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SPI: 'I can't get no satisfaction' – directing process improvement to meet business needs

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IT managers commonly complain of lack of resources for Software Process Improvement (SPI) projects. The authors postulate that this comes from lack of understanding by the company board of the benefit of SPI, and perhaps a lack of understanding by IT managers of the needs of the company board? So how can IT managers obtain satisfaction? A shortcoming of the ISO-9001 and the Capability Maturity Model (CMM) approaches to process improvement (in software production) is the lack of explicit connection to the *business goals* of the organization in question. In the eyes of business management, therefore, these models appear to represent an 'idealized' view of the world. A negative assessment against such a model is insufficient, in itself, to justify significant expenditure on an improvement plan. While a standardized model is invaluable as a common reference for measurement and comparison, the initiation of a meaningful improvement plan requires investment of money and allocation of resources; and that can only take place if current business goals, not an 'ideal' model, are the motivating force. The draft SPICE method has recognized this need. It proposes the comparison of an *assessed capability profile* with a *target capability profile*. However the current draft standard (version 2.0) contains little guidance on how to arrive at such a target capability profile. This paper describes a method for drawing up such a *target capability profile*. To preserve clarity, we have placed the description of our method in the context of a SPICE assessment and process improvement, but the method would also be suitable for use with ISO, CMM, ITIL or other process models.[1] In all cases an improvement plan can be set up which is visibly geared to the business goals.

Keywords: business process improvement (BPI), continuous process improvement, software quality, software process improvement (SPI), IT strategy determination

1. Introduction and context

IT managers have been working for many years now to achieve improvements in the processes employed by their organizations. While many improvements have been made, and there are tales of successful projects, there are many more tales of unsuccessful projects – as often as not accompanied by the IT manager's plaintiff wail: 'can't get people, can't get resources, can't get money for process improvement ... the management is not interested'. Why not? If we are improving the business then the management should be very interested. (Of course, if we are not, then we should stop.) One of the conclusions of the Quantum study [2] was that measurements of software process

[1] ITIL does not actually include a (published) process model; it is better described as a collection of best practices from which a process model can be derived; the implicit list of key processes is sufficient for our purposes [1].

improvement are not made because the meaning of the measurements is not clearly understood. It has previously been pointed out by Hinley and Reiblein [3] that the definition of key performance indicators (KPIs) can be used to direct process improvement in a way which is meaningful to the company board. This paper suggests a mechanism for using KPIs to target a process improvement programme to the actions which will yield the greatest benefit for the business. The method proposed is compatible with the Balanced Scorecard approach of Kaplan and Norton [4, 5] for determining objectives, but our method provides a mechanism for selecting the objectives which can be addressed by a process improvement programme to give the most benefit to the business in the shortest time.

So let us assume that the apparent lack of interest is actually a lack of understanding of what SPI can achieve for the business, and what improvements can be expected. In other words, we need a better means of communication between the management and those controlling the SPI-process. We need to understand each other's language. We need to agree on goals and measurements of the attainment of goals. If the company board can see the effects of SPI in terms of what it means for the business, then adequate resources will be allocated.

The process improvement cycle (for any process) can be represented as a specific form of the Deming cycle [6] as represented by Vlasveld [7] and reproduced with permission in Fig.1.

