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# **Practical Application of SPICE in the Finance Sector**

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## **Abstract:**

In this paper, performance, outcomes and benefits are reported of nearly 140 SPICE-Assessments conducted over a time span of two years in the IT-organization of one of the largest German banking groups. The scope of the assessments includes projects and services covering development, maintenance, migration and production assurance of finance applications. The numerical results of the assessments are used as input for the organization's Balanced Scorecard, while the identified strengths and weaknesses serve as input to refine the organization's standard process and for further improvement of process effectiveness and efficiency. The paper reflects the trend in the finance sector of the increasing awareness and importance of the quality and effectiveness of IT-Processes. It demonstrates that ISO/IEC TR 15504 (SPICE) spans across the landscape of IT Processes in a financial environment and how it can be used for performance evaluation at various levels in an organization. It is described how the assessment process has been optimized to perform the high number of assessments and how the assessment model has been adapted to the particular needs and culture of the organization. In addition, the overall benefits from the assessments are discussed from the organization's point of view.

## **1 Introduction**

Following a trial phase of several years, the international standard ISO/IEC TR 15504 has been published in 1998 [ISO98]. This standard integrates the concepts and experiences made with various assessment methods, including CMM [Pa93] and BOOTSTRAP [Ku93] and provides a reference model as a basis for comparing results from the different assessment models. This reference model contains process definitions that are related to the Software Life Cycle Processes of ISO/IEC 12207:1995 [ISO95] and covers all processes that are necessary for the acquisition, development, maintenance, and operation of software. In addition, the reference model defines a universal measurement framework that can be applied to any process in any organization. With this measurement framework, the capability of any process can be determined on an integer scale from 0 (incomplete) to 5 (optimizing).

Since its publication as Technical Report, the standard – most commonly referred to as SPICE (Software Process Improvement and Capability dEtermination) - has been used in many

companies of various IT sectors as a starting point for process improvement. In particular in Aerospace [Ca04] and Automotive [HIS04, Vö03], ISO/IEC TR 15504 has also been intensively applied as a means for evaluating the software processes of IT suppliers.

It is the flexibility and the universality of SPICE as well as the transparency of the results that ensures its rapidly increasing popularity throughout all IT sectors. The structure of the standard allows defining additional domain specific processes beyond the scope of ISO/IEC TR 15504 when necessary. In order to deploy the concept of process assessment beyond the IT industry, the standard has been revised in the past years with the following key modifications:

- Alignment of the Capability Level attributes with ISO 9001:2000
- Introduction of the concept of process reference models
- Transfer of the process dimension of TR 15504 to a process reference model embedded in ISO/IEC 12207 AMD1:2002 (and AMD2:2004),

The result is now being published as ISO/IEC 15504:2004 [ISO03, ISO04a, ISO04b, ISO04c]. An exemplar assessment model based on the process reference model of ISO/IEC 12207 AMD1 and AMD2 was published in early 2006 as an international Standard (IS).

## **2 Process Assessment in the Finance Sector – Current Situation**

While IT development in Aerospace, Telecommunication and Automotive is traditionally deployed in a complex structure of contractors, subcontractors and sub-subcontractors, in the finance sector (mostly) just one department or subsidiary company provides the development, operation and maintenance of software. Nevertheless, outsourcing IT solutions and services to third parties becomes more and more popular as companies - in particular from Asia or Eastern Europe - offer more and more competitive conditions as an alternative to an internal IT organization. These companies offer cheaper rates and very often they also advertise their very high process capability or maturity as additional asset. Therefore, the internal IT organizations face pressure from principals and competitors on both cost and process quality.

These trends have made cost reduction as well as adherence to the organizations standard process the primary objectives for the executive board of HVB Systems, the IT service organization of the HVB Group, one of the largest financial institutions in Europe. To enforce the achievement of these objectives throughout the organization, a Balanced Scorecard is

defined for each business year, which covers key data related to cost, internal processes, customer satisfaction and employee development.

In order to be able to benchmark internally and externally, HVB Systems has selected SPICE as the method for evaluating the process capability. To emphasize the company's commitment to SPICE, HVB Systems top management selected the average SPICE capability level to be one of the key metrics for the process perspective of the company's Balanced Scorecard. For each year, a minimum average Capability Level is defined as measurable objective in the Balanced Scorecard. If the objective is met, the respective department's bonus is affected positively.

Other IT departments and subsidiaries in Germany and Switzerland apply similar measures or programs in order to improve process adherence, predictability and to reduce cost caused by ineffective processes. Some of them have chosen CMMI, while others decided in favour of SPICE, because they considered it to be more cost effective and easily adaptable to the particular needs of the organization.

### **3 The Initial Situation**

In order to deliver the measures for the HVB Systems Balanced Scorecard of 2004 and 2005, 10 departments had to be assessed in three business areas: application development projects, production assurance and application maintenance. The latter two are continuous activities that include problem prevention and bug fixing during operation as well as the implementation of small functional changes. Since these two business areas generally involve the same people for each application, evaluation of production assurance and application maintenance have been combined into one assessment per application. In 2004 nearly 70 SPICE assessments had to be performed within a period of 7 months in 2004. For 2005, the same scope has been used which resulted in a total of almost 140 assessments in two years.

