Learning and Organizational Change in SPI Initiatives

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Abstract. Explaining how organizations chance has been a central and enduring quest of management scholars and many other disciplines. In order to be successful change requires not only a new process or technology but also the engagement and participation of the people involved. In this vein the change process results in new behavior and is routinized in practical daily business life of the company. Change management provides a framework for managing the human side of these changes. In this article we present a literature review on the change management in the context of Software Process Improvement. The traditional view of learning, as a "lessons learned" or post-mortem reporting activity is often apparent in SPI literature. However, learning can also be viewed as a continuous change process where specific learning cycle starts with creative conflict and ends up in formal norms and systems. Since this perspective has almost no visibility in SPI literature of past it could show a new direction to the future development of change management in SPI.

Keywords: Organizational change, learning, SPI.

1 Introduction

Many software firms see Software Process Improvement (SPI) as a strategic matter and are involved in organizational change initiatives to improve their software development practices. The fundamental goal of the SPI is improvement - for instance in software quality and reliability, employee and customer satisfaction, and profitability - by changing the organizational practices of firms [1]. Various maturity models can steer SPI initiatives since they offer different options for assessment and improvement, but successful SPI requires effective change management irrespective of the model adopted [2]. The challenge is that software developers must continue working productively while process changes are being implemented. Process improvement requires organizational and behavioral changes - changes in the way people communicate and collaborate as they do their work. Bringing about such changes requires management: a proven strategy, careful planning, flexibility and creativity in executing plans, and insight into issues surrounding organizational change. Thus organizational change management can be described as a process where structured approaches and tools are applied within organizations to enable its transition from a current state to a desired future state.

The literature on the change management field comes from psychology and organizational science. There are a multitude of approaches on change management and it

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is rather difficult to point out a common denominator. But obviously there is a tight connection with the concept of learning organizations [3,1]. In the context of SPI, change is the result from an organizational learning process that centers on the topic of SPI initiatives. Only if organizations and individuals within organizations learn, they will able to master a positive change.

In this paper we combine literature on organizational learning and management to understand learning and change in organizational settings. We then apply these theories in analysis of SPI models, particularly CMM(I), SPICE and IDEAL. Thus we aim at better understanding of organizational learning in SPI context. Our contributions are consequently twofold. First, we review different theoretical perspectives on learning. Second, we utilize the literature to analyze SPI models to make suggestions how learning can be supported, encouraged and facilitated.

The paper is organized as follows. First, as theoretical background, literature on learning in organizations and change management is reviewed. Second, the recommendations and findings from the above mentioned literature are applied in the analysis of SPI models. The article ends with conclusions suggesting some amendments to current SPI models promoting, in a coordinated manner, the innovativeness and capabilities of the personnel.

2 Learning Organizations

Argyris and Schön [4] introduced a conceptualization of organizational learning. They identified three levels of 'learning loop' within an organization: single-loop learning is a simple behaviour adjustment in a mismatch or error situation, respecting the organization's current principles and rules. At a higher level, i.e. double-loop learning, the organization questions and modifies existing rules and procedures in response to mismatch or error. In other words, the organization tries to make sense of what is going on and what assumptions should be changed in order to achieve better results. The highest organizational learning loop is deutero-learning. This loop refers to the organizational problem solving capacity and capability to redesign policies, structures and techniques in the situation of constantly changing assumptions about the self and the environment. Deutero learning means understanding single-loop and double-loop learning in order to increment them. Thus the challenge for an organization – or network of organizations – is to provide its members with the necessary conditions for developing its capacity to assimilate knowledge and to solve problems [5] between the network partners [6,7].

Gattermann & Hoffmann [8] suggest that the success of deutero learning and the restructuring of values and rules can be assessed by the level of acceptance of change within organizations. Evidently, in order for that to take place, not only individuals but also organizations and networks must be provided with the conditions necessary for learning. Indeed, knowledge management literature suggests a variety of models and methods for knowledge creation and sharing through interaction (tacit knowledge) or through documents and information systems (explicit knowledge).

