Rethinking the Concept of Commitment in Software Process Improvement

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Abstract

Literature and practice has agreed that commitment plays an important role in software process improvement (SPI)[1] initiatives. However, the concept of commitment has not been seriously researched in the SPI community. This paper seeks to provide a synthesis of contemporary commitment literature – giving SPI research and practice a new perspective on the phenomenon. It is shown that current thinking relies on models of commitment that are flawed in both academic and practical sense. Namely, four misconceptions [2] are identified in current thinking: 1) the assumption of causality in the human cognitive processes, i.e., commitment in this case), 2) the controllability of this process, 3) the notion of a singular commitment construct, and 4) the idea that commitment is an all-positive phenomenon. Implications of these findings for SPI research and practice are discussed.

Keywords:

Software process improvement, commitment, forms of commitment, commitment models, misconceptions

1. Introduction

Software is playing an ever-increasing role in today's society and in industry. Modern software organizations operate in a highly dynamic market, under tight time and cost constraints (Cugola and Ghezzi 1998). As an answer to these business and market needs, organizations have started to undertake software process improvement (SPI) initiatives aimed at increasing the maturity and quality of their software processes (Humphrey 1989; Grady 1997; Zahran 1998; El Emam and Madhavji 1999). Investment in process improvement has had significant business benefits such as improving the product quality, reducing time to market, resulted in better productivity (Zahran 1998), increased organizational flexibility, customer satisfaction (Florac, Park et al. 1997), and employee satisfaction (Yamamura 1999). A 1996 report commissioned by The Data & Analysis Center for Software (DACS) reported that successful SPI programs have reduced the number of defects delivered to customers by 95%, reduced software development schedules by 71%, and increased productivity in terms of lines-of-code or function points per day by 222%. Additionally, the SEI (Software Engineering Institute) reported an average return of 5:1 investments in successful SPI programs. However, caution should be paid to these benefit reports due to a number of reasons. Most of them - with some exceptions, see e.g. (Messnarz and Tully 1999) for details - originated in the US with its specific cultural context and might not be applicable elsewhere. In Europe, f. ex., although many SPI approaches are generally known there, they are not widely used (Kautz and Larsen 2000).

Recently, researchers (e.g. (Kuilboer and Ashrafi 2000)) are focusing their attention to the problems of defining the relation of process to the quality of the products (Tortorella and Visaggio 1999). While this remains to be important, many researchers have turned to explore the people issues that inherently play a major role in adopting new processes to software developers' daily work. Understanding these cognitive processes of change is becoming important since studies have shown that nearly two-thirds of all organizational change efforts - software process improvement activities result in organizational changes (e.g. (Johansen and Mathiassen 1998)) - have failed or at least fell short of expectations (Trahant 1996). Similar findings are reported in the context of improving software processes (Debou 1999). For example, in spite of extensive literature on software measurement companies are facing serious problems initiating even the simplest metrics programs (Hall and Fenton 1997; Herbsleb and Grinter 1998).

Authors in the SPI field reported earlier that the main reason for a failure was the poor planning and the organization of the process improvement activities (Kasse and McQuaid 1998; Debou 1999). In recent years a growing number of papers explain the failure or success of SPI initiative in terms of human or soft factors (Johnson 1994; Statz, Oxley et al. 1997; Johansen and Mathiassen 1998; Moitra 1998; Wiegers 1998). A database search into Process Improvement Experiment (PIE) repository (http://www.esi.es/VasieSearch/) showed that in 128/250 industrial SPI cases reported 'people management' affecting the outcome of the experiment. Of these people aspects, the concept of commitment to SPI by all levels of the organization has been brought up as one of the most prominent factors to determine whether a well-planned process improvement program will succeed or not (Humphrey 1989; Wohlwend and Rosenbaum 1994; Dahlberg and Järvinen 1997; Diaz and Sligo 1997; Grady 1997; Humphrey 1997; El Emam, Goldenson et al. 1998; Stelzer and Mellis 1998; Zahran 1998; Kautz 1999; Rodenbach, Debou 2000; van Latum et al. 2000). A recent model for implementing CMM-based improvement activities includes commitment as one of the key elements of an improvement program (Isacsson, Pedersen et al. 2001). Commitment is seen as a force that endures over the hardships of a process improvement effort – an effort that can be considered as an investment having its results visible maybe years later. It has been well understood that people should not be considered as robots to be guided in a step-by-step fashion, but rather they should be viewed as the most crucial resource in software development (Cugola and Ghezzi 1998). This however is not a new realization. A summer issue 1990 of American Programmer (Ed Yourdon's Software Journal, Vol. 3, No. 7-8) was devoted exclusively to 'Peopleware'. The editor comments the special issue by pointing out that "everyone knows the best way to improve software productivity and quality is to focus on people." Thus, there exists a need to better understand the cognitive processes and corresponding behavior in the context of software professionals' turbulent work environment

and continuous process improvement activities.