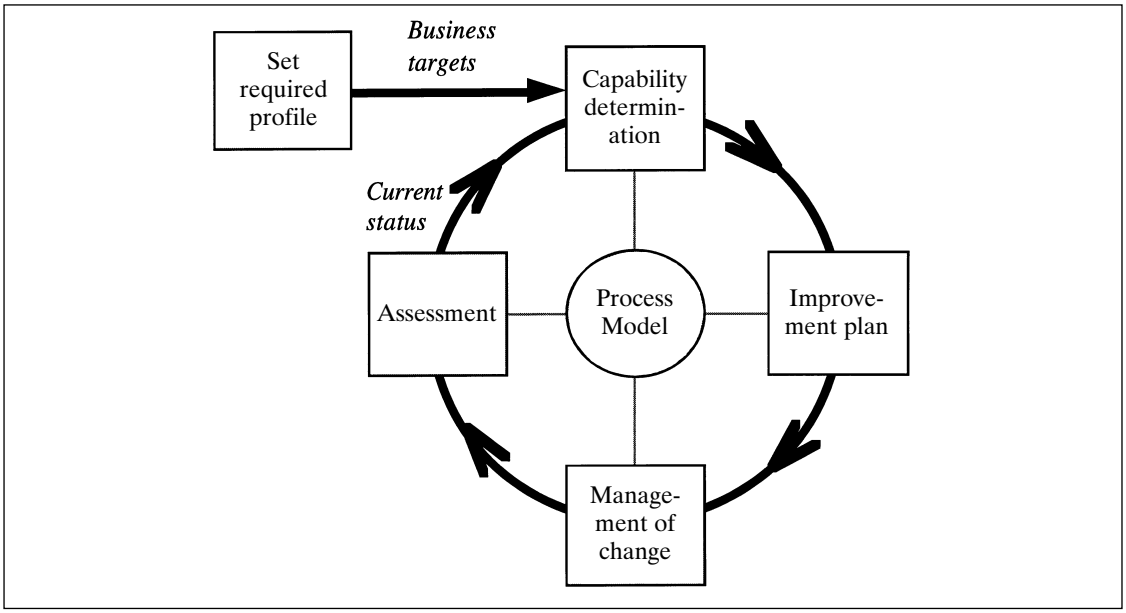

Fig. 1. The process improvement cycle

This principle can be applied to various processes. It is only the process model which is specific, the other parts are generic. Thus a complete method can be assembled by inserting a relevant process model. This is the 'plug-and-play' principle described by Vlasveld [7].

The 'established' (software) process improvement methods generally cover a subset of the blocks shown in the figure. For example, ISO9001 [8] is a process model which does not say much about assessment. TickIT [9] is an assessment method based on ISO9001. CMM [10] is also a process model and various assessment methods have been developed around it.

SPICE [11] can be viewed as the next generation of process improvement methods in that it contains a process model (for software development), an assessment method, a method for capability determination, and a guide for improvement planning, i.e. contents for most of the blocks in the figure. In the method for capability determination SPICE proposes that the assessed profile be compared with the profile required by the business. A 'gap analysis' focuses attention on the most *important* areas for improvement. What SPICE does not give is a guide to how to arrive at the required profile.

Whatever method is used, a programme to introduce process improvement in any business organization will only be acceptable if it is demonstrably linked to the business goals of the organization. We therefore believe that the method used to establish the *required profile* is essential for convincing management of the importance of a software improvement programme, setting priorities in conjunction with management and developing a realistic plan consistent with available budgets.

2. Overview of the method

We hereunder introduce the main concepts and elements of the method.

2.1 *Quality profiles*

The method focuses on the establishment and use of quality profiles to arrive at a process improvement plan. A profile is defined as a (graphical) representation of the quality of the set of processes under consideration, as illustrated in Fig. 2. For the purposes of this description, we have chosen a simpler representation of a quality profile than that used by SPICE, but the SPICE profile would do even better.

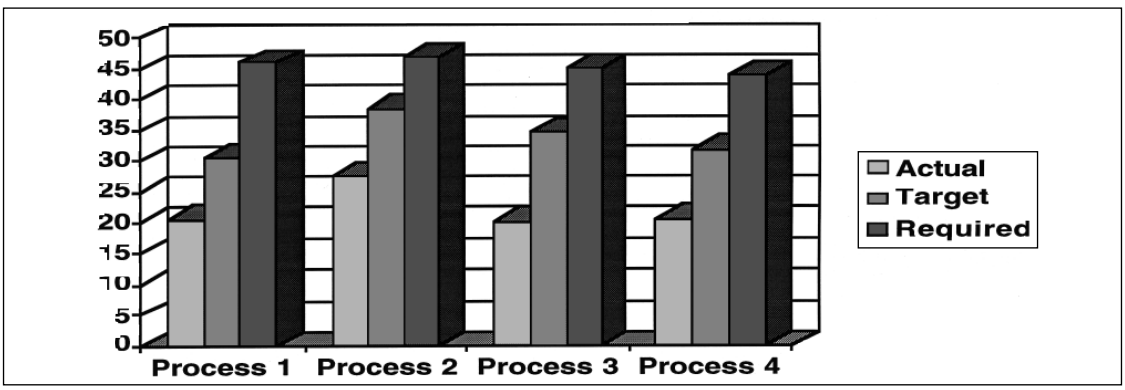

Fig. 2. Process profiles

We distinguish the following profiles:

- *actual* quality profile (result of an assessment);
- *process importance profile* (long term goal);
- *target* quality profile (for the coming planning period, associated with a budget).