In line with the view of the firm as a 'sense-making system' [9,10] Nooteboom [11] explains the need for shared insights and models by pointing out that information

is useless if it is not new, but it is also useless if it is so new that it cannot be understood. He argues that organizations should be able to reduce cognitive distance between its members, i.e. to achieve a sufficient alignment of mental models, to understand each other and achieve a common goal [11]. He also indicates the trade-off between need for cognitive distance for the sake of novelty and cognitive proximity and for the sake of efficient absorption. This is precisely the same challenge that Nonaka points out when he suggests that, one of the enabling elements for the process of organizational knowledge creation are requisite variety and redundancy of information. This need for variety and at the same time overlapping knowledge domains of individuals is concerned with balancing cognitive distance and cognitive proximity, as mentioned by Nooteboom [11].

2.1 Creativity and Chaos

Nonaka [12] proposes that new knowledge can be created by dialogue which brings up conflicting views. Open discourse and reference models seem to emerge in particular as important enablers for organizational learning and even more vital in the context of learning networks [12,13,14]. They are needed for members with differing backgrounds and history to achieve a shared desired vision for the future. That is, organizational learning occurs through shared insights, knowledge and mental models. Change is blocked unless all of the major decision makers learn together, come to share beliefs and goals and are committed to take the actions to change. Second, learning builds on past knowledge and experience, that is, on memory. Organizational memory depends on institutional mechanisms (e.g. policies, strategies and explicit models) used to retain knowledge.

Nonaka [12], referring to Brown and Duguid's [15] evolving communities of practice, points out the significance of links between individuals that span boundaries. He sees knowledge creation as a process that constantly makes extensive use of knowledge in the environment, especially that of customers and suppliers [12]. Thus, selecting people with the right mix of knowledge and capabilities for the creation process is critical [16]. Nonaka promotes the use of cross-departmental or even cross-organizational teams for organizational knowledge creation: "Teams play a central role in the knowledge-creating company because they provide a shared context where individuals can interact with each other and engage in the constant dialogue on which effective reflection depends. Team members create new points of view through dialogue and discussion. They pool their information and examine it from various angles. Eventually, they integrate their diverse individual perspectives into a new collective perspective. This dialogue can -- indeed, should -- involve considerable conflict and disagreement. It is precisely such conflict that pushes employees to question existing premises and make sense of their experience in a new way." [13].

Also Zimmerman [17] building on Stacey [18] points out that organizational learning often takes place in a complex setting. He proposed a matrix about learning and knowledge creation (in Fig. 1.). It has two dimensions: the degree of certainty and the level of agreement.

Many simple business processes are situated at a level in which it is certain what needs to be done and people involved agree on that. Here (area 1), traditional management approaches, e.g. management by objectives apply and work well. Organizations

use techniques which gather data from the past and use that to predict the future. However, when members of the organization do not agree, or show resistance to the planned changes, the traditional methods fall short (area 2). Then politics become more important. Coalition building, negotiation, and compromise are used to create the organization's agenda and direction. Third case is where managers find themselves and their organizations in a situation characterized by a high agreement of stakeholders - what Senge calls "shared vision", but a substantial degree of uncertainty (area 3). In this region, the goal is to head towards an agreed upon future state even though the specific paths cannot be predetermined. A strong sense of shared mission or vision may substitute for a plan and comparisons are made not against plans but against the mission. This is the area when scenario design and participatory approaches for defining strategies are valuable.