Commitment has been one of the most popular research subjects in industrial psychology and organizational behavior over the past 30 years (Benkhoff 1997). The reason for a widespread interest on the subject has been the assumed relationship between commitment and performance. Mathieu and Zajac (1990, p.184) sum up findings in their meta-analysis on organizational commitment research on this relationship by stating that

> […] the present findings suggest that commitment has very little direct influence on performance in most instances.

However, a recent meta-analytic study by Lee, Carswell and Allen (2000) suggests that occupational commitment is positively related to job performance. Despite these contrasting findings, commitment is attributed to other positive organizational consequences as well. Such consequences commonly reflect an idea that a committed person stays with the organization through thick and thin, puts in a full day and more, protects company assets, shares company's beliefs and goals (Meyer and Allen 1997), is a happy employee (Salancik 1977), invests freely in achieving the desired outcome (Conner and Patterson 1982), and even breaks the rules when necessary (Senge 1990). Although these and many other characterizations have been put forward, few of them have been empirically validated and agreed upon. In fact, literally hundreds of studies have tried to examine the correlations between commitment and variables hypothesized to be its antecedents or consequences (Meyer and Allen 1997) with disappointing results (Benkhoff 1997).

In spite of the agreed importance about the need for commitment, the SPI community has not considered how the commitment to SPI develops, nor has it explored the conceptual base for it. Concrete evidence (i.e., hypothesized results of the commitment process) of management commitment has been suggested (Wiegers 1998), as well as some ways to influence the process of gaining it (Grady 1997). Recently, Dybå (2000) developed an instrument for measuring the extent of management commitment. Based on anecdotal evidence, suggestions have also been made on how to deal with manager's and software developer's commitment (Rodenbach et al. 2000). Lack of studies has lead to operational and conceptual confusion in the field, i.e., it is widely used but little understood. For example, Humphrey - a respected authority in the SPI field - calls for commitment discipline and sees commitment as "a way of life" (Humphrey 1989; Humphrey 1997). Even though this kind of argumentation is appealing, it does not advance our understanding in what makes someone

a) make and keep a commitment,
b) become and stay committed, nor does it help to understand
c) what are the consequences of commitment, i.e., does it make a difference concerning the level of success achieved in the context of improving software processes.

Salancik (1977) criticized early writings on commitment similarly to what could be attributed to existing SPI literature.

> In them (early writings), you will find, in short, a lot of nonsense mixed with a lot of common sense. But from them your understanding of commitment may not be enhanced (p.1).

While experience reports and suggestions on how to handle the commitment problem remain important, they do not provide the SPI field with a theoretical device through which one can infer understanding, nor it is their intention. Therefore, the intention of this paper is not to undermine existing SPI research in this area but to provide the field with analytical tools to discuss commitment related issues at a more meaningful level.

The paper is organized as follows. An exploration of the commitment concept and a synthesis of contemporary commitment literature are provided (1st section). This is followed by an analysis of existing commitment models (2nd section). Analysis shows that they are based on four critical misconceptions: (1) the assumption of causality of the human cognitive processes, i.e., commitment in this case), (2) the controllability of this process, (3) the notion of a singular commitment construct, and (4) commitment is an all-positive phenomenon. Each misconception is reviewed against SPI literature. Finally, the implications (3rd section) for software process improvement field in terms of research and practice are discussed.

2. Exploring the commitment concept

The following exploration draws mainly upon the literature considering organizational commitment, i.e. the target of one's attachment is an organization. Research on organizational commitment can be considered to be quite mature (Meyer and Allen 1997) even though disagreements over several issues are still pertaining (Oliver 1990). Indeed, a clear-cut definition or exploration of the commitment concept would be difficult to provide since many different interpretations exist. For example, Morrow (1983) identified 25 commitment-related constructs in the literature. The reason for this inconsistency and confusion has been attributed to the lack of a specific model of commitment (Coopey and Hartley 1991). In commitment research (O'Reilly and Chatman 1986), similarly to dictionary definitions and the information systems (IS) and SPI fields, the term commitment is broadly used to refer to antecedents and consequences, as well as to the process of becoming committed or attached or to the state of commitment or attachment itself.

The roots of commitment research date back to late the 1940's. Since then, hundreds of articles have been published in a variety of disciplines. Becker (1960) made the first serious effort to meaningfully conceptualize the concept of commitment as he argued that a person's decision to stay in an organization is explained by the theory of side bets. His theory asserts that "commitment comes into being when a person, by making a side bet, links extraneous, i.e. personally important, interests with a consistent line of activity." Mowday et al. (1982) provided the first extensive theory of organizational commitment. Up until early the 1990's the main thrust of commitment research has been USA oriented. Recently the focus has shifted to a more international point of view (Randall 1993).