The distinction between the last two types of profile is not made by SPICE, but is important in a business context. No matter how noble the ideal (to reach the required quality immediately), it will usually not be feasible in the next planning period due to limitations on resources and cash, and due

to organizational inertia. On the other hand, it is important to keep the long-term aims in mind when making the short-term plan.

2.2 *The steps*

The ordering of the method is:

1. Establish *importance* profile
2. Establish the current profile
3. First gap analysis
4. Budgeting
5. Planning

Of course, the cycle then continues with the carrying out of the plan, the re-assessment of its results (at the end of the planning period) and the loop is closed with the repetition of this method for the next planning period.

3. Establishing the *importance* profile

The steps in establishing the importance profile are:

1. Identify the business drivers
2. Identify the key processes
3. Weighting the business drivers
4. Formulate a contribution factor matrix
5. Calculate importance profile

3.1 *Identifying the business drivers*

Many organizations have realized that directing efforts to achieving their mission is not a simple operation. Organizations after enthusiastically launching a new corporate mission only discover later that they have merely made cosmetic adjustments to 'business as usual'.

The reasons given for this failure are varied but often excuses are given such as organizational inertia, lack of motivation, culture and size of operation. All these are probably true but perhaps the reason why some organizations achieve their mission and others do not is that the achievers know how to achieve their goals and they focus on them. This means changing managers and staff motivators to align with business goals.

The main issue is that there needs to be a translation from business mission to quantifiable business goals and objectives. This process rarely happens and managers are left with a plethora of projects which would improve the processes/service/product but with no objective mechanism to decide how to ration scarce resources into having most impact on the business goals.

Ideally the organization would as a matter of course cascade the company objectives to each individual, but this rarely happens. The IT manager, often divorced from the company's main product has to translate the company mission into specific objectives. This situation occurred in an organization which had not only changed its mission, but if it did not change and achieve the organizational objectives (even in the short term) would cease to exist.

In this situation the IT manager drew together his production services management team who were called upon to determine what they saw as the main business drivers for the organization. The organization had not been derelict in communicating mission statements, company policy and policy for change statements but in many instances this was far too detached from operational life to provide any real direction.

The production services management team who were owners of a variety of processes derived from these statements and their interpretation of what they meant a ranked list of key business drivers and associated measures for recognition of achievement. This list was presented to their senior management for agreement. The ranked list of drivers caused much debate within the senior management, such was the confusion and multiple interpretations, even within the senior management team, of the communications that had been sent out. Once senior management realized that action was to be taken on the drivers the list and the rankings were revised several times.

This list was to be used to direct activity, the problem was then to decide where to place the effort.

3.2 *Identifying the key processes*

Although many organizations have an extensive list of 'improvement' projects which could be carried out to improve the effectiveness of the organization, the list is often compiled by submissions by the more vigorous managers rather than the most needy cases. Some organizations do not always recognize all of the processes which are carried out and in fact the ones which are not recognized are the ones where little effort has been expended on them.

Identifying the processes which are carried out by the organization is a first step to organizational improvement. This comprehensive list provides a broad base for management's attention.

Creating a process model for the area concerned would be the ideal way of identifying the entire processes carried out by the organization but this would take a long time to develop. A standard model is useful to act as a basis. In the example case the production services team had worked with the ITIL model to develop their processes and it was this list of high level processes which were used to identify the potential areas for improvement.

Key process →		**Contributions**					
Key Drivers ↓	Driver weight	P1	P2	P3	P4	etc.	TOTAL
A							100
B							100
C							100
D							100
WEIGHTED AVERAGE							

Fig. 3. The process contribution matrix

Having identified the business drivers and the key processes, we can draw a matrix as illustrated in Fig. 3 with the drivers on the vertical axis and the processes on the horizontal axis. In the following steps we will fill in the business driver ranking column and the process contribution cells.

