

Software Process Improvement: A organizational change that need to be managed and motivated

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Abstract— As seen in literature, about 70% of the improvement initiatives fail, and a significant number do not even get started. This paper analyses the problem of failing initiatives on Software Process Improvement (SPI), and proposes good practices supported by motivational tools that can help minimizing failures. It elaborates on the hypothesis that human factors are poorly addressed by deployers, especially because implementation guides usually emphasize only technical factors. This research was conducted with SPI deployers and analyses 32 SPI initiatives. The results indicate that although human factors are not commonly highlighted in guidelines, the successful initiatives usually address human factors implicitly. This research shows that practices based on human factors indeed perform a crucial role on successful implantations of SPI, proposes change management as a theoretical framework to introduce those practices in the SPI context and suggests some motivational tools based on SPI deployers experience to support it.

Keywords—change management, human factors, motivation, software process improvement.

I. INTRODUCTION

DURING the last years, the influence of human factors in Software Engineering is being seriously addressed in literature [1]. It can be said that people are an utterly important factor for the success of software development [2]. However, human factors are still the less formalized aspect in software process models [3].

The main reason for failure in implantation of Software Process Improvement (SPI) can be explained by the lack of ability of organizations in introducing, implanting and institutionalizing those initiatives for the people that would be affected by the new working methods [4]. This is explained in part because most researchers and professionals in the technology area have superficial and insufficient knowledge on human and social sciences. Moreover, normative models for process improvement usually focus more on technical, instrumental and procedural aspects than on human and social aspects [5]. This weakness can result in a return of investment

below expectations, and it can also have a negative impact on the development team [4].

Initiatives for improving software processes imply in changes in the way software is developed, what can be considered as an organizational change [6]. Those initiatives could take experience and knowledge from other areas in order to deal with their own risk factors [7]. This paper shows that human factors are already addressed by deployers in an implicit way, and it proposes the application of the theory of organizational change in the context of software process improvement in order to make explicit such factors.

Besides identifying human factors based on the change management theory in SPI, this paper shows that deployers already use motivational strategies for involving people in the changing process, even though they are not usually aware of that. This suggests the need for a systematic guidance, which is sketched here.

The analyses and findings are presented and discussed as follows. Section 2 presents the motivation for this work. Section 3 describes the research method. Section 4 analyses problems in SPI initiatives that have been reported by literature. Section 5 presents the common problems consequent to the implementation of changes in companies and relates those problems to the SPI ones. Section 6 describes the conceptual framework for addressing those problems: change management. Section 7 presents the results of the research done with SPI deployers, which aimed to see what kind of human factors are already present in successful implementations of SPI and motivational tools gathered in the survey, and section 8 presents the final considerations.

II. MOTIVATION

Software industry has adopted development processes to avoid problems such as those reported by the Standish Group in its Chaos Report [8, 9]. However, despite that interest on formalizing software processes, most implantations of such processes failed [10], and continue to fail. Some researchers estimate that two out of three initiatives fail or do not evolve as planned because they are not adequately conducted [8, 11].

In face of those numbers, academy and industry seek for an explanation for those failures [5, 9]. Most papers on the subject suggest that usually organizational factors are crucial for the failure or success of SPI initiatives [5], and therefore, those factors should have an adequate treatment [7, 10].

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The current problem is not the absence of standards or models to guide the new software processes, but the lack of an effective strategy to introduce those standards and models [12] to the organization, i.e., the people involved. Lewin [13] suggests that the “barriers” forces should be reduced before trying to increase the “accelerating” forces. However, SPI practitioners seem to behave against Lewin’s recommendations, imposing the change to the software team [14]. It is reported that implementing changes in software development processes without an effective strategy can make development teams discouraged or even averse to those initiatives [15].

Moreover, process models establish many options for assessment and improvement, but to achieve success in the SPI initiative it is required an effective change management process in parallel [16]. A report [17] generated by the Software Engineering Institute (SEI) suggests that after the initial assessment, many SPI initiatives have difficulties managing the changes required.

However, even considering the relevance of strategies that attend the organizational issues, most papers on the implantation of changes in software processes do not address human and social factors [5, 6]. Even papers that address people involvement in the process [18] refer to them in a technical way, without considering aspects related to the human nature.

III. METHODOLOGY

In order to seek for human factors relevant to the implantation of SPI, a study was conducted with specialists in SPI deployment. The theoretical reference for the organization of the interviews is the theory of change management [6, 19]. From the answers to a questionnaire and unstructured interviews, some important recommendations based on human factors were identified and presented in section 7.