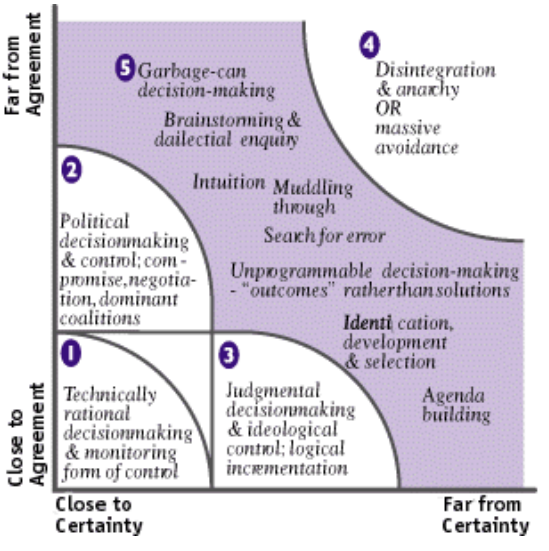

Fig. 1. Learning and knowledge creation

Situations where there are very high levels of uncertainty and the stakeholders are far beyond any agreement (area 4) often result in a breakdown or anarchy. The traditional methods of planning, visioning, and negotiation are insufficient in these contexts. Even though many political leaders are operating in exactly such an environment, in an organization managers would do everything to escape that situation which complexity scientists call "The Edge of Chaos". However, interestingly many contemporary management processes are situated in a field that fluctuates between the extremes that have been delineated above (area 5.). Here change is regarded as the norm. It is the zone of high creativity, innovation, and breaking with the past to create new modes of operating. In such environments, the main task of management is to facilitate the co-creation of the organization's future [17]. Methods proposed include several types of meetings and conferences advancing innovative co-operative thinking, and brainstorming (e.g. Open Space Technology, Appreciative Inquiry, World Café).

2.2 The Change Process

The lesson learned from the above discussion is that in order to be innovative and creative the companies should promote situations where members – or at least the major decision makers - of the organizations are able to express their differing views, share their information and eventually end up with a new collective perspective and solution. However, this should be done in a coordinated manner, so that the company does not end up in an anarchy and chaos. A change model [19] includes four steps: unfreezing, learning, internalization, and refreezing. The unfreezing is a cathartic process of increasing forces towards change and/or decreasing forces resisting change. After moving to a new equilibrium state through learning and internalization, the system is refrozen. In turn, Nonaka and Takeuchi [20] view on how the knowledge is diffused into the organization (in Fig. 2.) They note that there are two types of knowledge: tacit (subjective) knowledge and explicit (objective) knowledge. Tacit knowledge is the knowledge built on experience. It includes insights and intuitions, and is not easily visible and expressible. It is highly personal and is hard to formalize and share with others. Explicit knowledge is formal, systematic and easily communicated and shared in the form of hard data, formulae, codified procedures, or universal principles.

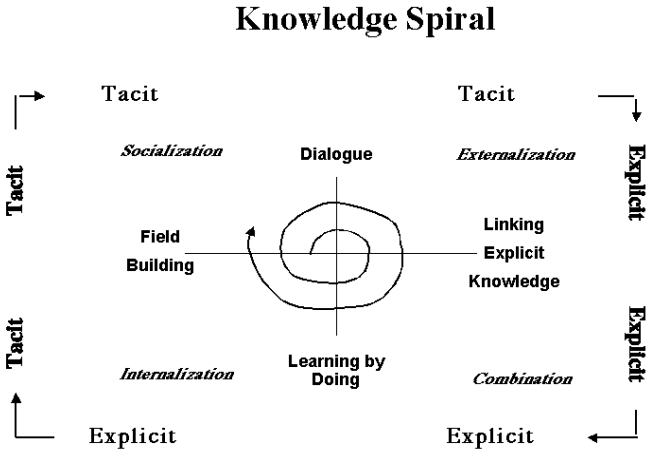

Fig. 2. Knowledge Spriral

Nonaka and Takeuchi represent the knowledge transfer process as a spiral, starting off with tacit knowledge that is externalized to someone else via dialogues. Then these explicit ideas are connected to the existing body of knowledge, combining them and internalizing them, making them tacit once again. The spiral points out that the process starts with dialogue, continuing with linking explicit knowledge, to learning by doing and finally to field building. Thus after the 'conflict and creativity' phase discussed above the company should engage in more rigid phase of learning by combining explicit information, followed by 'learning by doing' phase. Only when the new process knowledge is adopted into real work, and included into its tacit knowledge, the

organizations has achieved sustainable process improvement. Thus in this learning process the approach starts with creative chaos, where mental models and brainstorming are applied to boost innovativeness in multi-departmental or multi-organizational teams, and finally curbs down to 'status quo' coordinated by shared work practices and formal rules (illustrated in Fig. 3.)

