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Making SPI Happen: The Roads to Process Implementation

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Abstract

Software Process Improvement (SPI) has been widely adopted by software organizations to enhance their capability to effectively deliver quality software. The approach has several positive merits. But many initiatives fail because the software processes are never adopted in practice. This paper offers a comparative analysis of the implementation strategies and outcomes of 18 SPI initiatives within Ericsson. The analysis draws upon concepts from the diffusion of innovations literature and leads to four different process implementation strategies – High Way, Country Road, Crossroads, and Dead End Street. These roads to software process implementation target different levels of practice and they rely on different mixtures of process push and practice pull. Our research suggests that the High Way with its combination of strong push and strong pull is the most promising road to implementation success, whereas the other roads imply serious barriers to success.

Keywords: Software Process Improvement, Implementation Success, Process Push, Practice Pull, Process Tailoring.

1 INTRODUCTION

Many software organizations have adopted Software Process Improvement (SPI) as a systematic approach to enhance their capability to deliver quality software (Humphrey 1989; Grady 1997; Mathiassen et al. 2002). A number of successful cases are reported (Diaz and Sligo 1997; Hayley 1996; Humphrey et al. 1991). But there are also many less successful. The Software Engineering Institute reports data from 1,638 organizations that have engaged in SPI (SEMA 2002). Only 34 per cent proceeded with a second assessment, 13 per cent of these did not improve their capability to develop quality software, and 3.1 per cent moved to a lower level of capability. The average time to move up one level (out of five) was 16-32 months. These data show that SPI efforts are complex change processes with many sources for failure (Aaen et al. 2001).

SPI initiatives are performed in a step-wise and evolutionary fashion based on existing practices (Humphrey 1989; Aaen et al. 2001). They start by diagnosing the software operation (Humphrey 1989; McFeeley 1996) to identify change initiatives. Each initiative focuses on a particular process, e.g. requirement management or project tracking and oversight; it develops new approaches; and it seeks to change practices based on the new process. There are many sources of failure along this evolutionary path. The diagnosis can fail to capture relevant problems; the new process can fail to effectively address practical needs; and the SPI initiative can fail to implement the new processes.

This research focuses on the overall objective of SPI: to improve current practices through implementation of new or modified processes (Humphrey 1989). The key concept underlying our research is hence process implementation, i.e. the activities required to bring a new or modified software process effectively into engineering practice. The involved actor's competence (i.e. what they know), commitment (i.e. how they prioritize) and participation (i.e. what they do) is further used to characterize different strategies to implementation. We present data from Ericsson AB in Gothenburg, Sweden. The data cover 18 SPI initiatives carried out in the period 1998 to 2001. All initiatives were similar in terms of engineering environment, management attention, development technology, and resources. But the implementation strategies and outcomes differed. Some initiatives succeeded while others failed. These data provide unique opportunities to study key factors that enable or create barriers for successful process implementation in SPI.

Section 2 presents the SPI literature on process implementation and introduces the notions of process push and practice pull. We use these concepts to characterize variations in the strategies for process implementation. Section 3 describes the organizational context at Ericsson and how the case study was performed. Section 4 presents the 18 cases and interpretations in terms of four different roads to process implementation. Section 5 discusses our findings.

2 THEORETICAL BACKGROUND

Most of the literature on SPI (Fuggetta and Picco 1994; Paulk 1999; Aaen et al. 2001) builds on the ideas of Watts Humphrey (1989). His emphasis on process implementation is clear: "the key focus of change agents is on improving the practice of software engineering - they do this by working with software practitioners both to provide them assistance and to stay current on project problems", "commitment to SPI from both management and practitioners is necessary to accomplish successful SPI". Humphrey (1996) has also argued that innovation requires creation *and* implementation again stressing the importance of bringing new processes into practice. Another key source on SPI (McFeeley 1996) stresses the importance of committing resources to drive the SPI work and committing practitioners to participate to assure successful SPI. Process implementation is, in this way, addressed as a key issue in SPI theory.