The research method used in this paper follows the concepts specified in Juristo and Moreno [20]. The method is inductive and uses a qualitative approach. This study was organized in two phases: literature review and questionnaires application.

A. Literature Review

The literature review was developed following the statements of Zoucas, Thiry and Salviano [21]:

1. *Identifying specific literary sources*: background information on *SPI deployment* and *how the SPI implantation has been made by deployers*. The related keywords used in this phase were: *software process improvement, implantation of SPI, people in SPI, human factors*. The research included journals and proceedings from IEEE and ACM, as well as other journals in the area.
2. *Collecting specific literary sources*: selecting the relevant documents to this research from the list of the documents obtained in the previous step.
3. *Analyzing specific literary sources*: a thorough and intensive reading of selected papers.

4. *Collecting the problems*: the bibliographical research was narrowed and the keywords *SPI problems* were used to find specific papers.
5. *Analyzing how others areas solve similar problems*: a collateral bibliographical research was made and the following keywords were searched: *business management, production engineering and organizational management*.
6. *Analyzing which correlated theory could be a best candidate to solve the problems identified*: from other areas the most promising theoretical framework is *Kotter’s change management* [19].
7. *Building a questionnaire*: having chosen a theoretical framework, a survey was conducted with SPI deployers to see whether those issues are already considered in a tacit or explicit way in successful initiatives.

Figure 1 shows the progress of the literature review. The right is the framework for literature review of Zoucas, Thiry and Salviano [21] and the left are the steps by which the survey started. The first three steps implemented the framework for the *quoted words in italics* as follows:

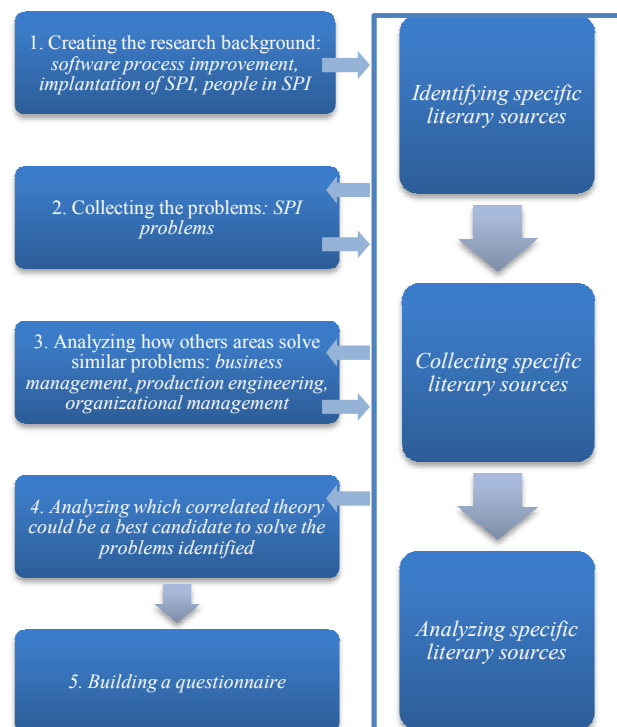


Fig. 1 The Progress of Literature Review

B. Questionnaires Application (Survey)

In order to examine how SPI implantations have been made and characterize how human factors have been approached during those efforts, the research approach chosen was a survey. The survey phase was guided by the recommendations of Kasunic [22]:

1. *Identifying the research objectives*: the problem stated is that *about 60% of the SPI initiatives fail*. A survey was made to *analyze how successful SPI initiatives address human factors from the perspective of change management*.

2. *Identifying and characterizing the target audience*: based on required knowledge, availability, neutrality, and especially on an active role in implementing the SPI initiative, the chosen target public was constituted by the SPI deployers.
3. *Designing the sampling plan*: the target population was chosen as the MPS.Br deployers. MPS.Br [5] is a SPI program based on CMMI [17].
4. *Designing and writing the questionnaire*: the questionnaire was designed based on the *change management* theory.
5. *Piloting test the questionnaire*: in order to verify if the questionnaire was adequate, it was tested face-to-face with some SPI's deployers.
6. *Distributing the questionnaire*: after making the necessary improvements, a digital version of the questionnaire was available to the entire population of deployers.
7. *Analyzing the results and write a report*: the results were analyzed and interpreted.

3. *Imposition*: sometimes the SPI initiatives are conducted as new rules that practitioners must follow, without the right to disagree.
4. *Resource constraints*: occasionally, the senior management prioritizes other company's areas over the SPI initiative and do not dedicate a significant part of the budget to the SPI effort.
5. *Commercial pressures*: it happens when the projects commitments and costumers interests are over the SPI initiatives needs, resulting in heavy workload, by example.
6. *Staff groups*: all problems related to staff, such as when the staff group does not have the necessary experience or the ability to lead the SPI initiative, when there are conflicts among staff people or a significant turnover.