Ginzberg (1981), Markus (1981) and Lucas (1981) were among the first ones to introduce the concept of commitment to the IS field. Among others Ginzberg concluded that a state of commitment should be developed since it increases odds that appropriate actions will be taken to assure a software project's success (p. 54). Since then his article has become one of the most cited publications regarding the commitment concept in the IS field. Humphrey (1989) in his classic treatment of SPI was one of the first ones to introduce the concept into the SPI field. A commonly found definition for commitment used in SPI literature is the one defined in the CMM (Capability Maturity Model) by Software Engineering Institute as follows:

> Commitment – A pact that is freely assumed, visible, and expected to be kept by all parties. (CMU/SEI-94-HB-1, Appendix-6)

As a promise, commitment represents a conscious and overt act that binds or obligates a person to some future action (Brown 1990). This type of explicit pact is only one side of the commitment concept albeit an important one.

2.1. Two schools of thought

Commitment research has made a distinction between two schools of thought: attitudinal and behavioral commitment (Reichers 1985). Mowday et al. (1982, p.26) explain the difference as follows:

> Attitudinal commitment focuses on the process by which people come to think about their relationship with the organization. […] Behavioral commitment, on the other hand, relates to the process by which individuals become locked into a certain organization and how they deal with this problem.

The difference is also visible in the research focuses: Research on attitudinal commitment has traditionally been closely related to discovering the antecedent factors or conditions that contribute to the development of commitment and the behavioral consequences of such commitment. Behavioral commitment research has mostly been concerned with identifying conditions under which a behavior tends to be repeated, as well as on the effects of such behavior on attitude change (Meyer and Allen 1991). When translating the research focuses of the above mentioned two commitment approaches to the SPI world, the former would focus one's interest on the conditions under which a person would become committed to a SPI project and its' - i.e. the psychological state - effect on the behavioral consequences for possibly active participation or support. Behavioral commitment research would direct one's interest to discovering conditions under which a stakeholder chooses to continue

participating or sponsoring an ongoing SPI initiative. Both approaches would appear to provide a fruitful theoretical viewpoint for a SPI researcher to study SPI initiatives. In fact, Brown (1996, pp.237-238) tries to merge these two approaches by suggesting that they are two sides of the same coin:

> A resolution of the two approaches may lie in the recognition that both attitudes and behaviors play a role in development. Behaviors – binding acts – probably work to seal a commitment, since a person, by definition, becomes committed by virtue of having taken some action or made some pledge. In the case of an internal pledge, behaviors in support of the commitment, particularly public behaviors, would act to strengthen it.

2.2. Strength, focus and terms of commitment

Commitment can be viewed broadly as a psychological state of attachment that defines the relationship between a person and an entity (O'Reilly and Chatman 1986). This relationship can be viewed in terms of strength, focus and terms, which are common in all types and forms of commitments (Brown 1996). Strength of a commitment varies depending on the personal meaning associated with the commitment foci, i.e., target in question. Thus, should one become committed to SPI, one should have SPI play an important role in one's life. Therefore, if SPI has no personal meaning to a software developer, a state of commitment will not develop. For this reason, improvement practitioners argue that goals for improvement activities should come from software developers (see f. ex. (Rodenbach et al. 2000)). Terms of commitment define what has to be done in order to fulfill the requirements manifested by the commitment. A contract is an explicit pact where the terms are listed. If no public manifestation is made, only the committed person him/herself knows to what extent s/he has to perform to fulfill the commitment. Finally the focus of commitment is the entity that the person feels committed to. While commitment is something that occurs naturally (Meyer and Allen 1997), all employees and managers may be committed to more than one entity in an organization. For example, both may be committed to the organization, co-workers, projects, shareholders, etc. with differing strength (Reichers 1985; Becker 1992).

2.3. Archetypes of commitment

In addition to the strength, focus and terms, commitment as a psychological attachment may take different forms: Affective, normative and continuance commitment forms are distinguished by Meyer and Allen (1991). These forms may also be seen as bases of commitment, motives engendering attachment (Becker 1992). Other classification schemes have been proposed too (see O'Reilly and Chatman (1986) for details) but they are omitted from the exploration here due to the lack of empirical support. Meyer and Allen's conceptualization, on the other hand, has received empirical support (Dunham et al. 1994; Hackettet al. 1994; Hartmann and Bambacas 2000). Hence, they are used here.

Meyer and Allen's forms or components of commitment are identified from studies related to organizational commitment but are adaptable to other commitment targets as well (Meyer et al. 1993; Meyer and Allen 1997). By definition, commitment involves an idea of a psychological attachment toward an entity. There is no reason to argue that SPI could not be such an entity. Whether this type of attachment is easy or hard to achieve will be discussed in later sections of this paper (see 'critical misconceptions in current thinking' and 'implications for practice'). In general, affective commitment (1) refers to the employee's attachment to, identification with, and involvement within the entity in question, e.g. an organization, a SPI initiative. Continuance commitment (2) refers to an awareness of the costs associated with leaving or abandoning the entity in question, e.g. aborting an SPI project. If an organization f. ex. has a reward structure where manager's performance is linked to the success in SPI activities s/he can be said to have continuance commitment as primary commitment driver; it could be other forms too, but a reward structure generally invites continuance commitment. In IS literature the term commitment escalation refers to this component of commitment (see e.g. Keil and Robey (1999) for details on the phenomenon). Normative commitment (3) reflects a feeling of obligation to continue membership in the entity in question, e.g. the SPI project. Another commonly used term for normative commitment is moral commitment (Jaros et al. 1993). A person, be it a manager or a software developer, therefore, might

be committed to a SPI project in all three forms. The following figure (Figure 1) summarizes the discussion presented here about the concept of commitment.