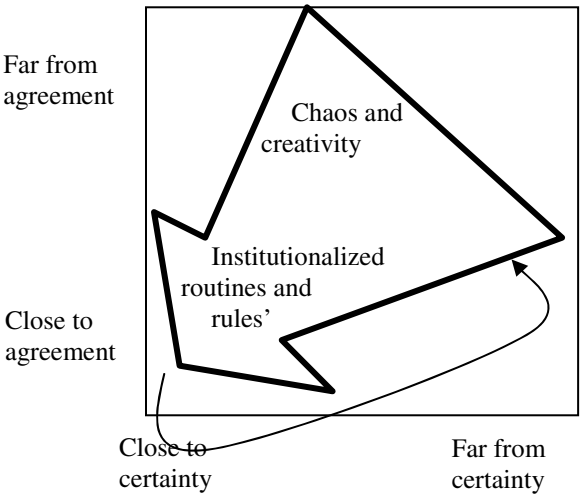

Fig. 3. The learning process

3 Organizations in Change

Whereas in the previous chapter we looked at organizational change from human learning perspective, here we would like to take another stance – organization.

Organizations have each own history and background, which affect the future decisions and actions. [21] defines organization's culture as "the accumulated learning that a given group has acquired during its history." This definition emphasizes learning aspect and also notes that culture applies only to that portion of the accumulated learning that is passed on to newcomers [21]. Huber [22] calls the learning related to institutionalized knowledge as congenital learning. (cultural transmission from other members). Other forms of learning identified by [22] were: experiential learning (via planned experimentation, self appraisal, and learning curves), vicarious learning (e.g., benchmarking other organizations' process, systems, and results), grafting (e.g., acquisitions and mergers, strategic alliances and partnering, and migration of top management), and Searching and Noticing (e.g. performance monitoring).

From organizational perspective, an organization consists of several variables, such as structure, people, technology and management [e.g. 23, 3]. These variables are highly independent, so that a change in one variable most often results in an intended or unintended change in other variables as well, which in turn cause new changes in the system. Dooley [19] points out that the magnitude of the change must be adjusted

to the specific organization context (and to cognitive distance and proximity): the difference between the perceived organization state and the desired organizational state creates a "state gap" [19]. The gap motivates or demotivates an individual's readiness for change. If the gap is too big, change may be deemed impossible; if the gap is too small, change may be viewed as being unnecessary.

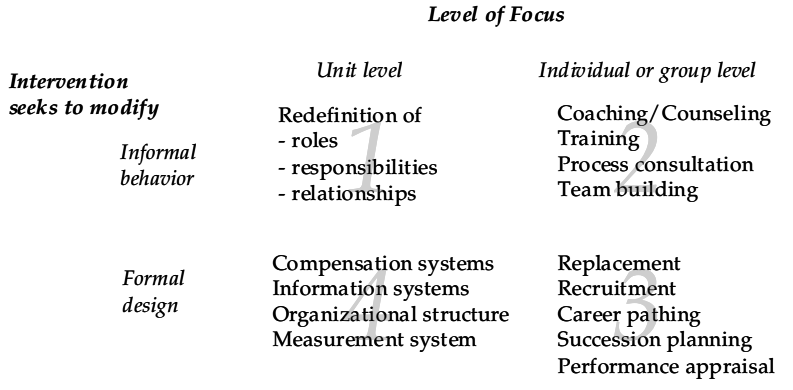

Fig. 4. The order of changing activities in an organization (adopted from [24])

Beer et al.'s [24] described in their series of studies how to revitalize (i.e. to introduce permanent improvement) to an existing company's activities. The intentional change (in Fig. 4. called 'Intervention') should start from modifying informal behavior at the level of official social unit. This is to utilize the social coherence in order to achieve real change in the roles, responsibilities and relationships of the people (structure and processes). After that we should start coaching, training, etc. at the individual level and make sure that the momentum remains by creating vision of the roles of the people in the near and long term future (people). It is also important to award good performance (rewards). In the last stage – after the social organization is more-or-less stable- is the time to introduce the formal systems (structure and processes).