Some SPI problems published in literature are presented in Table 1.

TABLE I
SPI PROBLEMS

| SPI Problems | Examples of problems | Publications |
|---|---|--|
| <i>Resistance, inertia and negative experiences</i> | Cumbersome processes, lack of commitment, lack of overall support, low process priority, organization culture | [4, 5, 9, 12, 14, 23, 24, 25, 26, 27] |
| <i>Lack of evidence of benefits</i> | Lack of commitment, lack of feedback | [4, 5, 12, 23, 24, 25, 26, 27] |
| <i>Imposition</i> | Inadequate communication, lack of management skills, lack of technical knowledge | [4, 5, 12, 14, 23, 24, 25, 26, 27] |
| <i>Resource constraints</i> | Lack of standards platforms, budget constraint | [4, 5, 12, 23, 24, 25, 26, 27] |
| <i>Commercial pressures</i> | Demanding costumers, workload | [4, 5, 12, 14], [23, 24, 25, 26], [27] |
| <i>Staff groups</i> | Inexperienced staff, personality conflicts, staff turnover | [1, 4, 5, 9, 12, 14, 23, 24, 25, 26, 27] |

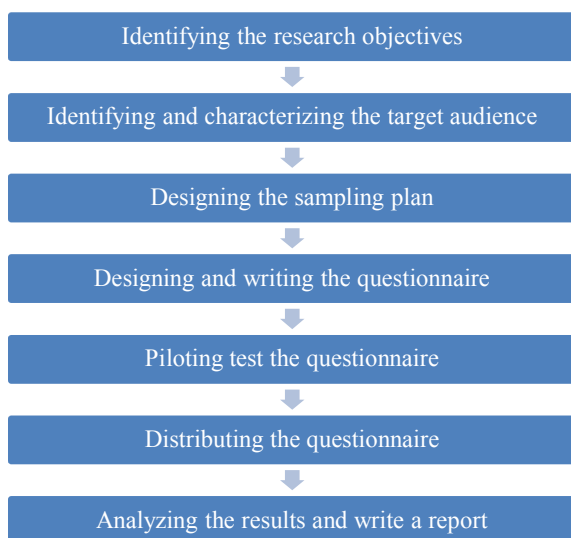


Fig. 2 The Progress of Questionnaire Application

IV. SOFTWARE PROCESS IMPROVEMENT INITIATIVES: THE CRITICAL BARRIERS

This section analyses the most mentioned barriers to SPI implantation according to the literature review. The following issues were identified as the most critical for the SPI initiatives. They are grouped based on Baddooe Hall's proposal [23]:

1. *Resistance, inertia and negative experiences*: those are the problems pointed by literature as the biggest obstacles to SPI. They happen when practitioners are unwilling to leave the practices they are comfortable with. They resist to the new practices sometimes because they are accustomed to the current ones, because they had a bad previous experience or they feel insecure about the new way of working, among other factors.
2. *Lack of evidence of benefits*: practitioners will not use the new methods if the benefits are not been clarified, having as a consequence their lack of commitment.

Commonly, the main problems pointed by literature are related to human factors [4, 10, 23, 25] as seen in this section. This fact supports the idea that processes should be implanted in a way more focused on the people that will be affected by the changes [12]. This idea is detailed in the section 6. The survey phase, described below also confirmed that the problems identified here are relevant to the success of SPI initiatives.

V. ORGANIZATIONAL CHANGES BRING PROBLEMS

Change has been often defined as the distinction between the state of an organization at a T_0 time and the state of this same organization at a T_n time [14]. As a consequence, SPI represents a change for the organization.

Increasingly economic competition demands constant changes in organizations. Initiatives which aim to institutionalize changes in the company seeking economic empowerment grew substantially over the past decades but are frequently conducted in a traumatic way. In many cases, the improvement resulting from the change process is frustrating, with resources being wasted and practitioners worried and disappointed. Anyhow, change is intimately linked to people resistance and pain. Nevertheless, a significant amount of

current errors can be avoided. The more common errors in organizational change initiatives are listed below [19]:

1. *Allowing excessive compliance during the change implantation:* not employing enough effort to drive people from their comfort zones and allowing risks to block the change process.
2. *Not assembling a powerful leading coalition:* not considering the importance of the leadership team, and not prioritizing experience and acknowledgment in teamwork.
3. *Not creating a vision:* not producing a portrait of the company in the future with the changes established, or making it in a complicated or vague way hindering comprehension.
4. *Not communicating efficiently the vision:* underestimating the significance of an efficient communication of the vision and behaving contrary to the proposed changes.
5. *Allowing obstacles to block the vision:* not weakening people resistance or process and structures that muddle changes.
6. *Not establishing short-term wins:* neither valuing the accomplishments nor the practitioners responsible for them.
7. *Let the sense of urgency to be reduced after some time:* not strengthening the changes already established and with the passage of time losing focus on the consolidation of changes.
8. *Not incorporating changes in the organizational culture:* not transmitting changes to newly hired people. Neither creating norms and shared values consistent with the change, nor establishing a policy coherent with the new approach.

It could be seen that most errors in change management are similar to or can incite the ones occurred in software process improvement, as presented in Table 2.

TABLE 2
RELATIONSHIP BETWEEN SPI PROBLEMS AND CHANGE MANAGEMENT ERRORS

| <div>SPI Problems</div> <div>Change Management Errors</div> | Resistance, inertia and negative experiences | Lack of evidence of benefits | Imposition | Resource constraints | Commercial pressures | Staff groups |
|--|--|------------------------------|------------|----------------------|----------------------|--------------|
| <i>Allowing excessive compliance during the changes implantation</i> | √ | √ | | √ | | √ |
| <i>Not assembling a powerful leading coalition</i> | √ | | √ | √ | √ | √ |
| <i>Not creating a vision</i> | √ | √ | √ | √ | √ | √ |
| <i>Not communicating efficiently de vision</i> | √ | √ | | | | √ |
| <i>Allowing that obstacles block the vision</i> | √ | √ | √ | √ | | |
| <i>Not establishing short-term wins</i> | √ | √ | | | √ | |
| <i>Let the sense of urgency diminishing with the time</i> | √ | √ | | | | √ |
| <i>Not incorporating the changes in the organizational culture</i> | √ | √ | | √ | √ | √ |

As stated in the literature [6, 19, 23], introducing any change in an organization without proper concern about the most appropriate way of doing this can produce many of the problems identified in this section. In this way, SPI can be seen as change and the recommendations of change management can be useful to conduct SPI initiatives [4, 16].

VI. CHANGE MANAGEMENT PRACTICES: AN APPROACH FOR SOFTWARE PROCESS DEPLOYMENT

SPI initiatives imply in important organizational changes in the company [14]. Based on this fact, this section presents an approach to the problems stated in previous section according to the theory of change management.

One of the cornerstone models for organizational change was developed by Kurt Lewin in 1947 [13], and still holds true today [14]. He was physicist and social scientist, and explained his model by making an analogy with changing the shape of a block of ice. For Lewin, a successful change includes the three stages as follows:

1. **Unfreezing:** time to relaxation, opening, discussing, information and starting the moving.
2. **Moving:** time to transformation, change. A transition period of behaviors and opinions, and training new behaviors.
3. **Refreezing:** time to establish the change, consolidation, stabilization, with appropriation of new behaviors.

This is a simple and easy-to-understand framework for change process which can be used to lead organizational changes required [14]. According to Lewin [13], the process of change often has a brief life. After a time performing modifications, the tendency is to return to the previous state. This shows that besides achieving a certain level of change, the company should also establish as a goal to remain at that level.

Following Lewin's reasoning, Kotter [19] proposes a process consisting of 8 steps through which every company that want to implant a change should pass to reach its goal. It can be noticed that these 8 steps serve as an extension of the stages proposed by Lewin [13]. Later, Kandt [6] emphasized the relevance of this theory to SPI.

As changing is a complex process, a significant effort is essential [6, 19]. The first four steps of the transition process are focused on shaking the company, creating motivation for change, or **unfreezing** (using a Lewin's [13] word) an inflexible status quo. Phases 5 to 7 are concentrated on communication and empowering people to simplify the institution of new practices which will guide the **moving** time. The last step consolidates the changes on the company's culture and supports its implantation. It is time to **refreezing** the new practices in the company. It is indispensable for creating the confidence necessary for the next inevitable change. It is showed at Figure 3.