Practitioners tend, however, to focus on the practical guidelines in the Capability Maturity Model (CMM) (Humphrey 1989; Paulk *et. al.*1995) and the IDEAL model (McFeeley 1996). The CMM is

focused on key processes and maturity levels. Little is said about process implementation except for one particular key process, 'Integrated Software Management' (CMM level 3), that addresses process tailoring. The IDEAL model provides guidelines for how to organize SPI initiatives. The model is based on five recommended phases: Initiating, Diagnosing, Establishing, Acting and Leveraging. Process implementation is stressed in the acting phase through the 'Rollout Solution' and 'Transition to Long-term Support' activities. This indicates that process implementation issues are addressed, but not strongly emphasized in SPI guidelines.

Kautz and Nielsen (2002) offer a framework for understanding process implementation in SPI. Based on Slappendel's work (1996) they distinguish between three perspectives. The individualistic focuses on the behavior and commitments of individual actors; the structuralist emphasizes the environment for change; and the process perspective focuses on the complex interactions between individual action and structural conditions. Kautz and Nielsen suggest that the process perspective leads to the deepest understanding of the complex dynamics involved in process implementation and it provides a partial roadmap to guide implementation efforts (2002).

General knowledge on diffusion of innovations (e.g. Rogers 1995) has been adopted to understand better the challenges faced in SPI (Ardis and Marcolin 2001; Pries-Heje and Tryde 2001). A practical framework for planning process implementations is provided by Pries-Heje and Tryde (2001). Based on a diagnosis of common failures in SPI practices they developed a workshop scheme for planning process implementations. The workshop focuses on understanding the target for process implementation (Mathiassen and Sorensen 1997), on deciding which roles to be played by different actors (Checkland and Scholes 1990), on determining the whole product that suits customer needs (Moore 1998), on designing an implementation approach (Eason 1988), and on resolving implementation risks (Iversen et al. 2002). The workshop has been successfully adopted by other organizations (Andersson and Nilsson 2002).

Aaen (2002) argues that the possibility to achieve successful SPI is higher when SPI practitioners work in close cooperation with software developers (End-user SPI) compared to situations where change agents develop solutions of their own (Improvement by Design). End-User SPI requires change agents with dedicated time to work with SPI and committed practitioners willing to work with the change agents.

One of the most important issues in forming a diffusion strategy in software organizations is the rationale for adopting the technology (Mathiassen and Sorensen 1997). Diffusions can be driven by a demand pull, where the reason for adopting a new technology is organizational needs triggered by a performance gap, or, diffusions can be driven by a technology push, where the reason for adoption is based on the espoused benefits of the new technology (Zmud 1984). In the specific case of process implementation we can distinguish between practice pull, where the competence, commitment, and participation of the practicing software engineers is the key driver, and process push, where the diffusion is driven by the competence, commitments, and participation of the SPI practitioners. Zmud (1984) suggests that successful diffusions are based on a considerable pull element.

3 RESEARCH APPROACH

Many SPI initiatives fail despite the focus on process implementation in the literature. This indicates that we need to know more about key factors that enable or create barriers for successful process implementation. Our research addresses this issue by contrasting successful and less successful SPI initiatives. An interpretive case study (Galliers 1992; Yin 1994; Walsham 1995) is well suited for that purpose. The research is part of a collaborative practice study (Mathiassen 2002) carried out at one of Ericsson's system development centers with over 20 years of experience developing packet data solutions for the international market. The organization has grown from 150 employees in 1995 to 900 in 2002 and SPI has become an increasingly important area to assure quality deliveries.

18 different SPI initiatives are presented, analyzed and compared. All initiatives were executed in the same organizational context and in most cases with the same people involved. One of the authors has been working in and been responsible for the initiatives. The potential bias and subjectivity is handled through the collaboration with the other author who was not involved in any of the cases. The study is interpretive (Galliers 1992; Walsham 1995) and action based (Yin 1994) with a focus on process implementation.