3.3 *Weighting the business drivers*

Although the business drivers will generally remain constant for a period of time, the relative priority of the drivers will vary over time as external and internal factors effect business development. At the beginning of each process improvement cycle the weighting of the business drivers should be revisited.

The business drivers are weighted for the period for which the improvement programme is to be drawn up (e.g. 1 year). Which drivers are the most important in this period? The drivers are weighted on a scale of 0 to 5 with 0 as not important at all (at the moment) and 5 representing the highest priority.

The intention is to achieve a fairly even spread of weightings, i.e. a roughly equal number of drivers weighted at factor 0, 1, 2, 3, 4 and 5. Weighting every driver with a factor 5 achieves no prioritization. The method used by the authors is to first *rank* the drivers, i.e. number them in order of priority, then divide them into six weight groups corresponding to the priority. For example if there were 12 business drivers, then there would be two in each weight group. Weighting 5 is allocated to each of the drivers in the first group, 4 to second group and so on to 0 in the last group.

An alternative is to calculate a (non-integer) weighting factor from the driver ranking by normalizing the driver rankings to a linear scale with the formula

$weight = (N–rank)*5/(N–1)$

Where N is the number of drivers and the drivers are ranked from 1 to N with 1 as the highest priority.

3.4 *Formulating the process contribution*

The only reason a process should be carried out in an organization is that it should contribute to meeting the organizational objective. If a process does not contribute it should be stopped. Using this logic, it should be possible to assess the contribution of each process to the key drivers for the organization.

Each process is likely to contribute to several organizational goals. However, the total contribution of all processes to each goal must be absolute (i.e. 100%). If this is not the case there is a process which is missing and should be identified.

The contribution matrix is formulated by assessing the contribution of each process to each business driver one by one. The authors' method is to draw up a first draft by holding a workshop attended by involved process owners (generally the first management level). The draft is then verified by the senior management (directors) who determined the business drivers in the first place.[2]

3.5 *Calculating the importance profile*

The final objective is to arrive at the *importance* profile, which is the representation of how important the key processes are to the business. Once the previous steps have been carried out, drawing up the importance profile is reduced to a matter of calculation. For each process a weighted average of contributions is calculated as:

*process importance rating = AVG(contribution/100 * ranking factor)*

The yielded rating for each process is on a scale of 0 to 5 where 0 means the process is unimportant (i.e. not required at all) and 5 means that this process is most important and has to be performed at the highest level in order to meet the business goals.

The natural reaction is to concentrate effort of the organization on those processes which are important. This may result in the organization placing effort where there is little opportunity for improvement. A separate exercise is required to establish the current competence to meet the organizational goal.

[2] In the authors' experience this process can in itself reveal a variety of misinterpretations which could lead to misdirection of effort and expenditure!

4. Establishing the current profile

Using any established assessment method such as ISO [12, 8], SEI-CMM [13, 14] or SPICE [11] one can establish the current capability of each process. The process of carrying out the assessments is well addressed by the references and not elaborated here. The only assumption is that the resulting assessment will be on a scale of 0 to 5. This is exactly true for SPICE and sometimes true for CMM-based methods. Other methods may require an extra step to express the results on a scale of 0 to 5.

When an assessment has been carried out, most processes will be found wanting in some form. A natural instinct is to want to improve the process in every instance; however, unless there are unlimited resources some sort of rationing has to take place. The question for most organizations is how to make rational judgements in rationing key resources. This question is addressed by the remainder of this paper.

5. Selecting projects for improvement

For senior managers/directors, the practical use of the information gathered above is to select from a list of candidate projects those which are to get the green light for the coming period.

5.1 *First gap analysis*

The purpose of gap analysis is to establish where the current performance falls short of the performance corresponding to the importance of the process. Of course if all processes have a performance matching that required, then no action is required. If processes are performed in excess of the requirements, then there may be scope for cost reductions! That scenario is not, however, discussed further here. In most real-life IT cases most, if not all, processes are performed below the requirement. The method suggested by SPICE is to compare the importance profile with the actual profile by overlaying the graphical representations of each in a manner illustrated in simplified form in Fig. 2.