The 8 steps suggested by Kotter [19] and reinforced by Kandt [6] for planning and implementing a successful change in the company should rather be performed in the sequence suggested, and all of them should be executed. A little

description of them is below:

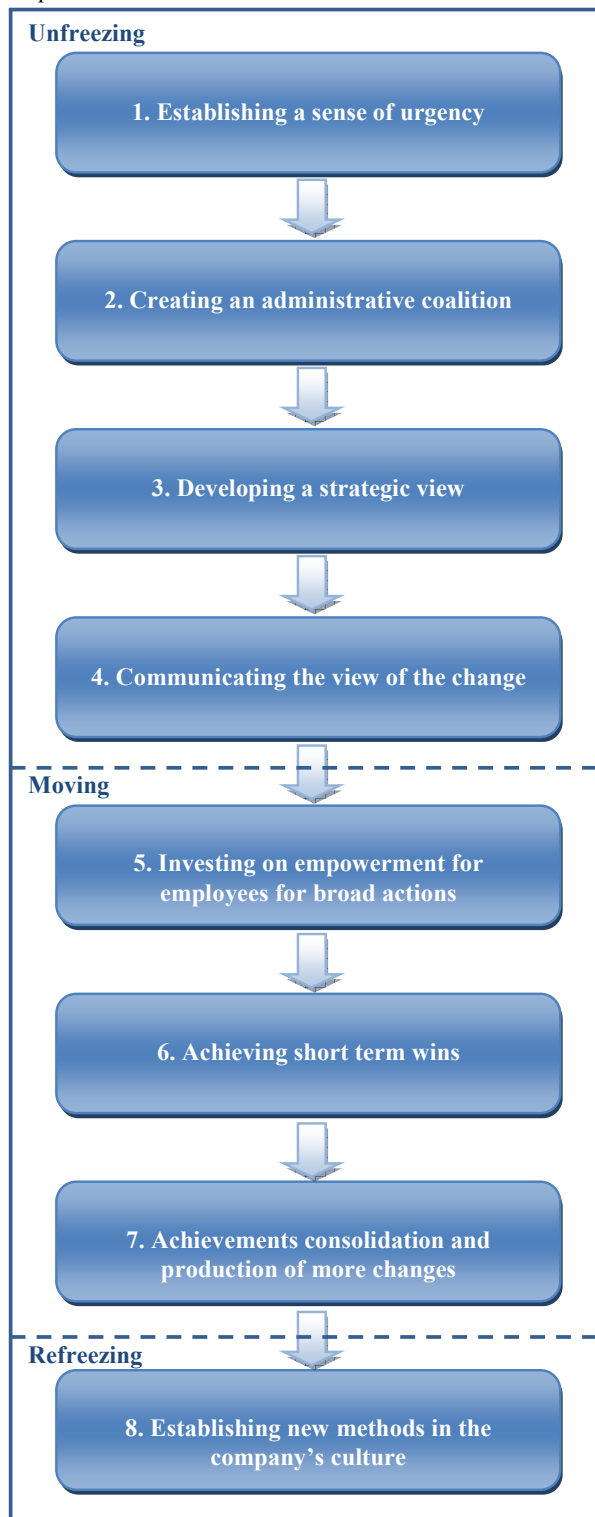


Fig. 3 SPI Change Management Process according Kotter [19]

1. **Establishing a sense of urgency:** The first step is about to convince people in the organization about the need to change. If the whole organization truly wants it, the changes will be facilitated. It is made by creating a sense of urgency for the change. This phase begins by scanning the marketplace and showing the reality of most competing companies. In parallel, statistical data about the company problems, potential crises and fundamental opportunities may be presented to compare the results and to persuade people for the real need to change. It is advised that to move to the next step and have a successful change, at least 75% of the managers have to be aligned to the initiative. This means that lots of energy and hard work are required in this step.
2. **Creating an administrative coalition:** the second step is related to the difficulty on establishing change in the organization and the need to assemble a powerful team to lead the process in a successful way. The transition phase usually demands strong leadership and support from key people in the company. It is important to identify the effective leaders in the company (not necessarily following the corporative hierarchy) and composing the coalition that will head the change. Once formed the administrative coalition, it should have enough authority to lead the change.
3. **Developing a strategic view:** this step is about drawing a clear picture of the company in the future with the changes established and showing it to people. It is essential that they comprehend perfectly the target of the change process. In addition, effective strategies should be developed to achieve the change. Those strategies should be made clear to people in the company, because in this case they will know how to reach the goals of the initiative.
4. **Communicating the view of the change:** the fourth step supports the idea that communicate a vision to people is as important as to create it. The success of the initiative will heavily depend on the effort applied to this. To achieve an efficient communication, every possible vehicle should be used to transmit it daily: meetings, journals, e-mails and conversation. The vision should be communicated as largely as possible. The communication of the vision is not only dependent on the speech, but mostly on the examples of coalition team's behavior. It is fundamental that the guiding people "walk the talk", in other words teach the new behavior by example. Showing is more effective than just talking.
5. **Investing on empowerment for employees for broad actions:** the fifth step is focused on combating all the resistance that may be undermining change in the company. Obstacles and barriers should be removed. All the structures and systems that could sabotage the success of the vision should be minimized. It is necessary to show people that the current priority is establishing the change. Attitudes contrary to the vision should be discouraged. But it is also important to stimulate the postures in favor of the change. Ideas, activities, actions and even risks that will help the implantation of the change must be incited. People who are making the change happen should be rewarded and recognized.