SPI outcomes are ideally measured in improvement success, i.e. differences in quality and productivity between old and new practices (Humphrey 1989; Grady 1997). Improvement success is, however, difficult to measure without comparable data from longitudinal studies. Our research focuses on the extent to which initiatives lead to changes in software practices. This notion of implementation success is easier to measure and validate and it can be considered an important prerequisite and indicator for improvement success (Börjesson and Mathiassen 2003).

The basic data was collected from different sources by the SPI unit during the initiatives based on unlimited access to time registration reports, SPI initiative final reports, and SPI project specifications. In addition, data were collected through 25 open-ended, semi-structured interviews with software practitioners, project managers and SPI initiative members. The use of different sources and interviews with the involved actors made triangulation of data possible. The resulting data from the 18 cases are presented in Table 1 and the Appendix and the involved practitioners have verified them.

4 PROCESS IMPLEMENTATION PRACTICES

The 18 initiatives were planned and executed under similar conditions. They addressed the same engineering operation, they were part of Ericsson's intensive SPI program, they had the same strong level of management attention, they had the same level of resources, and many of the SPI practitioners were the same. Table 1 provides a summary of the 18 cases (Appendix contains more extensive data). For each case we present the following data:

Process: The process area adressed by the initiative.

Volume: The # of weeks, # of man hours, and # of people participating in the initiative.

Target: The level of the software operation that the initiative targetted.

Process Push: The competence, commitment and active participation of the SPI team to create and implement a process.

Practice Pull: The competence, commitment, and active participation of the software engineers to create and implement a process

Success: The degree to which the process was adopted as part of software engineering practices.

These data focus in key issues pointed out in the IT diffusion and SPI literature, i.e. which process was implemented and on which organizational level (Humphrey 1989; Paulk *et. al.*1995) and the degree of process push and practice pull (Aaen (2002); Zmud 1984. The data show how implementation strategies and outcomes differed significantly. The initiatives targeted different levels of the software operation and they exercised different mixtures of process push and practice pull. All initiatives intended to create changes in the software operation and each initiative was at the time of execution believed to be successful. But the data show that some initiatives succeeded to implement the processes while others failed. If we categorize the 18 cases depending on the degree of process push and the degree of practice pull we arrive at four different roads to process implementation at Ericsson as described in Figure 1.

The Dead End Street initiatives focused on the core process. The main attention was directed toward process definition and tailoring. The target was the company, i.e. several units were expected to use the new process. The process often became hard to use out-of-the-box as many compromises had to be made to fit all needs. The process push was in this way low. The practice pull was also low because there were too many practitioners with different needs and backgrounds. A typical Dead End Street initiative will not happen. No one is really committed to implement the processes. The organization will rarely benefit from such initiatives.

The Country Road initiative was oriented towards engineering practice. The SPI members were allocated to spend time working with engineering issues in practice and they were strongly committed to support and change practice. The target level was therefore typically individual projects and the process was ready to use. The practitioner commitment was, however, weak. The software engineers did not understand why they had to be involved and they did not allocate time to work with process implementation. The process push was high, but the practice pull was low. A typical Country Road initiative can happen, but it is going slowly and it is likely to fail in implementation.