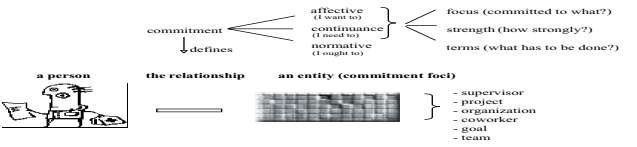

Figure 1: Defining the concept of commitment

Authors in organizational commitment research have suggested that the most desirable form of commitment is that of affective commitment (Meyer and Allen 1997). A similar claim can also be made for the SPI field. If software professionals' dominating form of commitment is based on affective commitment, they want to be part of SPI activities because they believe it is valuable, not because they are pressured or induced into it. The forms of commitment presented here reflect more of archetypes of commitment, are not mutually exclusive, and in reality a person develops a sense of commitment that is some composite of its components. This composite and total strength changes over time depending on current circumstances (Brown 1996). Depending on the target of a person's, commitment changes to a certain composite occur at different speed, f. ex., commitment to one's career is more stable than commitment to a current work task. Based on the conceptual framework introduced above two commitment models will be evaluated in terms of their validity and usefulness.

2.4. Analysis of commitment development models

The purpose of this section is to analyze commitment development models that current SPI approaches are based on. A SPI literature and database search discovered two existing models: Conner and Patterson's (1982) model of commitment development and Ernst & Young's model of commitment to new thinking (Ernst & Young Quality Improvement Consulting Group 1990). Both of them will be analyzed here. A slightly modified version of Conner's model is presented at Software Engineering Institute's (SEI) web page (SEI 1999) and has been used as part of a CMM (Capability Maturity Model) training material. Ernst & Young's model is linked to the TQM (Total Quality Management) approach and the 1980's quality movement, which has provided the intellectual bases for SPI thinking (Dahlberg and Järvinen 1997; Zahran 1998).

2.5. Conner and Patterson's model of commitment development

Conner and Patterson (1982) argue that the process of building employees' commitment to change can be represented as a causal model that an organization(al unit) as a whole moves through. It is therefore an organizational level commitment model. The components and processes in the model, however, imply individual level changes. Thus, as will be shown, the unit of analysis remains unclear to the reader. While the boundaries between an organization and an individual aren't clearly defined, it is often difficult to decide who is the actor in the model. Therefore, some ambiguities may exist in the following description of the model dynamics. The model also shows the hypothesized outcome for each stage if the stage is not completed adequately.

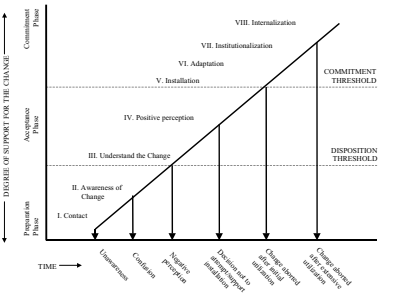

Figure 2: Development of commitment to change (Conner and Patterson 1982)

The model is presented as a grid with the vertical axis demonstrating the degrees of support for a change. Authors do not however define whether this support is shown by the organization or a single employee. The horizontal axis indicates the passage of time. The model is suggested to provide "a cognitive map of how commitment can be generated". The model, therefore, is intended for managers so that they can understand the complexities of commitment better when planning for organizational changes. The model is divided in three phases: (1) preparation, (2) acceptance and (3) commitment. Conner and Patterson included a total of 8 stages (shown in Figure 2) that an organization or a person (?) goes through when becoming committed to a change goal. They claim that each stage indicates a critical juncture where commitment can be threatened. This is represented by down turned arrows. If a stage is completed successfully, advancement to the next stage is possible.