Specifically in the context of quality improvement Spector and Beer [25] propose the following steps.

1. Trigger change by combining external competitive pressure with clearly defined direction from the organization's leader.
2. Develop on the part of the top management team agreement on, and commitment to, the belief that quality improvement is the key strategic task of the organization.
3. Form ad hoc teams around processes to be improved.
4. Create an organization-wide change oversight team which promotes learning and systemic change and helps to overcome resistance.
5. Enable teams to analyze and take action through: the delegation of decision-making authority; the provision of necessary team skills; and the information necessary to understand, analyze, and re-engineer processes.
6. Align formal measurement and information systems with the cross-functional process approach.

Comparing this to the lessons learned from previous chapter, we can notice that here the clear guidance from the organization's leader is expected in the beginning to show the direction for the learning and improvement (step 1). This should direct the learning process towards agreement and certainty, not towards anarchy and breakdown. Then, during the 'conflict and creativity' phase the top management team is expected to come up with commitment (step 2), and also expert, ad hock teams are expected to come up with initiatives for process improvements (step 3). In these teams – in line with suggestions of e.g. [12,13,14] – members engage in a dialogue and create new points of view, pool their information and eventually integrate their diverse individual views into a new collective perspective. The idea of self-organization, instead of tight control, is operationalized in as "empowerment". Empowerment means not only giving teams the authority to make decisions, but also making information concerning all aspects of the context readily available [19] (steps 4 and 5). As there are multiple improvement teams working at the same time it is essential to establish also an organization-wide team to promote learning and systemic change and to help to overcome resistance. Thus the task of this head team is concerned with the highest organizational learning loop, deutero-learning [4], to facilitate organizational problem solving capacity and capabilities to redesign processes. Only as the final stage (step 6.) the company can establish formal information systems and measures.

To sum up, when organizations are to be changed, the literature seems to point out the importance of interactions between the organizational dimensions, multiple levels of teams and top management commitment. The process should advance starting from strategies to structures and processes (i.e. roles, responsibilities and relationships) to individual training and recruiting (people) and rewards, finally to formalize the planned structures and processes by systems, measures and controls. This process should start with top management teams showing commitment. Then special cross-functional teams after interaction and discussion end up with a solution for improvement. This multi-level and multi-team learning process is facilitated by an organization-wide team.

4 Software Process Management in Changing Learning Organizations

Continual process improvement is essential element of successful organizations. With process improvement the organizations can increase their efficiency and improve the quality of their products and services. For software companies, the software processes improvement (SPI) is crucial for surviving in a present day highly challenging business environment. Variety of quality and process improvement frameworks, normative models and standards (such as CMMI, ISO 9001, ISO 15504 (SPICE) and Bootstrap) are available for supporting process improvement. These norms contain maturity levels indicating good software practices and are primarily used to identify the weak areas in the existing software practice and to prioritize future improvements [26]. One of the goals in SPI is to have common procedures in the organization. If the organization wish to improve their maturity according to a normative model, then it is important that the new processes are institutionalized in the daily norms and tacit knowledge of the workers. This seems to be problematic, since for example in a survey [27] on CMM

Initiatives two thirds of the respondents agreed with the statement, "We understood what needed to be improved, but we needed more guidance about how to improve it." Indeed, one of the main concerns in SPI is how to create mechanisms to help the organization institutionalize continuous process improvement.