#	Process	Volume	Target	Process Push	Practice Pull	Success
1	Configuration Management	10 weeks 300 man hours 4 participants	Company	Weak	Weak	Low
2	Design Information	21 weeks 400 man hours 6 participants	Company	Weak	Weak	Medium/Low
3	Estimation and Planning	14 weeks 600 man hours 11 participants	Company	Weak	Medium	Low
4	Historical Data	16 weeks 200 man hours 4 participants	Company	Weak	Weak	Low
5	Introductory training	14 weeks 620 man hours 11 participants	Project	Weak	Strong	Medium
6	Module Test	12 weeks 400 man hours 10 participants	Company	Weak	Weak	Medium/Low
7	Project Tracking	9 weeks 300 man hours 7 participants	Company	Weak	Weak	Medium/Low
8	Resource Handling	4 weeks 250 man hours 8 participants	Project	Weak	Medium	Medium
9	Requirements Management	10 weeks 200 man hours 5 participants	Company	Weak	Weak	Low
10	Requirements Management Implementation	12 weeks 330 man hours 7 participants	Project	Strong	Weak	Medium
11	Subcontract Management	18 weeks 650 man hours 9 participants	Company	Weak	Weak	Low
12	Requirements Management	30 weeks 1200 man hours 3 participants	Action	Strong	Strong	High

13	Analysis & Design	30 weeks 1000 man hours 4 participants	Action	Strong	Strong	Medium/High
14	Implementation	30 weeks 2000 man hours 4 participants	Action	Strong	Strong	High
15	Test	30 weeks 1300 man hours 2 participants	Action	Strong	Strong	High
16	Configuration Management	30 weeks 1650 man hours 6 participants	Action	Strong	Strong	High
17	Project Management	10 weeks 150 man hours 2 participants	Action	Strong	Strong	High
18	Process Development Map	30 weeks 200 man hours 2 participants	Action	Strong	Strong	High

Table 1: Summary data for the 18 cases.

The Crossroad initiatives targeted several units on the company level. The requirements were very similar across the units and compromises were not needed. The software engineers understood the need for new processes and they were committed to use them; the practice pull was high. But the SPI practitioners hadn't allocated time to work with process implementation; the process push was low. A typical Crossroad initiative can happen. But the software engineers have difficulties choosing what road to take and there are no resources to guide them and to facilitate the process.

The High Way initiatives targeted practice. The main focus was on solving practical problems. Few compromises had to be made as the initiatives targeted a specific project or unit. The SPI practitioners were committed and had time allocated to processes implementation. The process push was high. The software engineers understood the need for new approaches and they appreciated the SPI initiative. The practice pull was high. A typical Highway initiative will happen and the results will be implemented and used. The organization can directly benefit from such initiatives.

		Process Push: Low	Process Push: High
Practice Pull	Low	*„Dead End Street“* # 1, 2, 4, 6, 7, 9, 11 Process hard to use. Weak practitioner commitment. SPI won't happen.	*„Country Road“* # 10 Process ready to use. Weak practitioner commitment. SPI can happen.
	High	*„Crossroads“* # 3, 5, 8 Process hard to use. Strong practitioner commitment. SPI can happen.	*„High Way“* # 12, 13, 14, 15, 16, 17, 18 Process ready to use. Strong practitioner commitment. SPI will happen.

Figure 1: Four roads to process implementation at Ericsson.

5 DISCUSSION

We need to ask why so many of the projects failed given that they were based on considerable SPI training, they intended to change practices, they had appropriate resources, and they had strong management support. Our discussion of this issue is related to both theory and practice.

5.1 Implications for Theory

One possible explanation of the reported cases of implementation failure is that SPI theory is ambiguous. Process implementation issues are stressed (see Section 2). But there are a number of conceptual traps that invites practitioners to underestimate the importance of process implementation. The key literature on SPI (e.g. Humphrey 1989; McFeeley 1996) makes no explicit distinction between process and practice. Process covers both prescriptions for practice and practice itself. Also, a lot of emphasis is put on process tailoring, i.e. on transforming a process to suit specific needs. While this is an important activity, it is necessary to stress that tailored processes still need to be implemented. Without a clear understanding of the *difference* between process and practice and without a strong emphasis on process implementation in *addition* to process tailoring practitioners are easily lured into adopting simplistic strategies for process implementation. Finally, as pointed out in Section 2, there is a strong emphasis on process implementation principles in the SPI literature (Watts Humphrey 1989, 1996; McFeeley 1996), but the issue needs to be more emphasized and supported in the authoritative guidelines for SPI, i.e. the CMM (Humphrey 1989; Paulk *et. al.*1995) and the IDEAL model (McFeeley 1996).