The purpose of the preparation phase is to produce an awareness that a change may occur in the future. In the acceptance phase a person produces a tendency to act in certain ways towards a change project. The acceptance phase may also enable the development of a predominantly negative perception, which could lead to first signs of true resistance. If a person develops a positive perception of the upcoming or ongoing change, a decision to support the change is made and one - the entity is undefined, a person or an organization - is able to advance to the next phase – the commitment phase. In this phase the change becomes operational, it is tried out, i.e., piloted and a decision is made to either abort the change, f. ex. if it is viewed too expensive, or to institutionalize it as an organizational policy. The institutionalizing stage is the highest that an organization can achieve, organization's members control the internalization. Conner and Patterson argue that when a change has been internalized, "participants engage in goal-oriented activities in order to satisfy their own needs, as well as those of the organization." They continue further: "enthusiasm, high-energy investment and persistence characterize commitment at the internalized level". In the SPI literature e.g. Zahran (1998) acknowledges the internalization phase and suggests that the ultimate goal is to make the new process 'painless'. He describes this as follows:

> Once you have experience and knowledge of a certain situation 'wired' into your brain, this knowledge is automatically retrieved when you face a similar situation. Your actions will be nearly automatic. The process has been 'internalized' by you. (p.5)

Conner and Patterson's article is directed to a practice-oriented audience and being so it does not contain any references to related literature nor does it conceptualize specifically the very concept of commitment. The model is based largely on anecdotal evidence and experience as consultants, therefore lacking any scientific evidence to support their claims. March and Smith (1995) note basically that if you're the very first to introduce any set of constructs, models, methods, or instantiation, actual performance evaluation is not required at the introduction stage. The research contribution, in their words, lies in the novelty of the artifact and in the persuasiveness of the claims that it actually is effective.

The article is well written and provides many useful 'tactics' or strategies for addressing the commitment issue in times of organizational change. Many of these tactics and points made in the article seem plausible. However, there are several problems such as the notion of causality of the model. Galliers and Swan (1999) argue that such a stage model thinking fits comfortably with linear, rational assumptions about the cause and effect sequences, which the human mind, naturally, has not been proven to follow. Researchers have recently questioned the validity of this type of simple process models that assume neat linear progressions of well-defined phases (Van de Ven and Polley 1992). Moreover, it has been recognized that the presence of multileveled and changing contexts, feedback loops and multidirectional causalities often disturb the steady progression (Langley 1999). Kaplan (1964) would call this linear transition as an 'ideal' type that

> does not function as an observational term or even an indirect observable; the fact, therefore, that there is nothing in the world corresponding to it does not of itself rob such concept of scientific usefulness. (p. 82)

Indeed, the model has proved its usefulness since e.g. SEI has adopted it as a 'tactic' or a 'strategy' for building up commitment in general (SEI 1999). Based on the evidence found in the literature no judgment can be made on the validity of the model. Commitment literature, on the other hand, is mostly concerned with

the conceptualization of the commitment phenomenon (Reichers 1985) and has not even acknowledged Conner and Patterson's model.

2.6. Ernst &Young's model on management commitment

Ernst &Young (Ernst & Young Quality Improvement Consulting Group. 1990) explore the concept of management commitment in the context of quality improvement. They suggest similarly to Conner and Patterson's claims that commitment moves sequentially through several stages in causal or linear fashion (Figure 3).

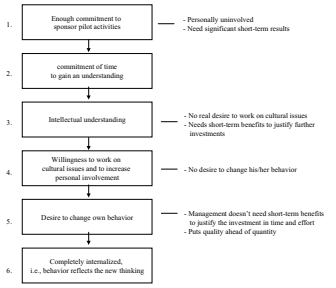

Figure 3: Development of management commitment to 'new thinking' (Ernst & Young Quality Improvement Consulting Group. 1990)

While the stages in the model seem self-explanatory and appealing at first sight, Ernst & Young do not provide detailed explanations on what they mean, in specific, by e.g. intellectual understanding. What is f. ex. real desire and where does it come from? What does it mean to put quality ahead of quantity? A detailed look into the model brings up more questions than answers. According to Ernst & Young, management has to be willing to change their own behavior to reflect the new thinking sought, i.e. Total Quality Management principles – concepts, philosophy, and a longer-term perspective. The progression in the model is accompanied by a decrease in the need for short-term results to justify further investments in quality initiatives (Taylor 1995). Taylor (1995) has applied Ernst & Young's model and notes that it is based on anecdotal evidence and the experience of its consultancy staff lacking therefore any scientific evidence to support its claims. Ernst & Young direct their book to a practice-oriented audience and use no references. The authors use a lot of eye-catching slogans such as "they must see the light!" Their model may contain usable ideas and concepts but still relies heavily on rational commitment development thinking, as did Conner and Patterson's model.

Some of their arguments can be supported by theories such as the idea that if people are sufficiently involved with something, they will ultimately become committed to it. Although oversimplified, both the Ernst and Young model and this idea have some theoretical background. For example, Bem's (1972) self-perception theory asserts that individuals come to

> know their own attitudes, emotions, and other internal states partially by inferring them from observations of their own overt behavior and/or the circumstances in which this behavior occurs. (p.2)

The authors, however, have gone so far as they have defined the number of hours of involvement needed to have someone committed, i.e. 10-15 hrs/week for a period of 3-6 months. The problem with these types of practical cookbook advices is that they aren't very practical (Kofman and Senge 1993) and often oversimplify the inherent complexities involved having omitted context, type of change and personnel. Thus, even though the intention is good, it would make little sense for a practitioner to plan an SPI initiative based on these practical suggestions.