6. **Achieving short term wins:** the sixth step will support the progress of the change's process with a plan of short term wins. People will be more motivated after every victory achieved, and this will strongly collaborate to the success of the initiative. It is recommended to create a plan of achievements that occur at regular intervals. It could be weeks, months or years, depending on the type of change. Every improvement caused by the change should be highlighted. Focus should not be on long term goals, but in the little ones necessary to reach it. Periodic achievements are one of the best ways to incite people to continue implementing the change and to discourage the resistant ones. Also, it is important to require people that are contributing to the accomplishments; this can incite the staff to execute the changes.
7. **Achievements consolidation and production of more changes:** this step is concentrated on avoiding declaring victory too soon and stopping investing on the change. The short term wins should be considered as just the iceberg's peak and not the entire triumph. They should serve to sustain the quest for the real implantation of the changes. It is essential to keep investing on the success of the factual establishment of the change until that really happens, what normally takes a considerable time. The credibility of short-term wins should be used to continue motivating people to believe in the changes and to adapt the systems, structures and policies. The project could be reinvigorated with the promotion, development and hiring of people who are coherent with the vision of the change.
8. **Establishing new methods in the company's culture:** the last step is about institutionalizing the changes in the company's culture. It is the solid incorporation of the changes in the organization's culture that will determine the success of the initiative. In order to really establishing the changes, it is necessary to embody them into existing processes, and make them necessary for the continuity of the production. Leaders should continue to support the change. And the new practices, ideals and values should be passed on to the new staff. It is important to keep focus on making the vision real everyday and for everyone in the organization. Constant efforts should be made to show that the new success is inherent, and that it comes from the new behavior adopted by the organization. This will assist to produce the essential reliance in the subsequent changes. Organizational changes demand hard work to be successful. Planning should be done carefully.

VII. SURVEY RESULTS AND DISCUSSION

Thirty-two successful implantations of SPI were studied from the point of view of twenty deployers with an average of 8 years experience in SPI, two representatives of a company that was evaluated for certification and one practitioner. All interviewees were members of the SPI leading teams.

The analysis of the interviews and questionnaires allowed the production of a comparison between the practices suggested by the theory of change management and the practices that are being applied by SPI deployers. The comparison and main recommendations are presented in the following subsections. They are organized in eight groups. For

each group motivational tools or good practices to promote the recommendation are also presented. The results summary is showed in Figure 4. Arrows show the change process sequence and next to each stage of the process (arrows) are the motivational tools used by deployers that help them in the SPI initiative.

It is interesting to notice that human factors were raised by deployers despite the fact of them not being formally mentioned in implantation guides. Even the main reference to the implantation of CMMI - the SEI implantation guide IDEAL - does not present recommendations to problems related to people, such as resistance or no commitment [5].

1. **Convincing people about the real need to implant a SPI initiative:** There is preoccupation in explaining the need of change to employees, but no real effort to persuade the practitioners, establishing a sense of urgency. The importance of convincing people is recognized by the deployers; nevertheless most of them still do not employ enough time to achieve this goal. They point out that the big issue in implantations of SPI is involved people. However, senior managers are more concerned about finishing projects, and they do not pay due attention to people which hinder the progress. Deployers agree that many times practitioners are not aware about the goals of change, and this is the reason for them to present resistance. It was noticed that generally about 50% of them do not believe that the change is really needed.

Good practice that some deployers use and can help to persuade practitioners:

- a) *Awareness workshop:* for presenting all the statistical data about the situation of the company and of the competitors, possible crises and improvements brought with a SPI initiative.

2. **Assembling a powerful leading coalition to the SPI initiative:** Despite the consensus between deployers that the administrative coalition should have credibility and power, it was admitted by them that some initiatives go on without a leadership respected by the practitioners, what undermines the power of persuasion necessary for the success of the SPI implantation. Also, occasionally, the members do not share a common goal, and they do not work focused on a goal. Usually the implantation team is formed by people who have the lowest workload, and lacks people with leadership and authority abilities.

Good practices that some deployers use and can help to unite the coalition:

- a) *Meetings outside work:* scheduled extra-work meetings carefully planned for unwinding and stimulating the union of the team.
- b) *Leadership with strong social and psychological features:* those are acknowledged features to lead people and integrate them in the goal of SPI deployment.