For the performance of the assessment series, four internal staff members and initially one external Lead Assessor were assigned. In order to meet the timeframe, the need for one additional external Lead Assessor was identified in the planning phase. Due to additional tasks of the internal staff members to be performed in other areas of the department, the number of assessors for 2005 had to be increased to five internal and three external assessors.

During the previous years, various programs for process establishment and process improvement have been performed at HVB Systems that were expected to have significant

positive impact on the process capability. The purpose of the assessments was therefore not only to provide the relevant data for the Balanced Scorecard, but also to gain deeper insight on the performance and suitability of the organization's standard process and to identify areas for further improvement of the standard process towards Capability Level 3 for all processes within the scope of the assessments. As a result, the time in-between the two assessment series of 2004 and 2005 was scheduled to be used for the prioritization and implementation of the identified improvement areas of the standard process.

## **4 Defining the Assessment method**

During the preparation phase, the main challenge was to define an assessment method that would

- minimize the duration of each assessment,
- minimize the interview time,
- ensure consistency of the ratings across the assessor teams,
- take into account the key processes of the organization's standard process,
- aggregate assessment results into one number per assessment, and
- effectively aggregate individual assessment feedback to identify areas for improvement for process performers and the standard processes.

The definition of the assessment method included

- tailoring the assessment model,
- defining the assessment process and the assessment tools to be used.

These tasks are described in detail in the following subsections.

### **4.1 Tailoring the Assessment Model**

In a first step, the organization's standard process activities and work products were mapped to the base practices and management practices of the ISO/IEC TR 15504 assessment model. It turned out that for some activities, the granularity of the process dimension of 15504 was not detailed enough or did not even cover the activities at all. For example, the CUS.2 Supply process consisted of two very distinct processes at HVB Systems, the tender preparation and

assignment process at one end of the software life cycle and the process for preparation and delivery for operations at the other end. This problem has been identified previously in other IT sectors, notably in the space sector [Ca01] and therefore the same solution was taken here: CUS.2 has been split into two processes, CUS.2.1 Supply Preparation and CUS.2.2 Delivery.

For the assessment of application maintenance, a distinct process for recording and tracking the change requests from the customer was required in the assessment model. This process is not adequately covered by ISO/IEC TR 15504, but this problem has been addressed during the migration of the process dimension to ISO/IEC 12207. Amendment 2 defines a ‘Change Request Management’ process that ideally meets the needs of the assessments at HVB Systems [ISO04d]. The base practices and work products for this process have been taken from the draft assessment model of the revised ISO/IEC 15504.

It should be noted that HVB Systems business areas focus on the engineering processes, and exclude software operation, which is under the responsibility of HVB Info, another member of the HVB Group. While HVB Info has structured its processes according to ITIL [BS02, BS03], this model was not found to be suitable for the application maintenance processes at HVB Systems and therefore has not been considered when tailoring the assessment model.

The full set of processes selected for the assessments at HVB Systems is shown in Table 1.

<b>Application Development:</b>	<b>Production Assurance:</b>
CUS.2.1 Supply preparation	CUS.4.1 Operational Use
CUS.2.2 Delivery	SUP.8 Problem Resolution
ENG.1.1 System Requirements Analysis and Design	ENG.2 System and Software Maintenance
ENG.1.2 Software Requirements Analysis	
ENG.1.3 Software Design	
ENG.1.4 Software Construction	<b>Application Maintenance</b>
ENG.1.5 Software Integration	SUP.9 Change Request Management
ENG.1.6 Software Test	ENG.2 System and Software Maintenance
ENG.1.7 System Integration and Test	
MAN.2 Project Management	
SUP.3 Quality Assurance	

Table 1: Processes assessed in three business areas of HVB Systems.



It is remarkable that although HVB Systems does not operate the software, all base practices of the process CUS.4.1 Operational Use except one (BP 3: Operate the software) were found to be applicable.

For each process, a list of questions has been developed around the base practices and a list of relevant work products and activities of the HVB Systems standard process has been established. These questions used wherever possible the company specific terminology with which the interviewees were familiar. In addition, a list of generic as well as process specific questions for each management practice has been developed. These standard questions for base practices and management practices have reduced the time and effort needed for the interviews significantly. Furthermore, comprehensive guidelines and rules for rating have been developed for internal use by the assessors to accelerate the data analysis phase and the rating phase of each assessment. Both questions and rating guidelines helped ensure consistency and comparability of the assessment results across the different two-person assessor teams.

#### **4.2 Defining the Assessment Process and Selecting the Assessment Tools**

The assessment process consisted of the typical activities required by ISO/IEC TR 15504 (planning, data collection, data validation, rating, reporting). In order to optimize the efficiency of the process, a few changes to the usual procedure have been implemented.