Currently the SPI literature focuses mainly on the aspects related to the norms for classifying software organizations, and metrics (i.e. how to assess whether an organization is compliant with the specific norm) [28]. Evolutionary approach to SPI is common: changes are implemented by a sequence (steps) of improvements over a period of time. For instance, the ultimate idea behind CMM is to create an organization at the highest maturity level that is able to continuously optimize its software processes and its software processes are institutionalized via policies, standards and organizational structures [29,30]. However, as [28] note, compliance to a norm does not automatically lead to success, but also other relevant aspects such as context and people should be considered [31]. Unfortunately, even though SPI is an organizational change mechanism the literature is lacking organizational change theory, and is thin in the area of organizational learning, and management of the SPI initiatives [28].

Next, using the organizational learning and change literature as a back drop, we assess the CMM(I), SPICE and IDEAL models first from management, and then from learning point of view.

4.1 Management

CMM(I) and ISO models can both be characterized as assessment-based models. Assessment-based techniques typically list a set of goals and sub-goals to achieve, provide a check-list to assess how much an organization achieves the goals, and may suggest tools to attain the goals. For example, ISO 15504-7 model (part of the forthcoming ISO 15504 standard) developed in a project called SPICE, approaches SPI with the following eight steps: Examine organisation's needs, Initiate process improvement, Prepare and conduct process assessment, Analyse results and derive action plan, Implement improvements, Confirm improvements, Sustain improvement gains, Monitor performance.

Like IDEAL, the ISO 15504-7 model deals with the management as a special issue, being something that is beyond the cycle itself. The management is seen as perhaps the most crucial issues of sustaining long-term improvement and ensuring that changes become permanent [32]. It includes organization, plan, measuring and reviewing tasks. SPI Literature is almost unique in recommending that improvement initiatives should be assigned to dedicated organizational units [28]. One of the most exact in this issue is perhaps IDEAL^{sm} [1], which defines several levels of groups concerned with SPI and is recommended to be used in parallel with CMM. In large organizations, in addition to practical operative working groups, there are four layers of management groups ensuring compliance to company's vision, coordinating and sharing of experiences (see Fig. 5.).

[1] The IDEAL^{SM} model has been developed in Software Engineering Institute at Carnegie Mellon University (SEI).

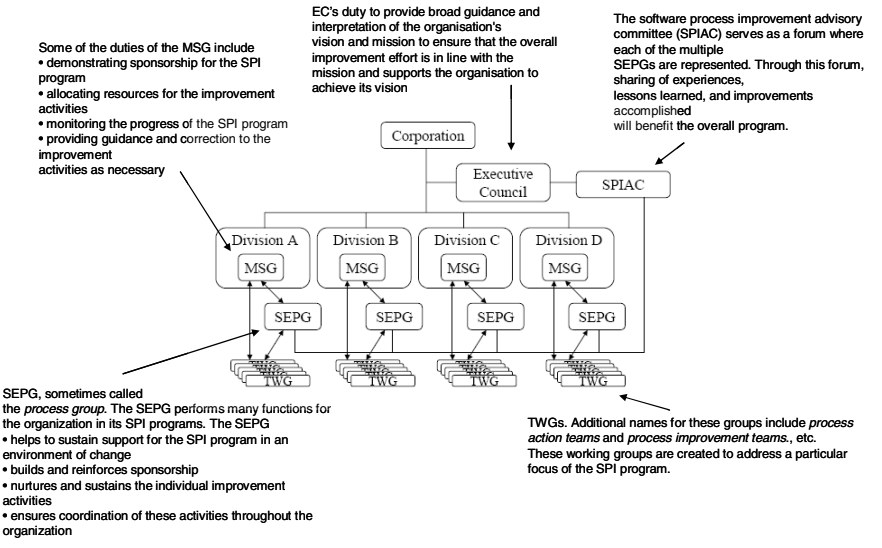

Fig. 5. Ideal: Typical SPI infrastructure in a large organization [33,32]

This arrangement assures that all levels of organization are involved in the SPI initiative: from senior management of executive council to people, working in or being customers to the process about to be changed, participating in TWG. As proposed in the organizational literature, wide scale participation is to guarantee that the entire organization is committed to follow the recommendations. "By involving practitioners in identifying and improving their own problems, the improvements will become situated in the proper context or practice, i.e. in their daily activities, making it far more likely that the practitioners will be committed to change their practice. By involving management, the SPI program will become linked to the organization's vision and appropriate resources to do improvements will be allocated and distributed." [2].