If Ernst & Young's effort were to be seen as a result of constructive research, the following requirements would hold even if the model developers were practitioners. The building process must be described in detail, all selections and omissions should be explained, and the originality of the solution and its superiority to other known solutions must be demonstrated (Järvinen 1999). However, since none of these basic requirements is met, it is not possible to merit these models scientifically. However, some evident misconceptions that influenced the form and structure of the models can and have to be pointed out. This is discussed in the following sub-section.

2.7. Critical misconceptions in current thinking

Russo and Stolterman (2000) recently clarified and explicated existing assumptions in IS research and argued that

> if these assumptions are not explicitly identified and analyzed by IS researchers,

> we believe that there is a risk that research and practice will continue to face the same problems of ‘’misfit” over and over again.
> (p.314)

Similarly, the SPI field needs to have its assumptions critically assessed in order to determine if research and practice are on legitimate paths. Based on the analysis presented above, four misconceptions can be depicted that existing models of commitment development are based upon. The assumptions that the model developers in the discussed two cases hold, concern 1) the causality in the human cognitive process during the development of commitment, 2) the controllability of this process, 3) the notion of a singular commitment construct, and 4) commitment as an all-positive phenomenon. Each misconception is reviewed against existing SPI literature. It is shown that most of SPI community agrees with these assumptions and as a consequence commitment has become an ambiguous concept that keeps conquering unmerited role in SPI models due to its obscurity. If assumptions are not clarified, the role of commitment will remain as a mystery.

2.7.1. Causality in human cognitive process

The first underlying assumption behind both models concerns the notion of causality in the development of commitment. While it fits comfortably with linear, rational assumptions about cause and effect sequences (Galliers and Swan 1999), it fails to acknowledge that commitment exists in varying strengths. The composite and strength of one’s commitment changes however. Thus, it is a dynamic rather than a static concept (Coopey and Hartley 1991). It has been long proposed [3] that commitment is a continuous variable rather than a dichotomous one (Kiesler 1971), i.e. people are referred to as being more or less committed rather than being simply committed or not (Brown 1996).

Lack of management commitment has often been argued to cause to some extent the failure to sustain SPI activities in an organization. Similarly the lack of process user - e.g. software developer, tester - commitment is attributed to cause the failure of SPI initiatives. The reason for having failed in SPI, therefore, is argued to have something to do with commitment, but it cannot be the lack of it since commitment is something that always exists in some form (Kiesler 1971). The failure in these cases is more related to the common aspects of commitment: the strength, focus and terms. Process users may have been more committed to their current work tasks (different foci), or they may have felt that the SPI effort is not so important (low strength), or they may have only promised to try out (simple terms) new procedures to see if they are of use for them

Making a commitment, therefore, does not directly indicate that one is committed per se. For example, in an IS project several commitments [4] are set early in the project such as delivery date, work effort, etc. but rarely met (84 % of projects are finished late or over budget (Standish Group Report 1995)). The problem in this line of reasoning is an assumption about the causal relationship of two meanings of the same construct, i.e., making a commitment and being committed. In fact, making a promise to act in a certain way may have very little to do with the state of psychological attachment of being committed. Commitments are formed to satisfy concerns (Flores and Spinosa 1998). Thus, only when a concern for the quality of the software is identified, is the organization, i. e. its members, able to begin to form commitments to address them. Software process assessments enable the software organization to identify these areas of concern. Mere formation of commitments does not constitute, i.e. is not directly connected to, the mental status of one’s state of mind, which is the corner stone of effective action. Seeing commitment only as an explicit pact is a view that is common in the SPI world (e.g. (Humphrey 1989)) and leads to another problem, which shall be dealt in a later section (see the section on ‘controllability of the commitment process’).

The strength of commitment does not remain at same level indefinitely (Brown 1996). A person evaluates his/her commitment from time to time when triggered by certain stimuli like a new task, changed circumstances, or new responsibilities. The evaluation process itself is affected by current attitudes, circumstances, organizational factors and the “history” of the commitment – its development process, and the reasons driving this development (Figure 4). Brown suggests that together these forces affect the way in which a commitment is evaluated and acted upon. Therefore, if a person is involved in several projects and is introduced to a new task, s/he will automatically enter into a commitment evaluation process after which s/he will be able to prioritize his/her tasks. As a result s/he perceives the relative importance of each

engagement s/he has and is able to act accordingly.