The existing literature on process implementation provides useful knowledge on process push tactics and practice pull tactics. The strong emphasis on both SPI and engineering commitment (Humphrey 1989; McFeeley 1996) supports the Highway to process implementation. End-user SPI (Aaen 2002) can be seen as a particular form of the Highway where SPI practitioners work in close cooperation with the software developers to create and implement a process. Moore's notion of the core product, the whole product, and the expanded product (1998) can be used to make processes easier to adopt and

use and hence support process push strategies. Eason's implementation strategies (1998) - big bang, parallel running, phased introduction, trials and dissemination, and incremental evolution – can be used to design implementation processes with appropriate degrees of practice pull. We can finally view the workshop model by Pries-Heje and Tryde (2001) as a practical approach to design an implementation strategy with a strong process push and practice pull that is suited to the particular needs of particular SPI efforts.

5.2 Implications for Practice

Software organizations can learn from the experiences from Ericsson. Most obviously, organizations should avoid Dead End Street initiatives and strongly prefer Highway initiatives. Dead End Street initiatives are definite failures. No initiative should be launched if the perceived need for the new process is low and the SPI team lacks the skills or commitment to develop and design the process. Highway initiatives are in contrast quite likely to succeed. If the organization has identified a number of possible initiatives it should for that reason give high priority to those that are actively requested by the software developers and that fit well with the competencies and preferences of its SPI practitioners. It is, however, not always possible to choose the Highway to process implementation; new processes might be needed without the active consent of software developers, and new types of processes might be needed that do not match previous experiences and preferences amongst the organization's SPI practitioners.

Country Road and Crossroads initiatives are interesting border cases with less certain outcomes. In such cases additional initiatives might create implementation success. The intention *up front* in the cases reported from Ericsson was, however, to achieve implementation success without additional efforts. In that case you will find it difficult to create the necessary commitment to re-launch an initiative. But if you realize that you are about to launch a border case with limited process push or with limited practice pull you need to adopt complementary tactics from the very start. Limited practice pull can be addressed through: software developer participation (Aaen 2002), incremental evolution (Eason 1988), or by tailoring the first version of the process to the particular needs of one project (Moore 1998; Börjesson and Mathiassen, 2003). Limited process push can be addressed through: early adoption of implementation workshops (Pries-Heje and Tryde 2001), software developer leadership (Aaen 2002), or by facilitating and strengthening the initiative by involving SPI consultants.

SPI practitioners should appreciate the distinction between a described process and a software practice. A described process is a prescription for intended practices. They are similar in nature to methods, templates and guidelines and they belong to our repertoire of espoused theories (Argyris and Schön 1978). Software practices are shaped and reshaped as part of an organization's tradition for developing software. They are enacted through the efforts of an organization's software developers and they are expressions of the developers' theories-in-use (Argyris and Schön 1978). Appreciating this difference will make SPI practitioners focus on the challenges related to process implementation, and it will, according to Argyris and Schön, stimulate their ongoing learning about SPI. Such an understanding would be a constant reminder that it is important to emphasize implementation issues from the very start of an initiative, it would encourage them to conduct implementation workshops (Pries-Heje and Tryde 2001), and it would challenge them to develop a practical understanding of the tactics involved in facilitating high process push and high practice pull.

Limitations

It is important to stress that the experiences in this paper are related to the particular context of Ericsson and that the 18 initiatives were evaluated in terms of their implementation success, i.e. the degree to which they led to actual changes in practices. Real success in SPI should be evaluated in terms of their improvement success, i.e. the degree to which they lead to better practices. The experiences from Ericsson do, however, strongly suggest that a combination of strong process push and practice pull is a key prerequisite for successful SPI initiatives.