The planning of all assessments was done centrally and supported by a database. All the necessary assessment information (date, status, assessors, interviewees, context, etc) was entered in this database and could be viewed by all assessors. Reports were generated from the database for planning and progress tracking.

The total time needed for data collection was reduced by about 30% with respect to what has been experienced by SYNSPACE in the past. This was achieved by measures like using pre-assessment questionnaires where the answers were automatically imported into the assessment database, by using video projectors during the interviews for quick electronic access to relevant documents, and by giving free access to the assessors to the HVB Systems standard repository for application and project documentation.

For rating the Process Attributes, performance of each relevant base or management practice has been rated separately on the n/p/l/f scale defined by ISO/IEC TR 15504-5. To support the interview and rating process, the off-the-shelf tool SPICE 1-2-1 [HMS05] was selected and its generic contents adapted according to the tailored assessment model using the complementary

tool SYNEDIT. It turned out to be extremely effective, if a preliminary rating of the practices was already done in SPICE 1-2-1 by one of the assessors during the interviews. After the interviews, the rating was consolidated using the guidelines and rules as specified in the tailored assessment model. For each base practice or management practice that was not rated 'fully', an appropriate improvement recommendation was addressed to the process performer or to the relevant process manager and included in the assessment report. Systematic quality assurance measures included reviews of the assessment reports by a third assessor and assessor rotation among the assessor teams. Various algorithms have been considered for aggregation of the results. However, in the end the simple arithmetic mean of the measured Capability Levels was preferred by the HVB Systems management. It was, however, decided to apply an additional deduction if some of the processes were at capability level 0.

## **5 Assessment Outcomes**

The key factors for the success of the assessments were full management support, high sample density throughout the organization and the combination of internal and external assessors.

About 15% of all HVB Systems employees were interviewed at least once during the two seven-month assessment periods in 2004 and 2005. Thus, the SPICE assessment process was highly visible throughout the organization and caused impressive awareness and motivation for improvement among the employees of HVB Systems. The result of each individual assessment was an assessment report that contained the process profiles and capability levels, a list of observed strengths, improvement recommendations addressed to the project and improvement recommendations addressed to those in charge of the standard process. The report was created using the central database which also served as a means to aggregate and track the improvement suggestions resulting from the assessments. Initially the only requirement for the assessments was to measure the actual capability level. However, top management objectives require all departments to improve the average capability level throughout the year. Therefore, the interest in the improvement recommendations from the individual assessment reports was tremendous and the most frequently asked question was 'what can we do to increase our level?'

In many departments, workshops were held shortly after completion of the assessments to derive clear improvement actions from the assessment reports that can be performed within the department. On the organizational level, workshops were held with those responsible for the

standard process to identify improvements to the current process definition, guidance and templates. In total, about 1000 improvement suggestions retained from individual assessments were grouped into about 50 general recommendations for the process performers and 40 recommendations for those in charge of the standard process.

Many of the recommendations for process performers were related to the systematic and consistent planning and tracking of a project and to the adherence of particular aspects of the standard process. Further recommendations focused on the traceability of the requirements for and the decisions made throughout the project. Recommendations for improving the standard process were mostly related to decreasing discrepancies and differences in planning and documentation across the organization and to providing a common basis for measurable processes. These recommendations were prioritized and mapped to a timeline for implementation.

Several departments and project managers have asked for special guidelines for achieving SPICE level 1, 2 and 3. These were developed as an outcome of the assessments taking into account the list of questions used in the assessment as well as the improvement recommendations. The result, a 'SPICE Guide' for process users has been published on the intranet and has been very positively accepted by the staff.

The particular strengths listed in the individual assessment reports, were consolidated and communicated as best practices that could be applied by other projects to improve the capability level of their processes.

Finally, top management held an event which was organized like a press conference, to inform the whole organization about the assessment results and to substantiate its expectations and objectives related to the required SPICE capability levels for the current calendar year.

## **6 Conclusions**

The assessments performed at HVB Systems demonstrated that ISO/IEC TR 15504 (SPICE) can be effectively applied as a means to enforce the adherence to the standard process model of an IT organization which is focused on the financial sector.

The principal condition for the success of the assessments was firm support by top management which resulted in consequences for those that deviated from the standard process without prior approval and encouragement for those who focus on systematic implementation and feedback.

Further factors for the success and the acceptance of the assessments were

- the tailoring of the assessment model to the particular needs of the finance sector
- the improvement recommendations that have been provided with the individual assessment results
- the combination of internal and external assessors
- a list of questions related to base practices and management practices that used the organization's terminology
- guidance for rating the process attributes
- an optimized assessment process with minimal resource needs for both assessors and assessees.

The management of HVB Systems has clearly identified several key benefits from the assessments for its customers, for its employees and for the company as a whole. These benefits strongly support the commitment to continue with SPICE for the next years.

The experience made in application of SPICE and in particular the tailoring of the assessment model may be applied not only to other IT organizations in the finance sector but also to software development and maintenance in any sectors with similar IT architectures (incorporating large databases and a high number of simultaneous users) and processes such as public administration, insurance or logistics.

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