3. **Defining the future state of the company with the SPI deployed:** Deployers pointed this phase as the most crucial

and critical of the entire SPI implantation process. They assume it is extremely important to show the benefits that SPI will bring to the organization and also argue that the success of the initiative depends on this. Thus, goals and strategy are usually clearly presented, but sometimes still there is no emphasis on clearly showing to people the situation that the company will reach after the changes.

Good practice that some deployers use and can help to explain the SPI initiative:

- a) *Definition meetings*: meetings to clearly identify all the benefits of the SPI initiative and characterize the company's situation in the future with the SPI established.

4. Communicating the SPI practices to the practitioners:

As important as defining the SPI benefits and the strategy to reach them is to pass them to the employers clearly and efficiently. It was recognized by deployers the need for a more efficient communication about the advantages of the changes. There is some communication but not a significant concentration on the efficiency of it. Besides, deployers believe that often the senior management behavior is contradictory to the SPI initiative and it can hinder the success of it.

Good practice that some deployers use and can help to communicate the SPI strategies:

- a) *Clarifier workshops*: those seminars should have the objective of truly enlightening the benefits of the SPI implantation and assuring that the practitioners understand the reasons of the initiative.

5. Investment on empowerment for employees for broad actions:

Deployers reported that professionals and their proposals should be heard. In some cases, practitioners should receive more autonomy to make suggestions to the new process. All ideas, even those adverse to change, should be listened, analyzed and discussed with the ones who have proposed them. When linked to business objectives and the SPI, the ideas are seen as an opportunity to improve the process and can be incorporated into the initiative. When they are negative, they have to be changed.

Good practice that some deployers use and can help to discuss ideas with practitioners:

- a) *Discussion forum*: in which opposite ideas can be freely expressed, analyzed and openly discussed.
- b) *Best employee*: the practitioners more involved with the initiative should be acknowledged and rewarded.

6. Achieving short-term wins in the SPI initiative:

Establishing a plan for short-term achievements is the phase considered by literature [4, 9, 19] as the key one, because acknowledging each achievement and its achievers assists to motivate practitioners. That shows that the efforts are working and, in the end, the initiative will improve the process of software development. It is also very important