In case study research there are a number of factors that can affect the outcome of the result. Other factors apart from practice pull and process push can, of course, also affect SPI implementation success. Börjesson and Mathiassen (2003) argue that the distribution of effort and the number of software projects targeted by an SPI initiative are other important factors the affect implementation success. Other possible factors are the complexity of the process area in question, the competencies and experiences of the involved practitioners and change agents, and the degree of iteration adopted to successfully meet practical needs. Further research is needed to learn and understand how these different factors correlate and affect the outcome of SPI implementation efforts.

6 CONCLUSION

18 different SPI initiatives conducted within Ericsson during 1998-2001 have been explored and contrasted. The study draws, in this way, on data from one particular company, but it analyses experiences across several, different initiatives. The Ericsson experience suggests that the High Way with its combination of strong push and strong pull is the most promising road to implementation success, whereas the other roads imply serious barriers to success. This finding provides useful guidance for SPI practice, but the data also raise relevant issues for further research such as how other factors in combination with less strong process push or practice pull can facilitate successful SPI implementation. The key literature on SPI (e.g. Humphrey 1989; McFeeley 1996) addresses the implementation issue, but there is little practical guidance and no distinction is made conceptually between process and practice. Our research suggests that SPI practitioners must appreciate this distinction and its many implications for SPI.

Appendix

#	Process Push	Practice Pull	Implementation Success
1	Weak. SPI participants focused mainly on process description on a generic level that all involved parties could agree on. No commitment from SPI participants to bring process into action.	Weak. Involved SW projects focused mainly on making generic process descriptions. They were eager to solve the problems on a general level, but little commitment to use the results.	Low. The result was considered hard to use out-of-the-box. Part of the results was used indirectly as SPI participants worked in different projects and applied knowledge fragments there.
2	Weak. SPI participants focused mainly on process description on a generic level that all involved parties could agree on. No commitment from SPI participants to bring process into action.	Weak. Involved SW projects focused mainly on making generic process descriptions. They were eager to solve the problems on a general level, but little commitment to use the results.	Medium/Low. The intention was to give the company a framework for design. The results were mainly implemented in one project where one of the SPI participants worked.
3	Weak. SPI participants focused mainly on process description on a generic level that all involved parties could agree on. Limited time for mentoring and support to bring the process into action.	Medium. Involved SW projects dedicated to solve generic process problems, but only one project manager interested in testing the results in action.	Low. The results were tried out in one project, but the project ran into a number of difficulties. As the support was weak no one could help the project. The SPI initiative was no longer available to make the necessary changes.
4	Weak. SPI participants focused on identifying historical data. Few historical data had been recorded so far. Few activities planned to communicate the results.	Weak. Managers were very eager to find out about historical data, but the commitment to change was very low when few historical data were found.	Low. The purpose of the SPI initiative was to build a database of old data and take action from there. No data of interest were found. No modified actions were taken when that result became known.
5	Weak. SPI participants	Strong. The result was focused	Medium. An estimated 50% of