Each person has only a certain amount of energy to expend throughout a day at work (Naylor et al. 1980). This energy level may been seen as fairly stable over time even though certain fluctuation naturally may exist due to emergency situations (f. ex. if a project is late). The possible strength of commitment depends largely on the amount of total energy one is willing to put forth in his/her work life. A non-visible limit must, therefore, exist. This limit varies from one person to another. Moreover, another limitation to one's commitment development process exists: Some people prefer concentrating on one task at a time while others like to work on multiple tasks at the same time. Literature on organizational culture refers here to two different ways of organizing activities: monochronically and polychronically (Bluedorn et al. 1999). This aspect on organizational culture is concerned with how many things an individual attends to and is involved with simultaneously (Hall and Hall 1990). People working in an organization where work activities are designed in a way that work duties seldom overlap - i.e., monochronically - is less fruitful for implementing SPI activities than otherwise, or at least it requires more effort because people in monochronic environment are not used to have many overlapping tasks that requires their simultaneous attention. Taken to extreme, any unscheduled event such as a phone call is considered to be an unpleasant interruption to a current work task (Bluedorn, Kaufman et al. 1992). Consider introducing a set of SPI activities that require an ability to react to unanticipated problems. On the other hand, people in a polychronically-dominated culture prefer to be engaged in two or more tasks or events simultaneously and believe their preference is the best way to do things (Bluedorn, Kalliath et al. 1999). While this concept applies to the organization's culture, it also applies in an individual context (Bluedorn, Kaufman et al. 1992). This aspect provides further explanation for the limitations of individuals' commitment process. Put simply, some people prefer to concentrate on a single task at a time. Thus, they are likely to become committed to few rather than many commitment targets. Moreover, if such a person conceives SPI as an overhead work that requires extra effort, s/he isn't likely to become involved in the process.

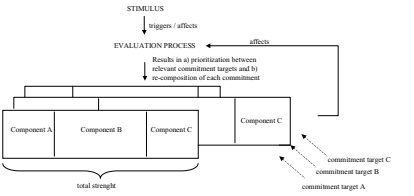

Figure 4: While commitment exists, strength and composition varies

Thus, rather than being a rational, causal process, a commitment development process is a series of self-reinforcing cycles of attitudes and behaviors that evolve over time (Mowday et al. 1982). These cycles involve processes that make individuals more aware and knowledgeable, enable them to make a decision and to sense the importance of each commitment target. For the SPI world this would indicate a need to ensure that all elements of well-practiced SPI such as process focus, supportive infrastructure, strategic alignment and skills (Zahran 1998) are considered to ensure that a person can develop a sense of commitment to SPI through mentoring, training, support, feedback, etc.

The stages incorporated in commitment models such as unawareness, understanding or acceptance are connected to the commitment process but do not necessarily follow any causal steps. Each archetype of commitment develops through its own mechanisms (Meyer and Allen 1991). These mechanisms (e.g., experiences) might differently affect the different archetypes. Positive experiences are known to strengthen the development of affective commitment (Mowday et al. 1982) while negative experiences may weaken the affective component and strengthen the normative component.

2.7.2. Controllability of the commitment process

The second flawed assumption behind both models introduced is the idea that commitment development as a phenomenon can be directed or controlled. SPI guidelines like the IDEAL model (McFeeley 1996) require sound 'management commitment' before an SPI initiative or program is in place. In other words, a SPI manager has to go out there and get commitment

from, among others, the business management. What is however needed for the SPI initiative is often not so much of a commitment as a state of psychological attachment from the managers but resources to launch the initiative and an assurance that those resources will not be withdrawn at the sign of trouble (Abrahamsson 2000). Trying to get someone committed to any entity before that someone has had any experiences with the entity is not possible. Management may provide resources because of pure trust or hunch, thus for reasons not directly connected to the commitment phenomenon. In a recent industrial case "the commitment from senior management was invisible" (Isacsson, Pedersen et al. 2001, p.32). This was seen as a major problem. Practitioners in this case solved the problem as follows.

> The commitment problem was addressed by having the senior management team spending one day every month to oversee progress […] as they were presented by the project managers.

There lies a lot of intelligence behind this simple solution but it is not necessarily connected to the management team's commitment. Previously managers were sponsors for the activities with no personal involvement. Later they were educated that they should be involved in the SPI process with a role suitable for them, i.e. to oversee, not to implement. This had a direct positive impact on the progress. Whether managers were or became committed is not so important than the fact that they acted out their role in the course of doing SPI. An educated management team realizes that the sponsor's role includes asking the right questions and demanding results from an SPI effort (Abrahamsson 2000). Thus, the problem in the abovementioned industrial case is a result of not having the management team acting out their role in SPI or not knowing how to act. The environment where SPI activities took place did not have management involvement in the process.

While commitment levels cannot be manipulated directly (Meyer and Allen 1997) the environment in which SPI takes place can be influenced as the industrial case example above demonstrated. Sabherwal and Elam (1995) identified 14 'commitment building and sustaining' tactics in information systems development projects. Their tactics include issues such as involvement, expectation management, making progress public, and demonstration of a system's value. Applying this type of tactics in SPI/IS efforts without thorough knowledge of the context is of little use. If the assumption behind these tactics presupposes that commitment towards change is built or can be built outside of one's control, it is a faulty one. Recent publications still seem to support this line of thinking (see, f. ex. Ulrich (1998)).