The members of SEPG (process group) should be experienced, have good interpersonal skills and be respected by peers [27,33,34]. This is because their role is to act as change agents and opinion leaders in the SPI initiative. Change agents initiate and support the improvement projects. They are teams (or individuals) external to the process that is to be improved. Opinion leaders, in turn, are competent individuals responsible for initiating, guiding and supporting the improvement at a local level. They also enjoy high respect in the social system that is to be changed [35].

The basic philosophy behind the IDEAL, as many other SPI models, is that the improvement or change is best done in project-like entities. The model itself is actually an attempt to establish good project management and engineering practices to process improvement program. Considering SPI initiatives as projects is one common way to approach planning of the initiative. In projects resources are allocated specifically to SPI initiatives, and their outcomes are specified as project deliverables. This improves visibility of the initiative [36], helps to ensure appropriate resources, and participation of experts from relevant parts of the organizations who can define working procedures that fit the organization and the new strategy [28].

The literature points out the need to obtain visible results backed up with data if possible, to keep the effort in focus, and to motivate and sustain interest in the SPI initiative [27]. Thus measurements that visualize the progress of the SPI effort are seen valuable. Applegate [3] suggests that to measure progress, it is necessary to benchmark initial performance and to conduct interval evaluations of process performance, stakeholder satisfaction and results. Process benchmarking can be done against leading firms in the industry or internally, or it can compare internally one development process with another highly successful development process. The company can also use baseline measurements, where the measurements are evaluated relative to a fixed norm, such as CMM [1]. The Goal Question [37], in turn, aims to deduce measurement from business goals of the organizations, instead of using the applied SPI model as a basis for measures.

Table 1. illustrates some aspects of organizational effectiveness that senior managers might want to measure [1,3].

Table 1. Organizational effectiveness measures [3]

Process performance	Stakeholder satisfaction	Results
• Time • Quality • Cost • Innovation	• Customer/supplier satisfaction • Employee satisfaction	• Market measures • Financial measures

4.2 Learning

Even though especially CMM is aimed at improving software processes with an approach that is incremental and learning oriented, the instrumental and abstract role of the CMM organization is often forgotten. Instead the ideal model is taken as "self-evidently describing the evolution of the software organization 'as it is in itself' " [38,p. 20]. Thus, the software specialists are induced to push their organization along the prescribed learning curve and even in a learning oriented methodology - CMM - the abstract model and the related measurements come to dictate behavior, up to the point that many admit that CMM with its bias for 'technologies of reason' needs to be supplemented with proper concern for experimentation and true organizational learning.

As the previous section hints, the general view of SPI on learning is mostly operationalized as measures in addition to explicit role definitions. If used in most limited way, the metrics are used as a control mechanism. For instance, analysis by Ngwenyama & Axel Nielsen [39] reveals that even though the proponents advocate the idea that CMM would lead to a dynamic, flexible learning organization, the paradigm's core assumptions are based on rational rule-governed organization structures that are oriented toward stability, control, and productivity. The hierarchical structures of CMM work processes with their explicitly defined role responsibilities and strict management control are contradictory to building trust upon which a developmental culture thrives [39]. Indeed, one of the key challenges to SPI seems to be to simultaneously balance the objectives of control and learning: "Take as an example the implementation of TQM. TQM is steeped in a paradigm of control [19]. Concepts like reduction of variation, defined and standardized processes, management by fact, causal thinking,

etc. all stem from the "Newtonian" paradigm of control and equilibrium, as manifested in the principles and practices of scientific management. Yet, TQM also has a learning component to it. Employee involvement, empowerment, and cross-functional cooperation are an important part of TQM. TQM thus has both mechanistic (control) and organismic (adaptive learning) components. These learning components, in some ways, are in direct competition with the control components"[40].