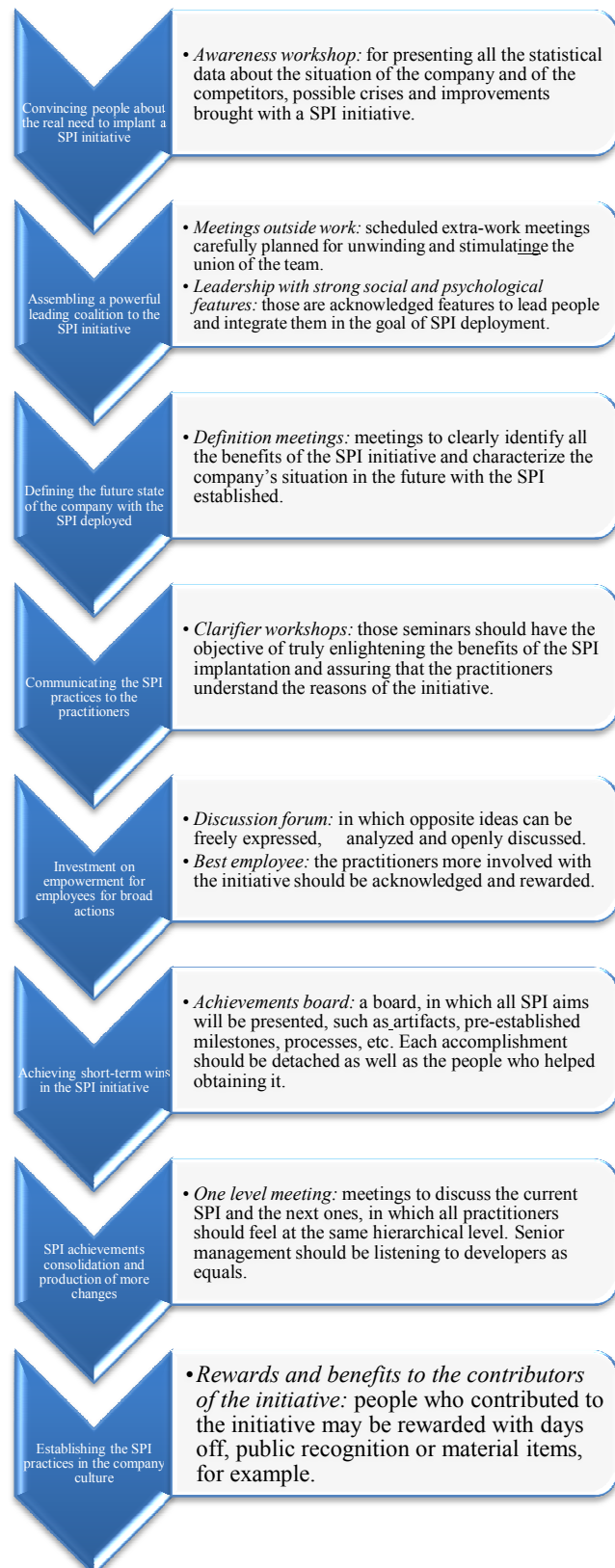


Fig. 4 SPI Practices and their respective motivational tools based on deployers experience

to the credibility of the SPI initiative and it will support the next improvements. Nevertheless, deployers reported that sometimes they do not build a plan for short-term wins, neither are they sufficiently concentrated on highlighting the short-term wins to the practitioners or noticing people who assisted the effort.

Good practice that some deployers use and can help to manage short-term wins:

- a) *Achievements board:* a board, in which all SPI aims will be presented, such as artifacts, pre-established milestones, processes, etc. Each accomplishment should be detached as well as the people who helped obtaining it.

7. SPI achievements consolidation and production of more changes: Interviewees reported that after a successful achievement there is a loss of intensity on the efforts regarding changes. However, the advantages of changing should incentive people to call for more improvement, and in the next initiatives, the efforts to drive people from their comfort zone should be minimized by the previous success. Some deployers create a software quality assurance group to supervise the implementation of the proposed changes.

Good practice that some deployers use and can help to solidify the SPI:

- a) *One level meeting:* meetings to discuss the current SPI and the next ones, in which all practitioners should feel at the same hierarchical level. Senior management should be listening to developers as equals.

8. Establishing the SPI practices in the company culture: Deployers reported that, after the end of the change process, in order to really establish the practices in the company's culture, it is necessary to designate people to supervise the new software process (for example the software quality assurance group mentioned previously) or the changes may lose intensity. Without further supervision people tend to not use the new processes systematically. The SQA group would also be responsible for instructing newly hired people on the software process and schedule periodic meetings to discuss the process with the practitioners.

Good practice that some deployers use and can help to incorporate SPI in the company's culture:

- a) *Rewards and benefits to the contributors of the initiative:* people who contributed to the initiative may be rewarded with days off, public recognition or material items, for example.

VIII.FINAL CONSIDERATIONS

Deployers interviewed recognized that besides a method that guide technically how to implant a process, it is also needed a guide on how to prepare people to receive and execute this new way of working. They agree that all eight recommendations based on organizational change can perform this role and should be considered essential for a successful implementation of SPI. From experience in other initiatives,

they reported to be using already some of these practices, but without any systematization, what may undermine the success of the deployment. They agreed that defining practices for SPI implantation focused on people is necessary. They also agree that change management is a promising alternative that can contribute to the success of the initiative.

Faced with constant failures in SPI deployment, the objective of this research was to infer that they are strongly associated with the low concern on people involved in the software process, and it suggest practices focused on people that could help the implantation of SPI. The main contributions of this paper are:

- a. Relating the problems in SPI to the ones of change management, justifying the use of this theory;
- b. A comparison between the practices suggested by change management and the ones used by deployers; and
- c. Proposing motivational strategies to support those practices.

During the interviews it was seen that the dominant concern during SPI initiatives is the correct institutionalization of the processes. However, the results of this research show that there is a background concern on human factors and a general acknowledgement that those factors are essential for the success of the initiatives. However, this influence was not yet methodically incorporated to the practice and it results in poor attention given on how to implant SPI in a less traumatic way. Deployers agreed that the formalization of an implantation process focused on people would allow wider success on initiatives and a continuing improvement on implantation processes.

Deployers also acknowledge that if the central practices based on human factors identified in this research are explicitly discussed with people involved in the process, possibly much resistance can be avoided. Some of them already use techniques for stimulating people to change, such as motivation meetings, boards acknowledging people that contributed most to the initiatives, and talks with all the team, including senior management. Deployers reported that they use those techniques without being aware that they are motivational tools, and this effectively proves the need to adapt such processes to knowledge from other areas, such as Kotter's theory of organizational change in order to guide a formalization of human factors into the process of implementation of SPI.

ACKNOWLEDGMENT

The authors acknowledge all the interviewees that collaborated with this work and CAPES for the financial support.

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