If the gap is to be represented in numerical form then the SPICE method implies a subtraction, e.g. a process with an importance rating of 5 and an assessed rating of 3 would yield a gap of 2. The answer is always on a scale of 0 to 5. The authors actually used a *division* of the importance rating by the assessment rating to give a ratio in the range zero to infinity. In the previous example of a process with an importance rating of 5 and an assessed rating of 3 the ratio is 5/3 or 1.6666. This method gives a relatively high priority for improvement to lower-rated processes. Whereas a process with importance 5 assessed at 3 has a ratio of 1.6666, a process with importance 3 assessed at 1 will have a ratio of 3.0000 although the 'gap' in both cases is 2. Any process assessed at zero will yield a priority of infinity unless its importance was zero.

This method is in practice only useful if a candidate project which improves only one specific process is under consideration. In the authors' experience, the practical situation is that there is a range of candidate projects, each of which will have an impact in varying degrees on several of the processes. This makes the problem of selection more difficult.

5.2 *'Bang for buck' selection*

We now have an overview of process weaknesses and an indication of priorities for improvement by process.

Given infinite money and resources, we could now go ahead and carry out all the activities needed to bring the performance of the processes up to the required level. Extremely well-run organizations who measure a small shortfall and have a generous budget may be able to proceed with all necessary actions immediately. It may also be the case that some processes are considered so critical for the business (required level 5) that the improvement activities will be initiated regardless of the cost, as a matter of survival.

For the rest of us, and the rest of the processes, it will be necessary to select a subset of the activities to carry out in the next planning period. What we want is the most improvement in the shortest time and/or for the least cost: *the biggest bang for our buck*.

We define the bang for the buck, or process improvement benefit of a project as the ratio of the cost of the project of its total contribution to the business. The total contribution to the business of a project is calculated as the sum of the contributions the project makes to each of the processes weighted by the already calculated importance ratings. This calculation is illustrated in Fig. 4.

Key process →	P1	P2	P3	P4	etc.			
Importance rating:								
Candidate projects ↓	PROJECT CONTRIBUTION					BENEFIT	COST	COST-BENEFIT
Project A								
Project B								
Project C								
Project D								
etc....								

Fig. 4. The project benefit matrix

The matrix is used as follows:

- The 'importance rating' row is copied from the previous matrix (Fig. 3).
- For each candidate project the 'project contribution' row is completed by the project proposer with the amount of improvement that the project will deliver, on the same scale of 0 to 5, as expected to be yielded by the selected assessment method. (Project proposer note that the assessment method will judge project success!)
- The 'benefit' column is completed for each project by successively multiplying the 'project contribution' figure for each process with that process importance rating and summing.
- The 'cost' column is completed with the expected cost of the proposed project using the company's usual method for project estimation.
- The cost-benefit column is completed with a figure corresponding to the benefit divided by the cost.

The highest figures in the cost-benefit column represent the projects which provide the biggest contribution to the business drivers (as defined by the process described in Section 3) for the least cost. This column can therefore be used to rank the candidate projects in the order of their greatest cost-benefit ratio.

5.3 *Creating a process improvement programme*

Creating a process improvement programme now consists of giving 'green lights' to projects from the list created in the previous section, in the ranked order, until all the available budget has been allocated.

Once the projects have been selected, then the total expected process improvement from the programme can be calculated by adding the improvement contributions for each process of the projects selected.[3]

Note that if at any time during the execution of the improvement programme the relative importance of the business drivers changes significantly, then the calculations described in this paper should be repeated to verify the appropriateness of the selected projects or if necessary re-select projects and re-plan the programme.

6. Summary

This paper has addressed the problems IT managers have in gaining appreciation and the allocation of resources by the company board. We postulated that this may well be due to poor communication between the company board, thinking in terms of business goals, and the quality improvement personnel carrying out improvements at the operational level. These improvements may not be wrong, but the focus will be clearer and the efforts more appreciated when the business improvement achieved is clear.

The paper therefore presented a method for the establishment of a process improvement profile which is compatible with the SPICE method. The method starts with business goals and should therefore be directly connected to the company board's way of thinking. It also connects directly to the SPICE method, so that there is no conflict or re-invention of wheels for companies employing SPICE. With minor modifications, the method could be connected to CMM or other similar assessment methods.

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[3] Strictly speaking, this statement is only true if the projects have been defined in such a way that their contributions to improvement are independent of each other. This may not always be the case.

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