	dedicated to define and describe process. But no plans for how to deploy the process and follow up to support its use in action.	to support managers who were asking for help and interested in applying the results.	managers used the new process. Some did not know about it or were not given the opportunity to learn about it. Assistance was sometimes needed to interpret everything in the right way. Supporting guidelines were provided for managers.
6	Weak. SPI participants focused on solving generic problems by defining a process. Too little time was planned to help the project make use of the result.	Weak. Many believed in performing systematic module tests, but no one was committed and given the time to work with implementation of the results in action	Medium/Low. The process was only used where SPI participants were members of a project or where a section manager strongly believed in systematic module tests.
7	Weak. SPI participants were only given time to define a process. No time to implement it in projects.	Weak. Almost all project managers believed it was necessary to have a good follow-up on a project, but only one was committed and willing to try the results out in practice. Everyone else wanted to wait to see if someone else benefited from the process.	Medium/Low. The process was only used in one project supported by the driver of the SPI initiative. The project managed to implement the process and to use it. The project was content with the outcome. The result was not used again after that.
8	Weak. The SPI participants were focused on solving the problem through a well defined process.	Medium. The managers believed in supporting resource handling and most of them were willing to use the result.	Medium. An estimated 75% of managers used the new process. Those not using the results were either not assisted in using it or just did not believe in the approach.
9	Weak. Most of the time was spent on define how to work with requirements management and almost no time was planned for SPI participants to help implement the results in action.	Weak. Everyone knew it is important to manage requirements, but no one was committed to take the results into action in their own project.	Low. The results were hard to use out-of-the-box. The results were mainly used as a framework by the members of the SPI Initiative.
10	Strong. Time was made available for the SPI participants to help implement the results in the project.	Weak. The targeted project was interested, but was not committed to spend time to make the change happen.	Medium. This Initiative was started because the impact of the previous RM initiative was low. It was decided to focus on one project and make it happen there. All of the results were designed to suit the needs of that project. The receivers were however not committed enough to assure that the results were used in a beneficial way for the project.
11	Weak. There was a strong focus from the SPI participants to solve the problems. But the resulting process was not grounded in current practices. No time was planned for activities to make change happen.	Weak. There was a high commitment to create better routines for subcontract management, but no time was planned for the projects to bring the new process into action.	Low. The results needed further adaptation to be useful for different projects, but no effort was made to tailor the results. Some of the results were indirectly used by SPI participants in different projects.
12	Strong. Time was made available for SPI participants to mentor and support the project in action. The SPI initiative was dedicated to solve the problems	Strong. There was a high commitment from a few highly respected practitioners that helped assure that the results were used in action.	High. The process was adapted to the specific needs of a certain project, but needed further adaptation to be used in action. The SPI participants and practitioners

	for one project.		solved these problems jointly and made the change happen
13	Strong. The SPI participants planed the deployment activities and time was made available for mentoring and support.	Strong. A few well respected practitioners were (after a few struggling weeks) convinced about the need for improved A&D practices and they were committed to make it happen in action.	Medium/High. The A&D area is complex and several iterations of trying out processes in action were needed before the result was satisfactory. Due to the strong push and pull the change was implemented and used.
14	Strong. The SPI participants were given time to participate in the project to support implementation of the results.	Strong. The practitioners were receptive to adopt a stronger focus on implementation and they participated actively in the change process.	High. Two slightly different adaptations were made to fit the different needs of different products that were developed on different sites. Collaboration between SPI participants and SW engineers made the change happen.
15	Strong. The SPI initiative members participated in project tests and came to understand the specific needs of the tester.	Strong. The practitioners came to understand that the SPI initiative was dedicated to respond to their specific needs and they became very committed to use the results in action.	High. The result was adapted to the specific needs of a certain project. Difficulties were solved together between SPI participants and SW practitioners and the result was implemented and used.
16	Strong. Competent resources were dedicated for daily mentoring and support to make the change happen in action.	Strong. The configuration managers were highly involved in both defining and deploying the results.	High. Within CM there are hundreds of possible solutions for each specific situation. This required extra attention to be able to choose one and focus on making that happen. The dedication of the practitioners played a key role.
17	Strong. The SPI participants overlapped with the persons who were going to use the results. The SPI commitment to the initiative was very high.	Strong. The project managers wanted to implement their own ideas and took the time to do it.	High. The results were used in action and the project managers continued to be dedicated to participate in SPI work within project management.
18	Strong. The SPI participants saw the new of a well defined process development map to be able to communicate and deploy all SPI work.	Strong. All SW engineers needed a process description to turn to get templates, guidelines and other relevant information.	High. The use of the development process map is measured in both “hits” and subjective opinions of the need. All measurements are very positive.

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