Often, the measures are recommended to form a basis for the next improvement round. For instance, in IDEAL the last phase in process improvement cycle is Learning phase, where the overall adoption or improvement experience is reviewed to determine what was accomplished, whether the effort met the intended goals, and how the organization can implement change more effectively or efficiently in the future. Reflecting this to learning models by Argyris and Schön [4] this view seems to support douple-loop learning where the procedures are changed according to past experiences.

But, the company should facilitate organizational learning. When, for instance the experiences, lessons learned etc. were stored in a data base [41], forming part of actively used organizational memory, the company is approaching more advanced 'deutero-level' learning. The improvement initiatives can also be supported by providing the groups with visualization tools, communication support, scheduling, reporting and controlling tools [41]. Experience factory is an example of a construct which separates practical problem solving and experience modeling. It aims to systematic reuse of previous knowledge by packaging experience related material relevant to a real user. This includes tailoring contents and format to a concrete anticipated usage situation. Experience is only valuable when set in context. It also point out that "we must base iteration, evolution, and learning on explicit information to form the seed for the next cycle." [42]. As a separate entity, an experience factory receives plans, status information, and experiences from all participating projects. Incoming data is organized in models, such as defect density models, Pareto charts of defect class baselines, algorithms, and so forth [42]. These models provide projects with immediate feedback.

In regard to assimilating tacit knowledge a few SPI articles and practical report suggests use of pilot projects, and mentoring [27]. Additionally, the multi level and cross-departmental SPI groups should advance a context where individuals with conflicting views can interact with each other and engage in dialogue. Otherwise, the means and tools to support learning in the route from 'creative chaos' towards rules and tacit knowledge is little discussed in the SPI literature. Maybe here the SPI literature could benefit from ideas presented in organizational learning on methods for advancing learning, such as in Fig. 1., and quality improvement steps proposed by [25].

5 Conclusions

This article provided a short presentation on literature on organizational learning and organizational change. A traditional way is to view learning as the "detection and correction" of error [43], i.e. acting and learning due to conflict between what-is and what-was-supposed. Argyris and Schön [4] distinquish between three levels of learning, simple correction, changing procedures as a result of an error, and facilitating organizational learning. The traditional of learning, as a "lessons learned" or post-mortem reporting activity is often apparent in SPI literature [44]. The SPI paradigm seems to

have adopted the views of Argyris and Schön [4] on learning where they aim at double-loop learning, i.e to to question and modify existing rules and procedures in response to mismatch or error. In this vein the organization plans to improve its processes gradually, that from learning point of view is generally regarded as being more favorable than radical changes. In the highest level of CMM(I) maturity, the goal is towards deutero-learning, where the double-loop learning is provided with proper organizational support and capabilities. Similar perspectives are proposed also in Experience factory.

However, there is also an alternative approach to learning suggested by literature. For instance Nonaka [12] proposes that new knowledge is created by dialogue which brings up conflicting views. This leads to a view where organizational learning is regarded as a continuous change process where specific learning cycle starts with creative conflict and ends up in formal norms and systems. This view can be recognized in the multi level organization structure of SPI groups. A few papers also advance use of mentoring and piloting in addition to formal training, but in general this 'learning via conflict' has almost no visibility in SPI literature.

Maybe, the SPI paradigm would benefit from taking a closer look on learning organization's models promoting creativity: the approach starts with creative phase, where mental models and brainstorming are applied to boost innovativeness in multi-departmental or multi-organizational teams, and finally curbs down to 'status quo' coordinated by shared work practices and formal rules.

We suggest that the software process improvement initiatives should pay more attention on how they facilitate learning and overcome the obstacles. Building on the organizational learning and change literature we propose the following steps to be considered more carefully in SPI models: First, the managers should communicate the objectives and methods for learning and provide also adequate resources and time for it. Second, innovation capability of people could be exploited more for instance by forming border-crossing teams and allowing more creative atmosphere in defining the objectives and means. Third, the management should commit and support personnel's learning and skill development. Fourth, learning and systemic change should be promoted with an organization level team. And, the final step in the change process is the adoption of formal metrics and systems.

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