR.1C Supplier selection) or by content base practices of the overarching process map to base practices of the sub-processes, but sub-processes provide more details.

V. USING COMMON COMPONENTS TO ALIGN ASSESSMENT MODELS WITH BUSINESS NEEDS

These common set of components allows several levels of adoption combined into one approach:

1) Combine processes of several models (e.g. acquisition processes of automotive SPICE and organisational management of ISO/IEC 15504 Part 6) to have the right set of processes at hand.

2) Define the target capabilities of the selected processes in order to achieve the necessary or expected business support (a standardized process supports fast acting teams and allows to quickly reconfigure teams, but its development might require some budget and its deployment might restrict creative ad hoc solutions).

3) Define if overarching or detailed processes will be assessed.

4) Define the in depth of process assessments. It makes a huge difference in cost and effort if an assessment team just checks if the process purpose is met and quickly gathers strengths and weaknesses, or if the team has to deliver an in-depth report reflecting purpose, outcomes and all types of indicators.

This approach supports the way of process improvement as described in ISO/IEC 15504 Part 4 or ISO/IEC 33014. Both standards recommend to 1st check influences on the business as given from the business ecosystem or from technological innovations, and next define a target profile. The profile can be expressed in capability levels, as described in ISO/IEC 33020.

Having the targets set, an assessment team will analyse to what degree the targets are met and if gaps create immediate business impact or business-related risks.

VI. CONCLUSION

Using SPICE Assessments in an inflexible and bureaucratic manner was on potential cause of decrease of usage of assessments. Consequently, binding SPI to business success and using a very flexible way to plan and execute assessments might be the first steps for a comeback.

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