The issue of controlling one's commitment is related to motivation as well. Deci and Ryan (1980) use the concept of intrinsically motivated behaviors and operationalise them as "those [behaviors] that are performed in the absence of any apparent external contingency". Characteristics that lead to such intrinsically motivated behavior broadly fall into three categories: control, arousal, and achievement (Grandon 1996). Control implies the sense of autonomy in one's work, arousal motivation stems from the individual's desire to achieve or maintain a particular mental state, and achievement is the sense of a person's own perception of performance in terms of quality, competence and significance. If a software designer should become committed to SPI, SPI activities should be intrinsically motivating. SPI community has not truly considered the nature of SPI work. Does it possess intrinsically motivating characteristics?

In fact, Deci and Ryan's (1980) operationalization of intrinsically motivated behavior describes the hypothesized outcome of an internalized change, i.e. behaviors are performed without a need of justification or reward. Studies have shown that intrinsic motivation is weakened when surveillance methods are employed (Deci and Ryan 1980). For example, spontaneous feedback rates may fall dramatically when systematic surveillance is enforced to monitor whether everybody has contributed to a process description database. Ryan and Deci (2000) explicate this, i.e., in connection with intrinsic motivation, in their later work by stating that intrinsic motivation is an inherent natural propensity that can be catalyzed, but not caused. This paper maintains a similar argument towards commitment. An environment can catalyze one's commitment, but not directly cause it. A SPI change agent can therefore catalyze the process of developing a sense of commitment towards SPI by for example pointing out weaknesses in the current process. Thus, trying to force someone to commit, produces compliance at best - not commitment (Senge 1990). This compliance exists as long as the surveillance or control system is in place.

A commitment as a promise, however, is a result of a decision-making process. Thus as in any decision, it is possible to influence the process itself in such a way that it has a binding effect, i.e., making the resulting promise more committing (Salancik 1982). These influence techniques include a) voluntariness, b) irrevocability and c) visibility of a behavior. The highest binding effect would, therefore, be in an action that is made voluntarily, cannot be taken back and is visible to a large group of audience.

2.7.3. The notion of a singular commitment construct

The third misconception identified is the notion of a singular commitment construct. Recent literature on commitment suggests strongly that it is a multidimensional construct (Caldwell et al. 1990; Lawler 1992; Jaros et al. 1993; Meyer and Allen 1997). Less agreement among commitment theorists exists about the dimensions that reflect commitment. Failure to acknowledge different drivers and differing forms of commitment invites oversimplification and misuse of the concept, as is the case in present SPI literature. Commitment is not a way of life as Humphrey (1989) claimed, or should we throw away project management and bring in commitment management as Keen (1998) called for.

Affective commitment would seem the most desirable form of commitment to look for in process improvement. Other claims could be made also. Consider for example an effort to incorporate an inspection process in a software development life cycle. Early on, a pilot group is introduced to the benefits and costs associated with the inspections, and they are educated and trained to do inspection activities. While they understand that they have had problems with faulty requirements (as an example) they recognize the costs of not trying out inspections. At this state, the pilot team is hoped for having a continuous commitment as the dominating commitment component, i.e., they recognize the costs associated with non-participation to an inspection activity. Literature calls this type of approach a cost of software quality (CoSQ) based reasoning (Knox 1993; Demirörs 2000). As a result of trying out inspections, it is hoped that the results are visible quickly, so that it would encourage the pilot team to continue with inspection activities. In other words, affective commitment is hoped for. After a while when the pilot team has performed inspections for a period of time, they still want to keep doing it because they are convinced about its benefits. While the pilot team is doing well, other teams may observe the benefits as well. Other teams recognize also the cost of not implementing inspections as part of their software process activities. Beer et al. (1990) referred to this type of approach as creating pockets-of-excellence starting from a periphery and creating a change movement from there. Finally, a new member joins the organization and observes inspections as part of organization's routine activity. As a part of a socialization process and normative commitment towards inspections, the new member performs them also, as it is expected from him/ her. Again, the quality manager hopes that the new member also becomes affectively committed as normative commitment lasts only as long as social pressure exists. The example given above maintained that all forms of commitment play a role in software process initiatives. The following table (Table 1) demonstrates how these roles are present in software process improvement initiatives from the software developers' and managers' point of view [5].

Archetype of commitment	Software developer	Manager [6]
Affective	Refers to one's attachment to, identification with, and involvement in an SPI initiative	
Continuance	Refers to an awareness of the [personal [7], project] costs associated with leaving the SPI initiative	Refers to an awareness of the [personal, project, organizational] costs associated with aborting the SPI initiative
Normative	Reflects a feeling of obligation to participate in an SPI initiative	Reflects a feeling of obligation to continue with and/or participate in an SPI initiative

Table 1: Archetypes of commitment in SPI

A discussion whether commitment is good or bad, can now be turned to the forms of commitment and their desirability in certain situations. Consider f. ex. Humphrey's arguments (Humphrey 1989; Humphrey 1997). He calls for commitment discipline as a way to reduce chances of a software project to be late. When Humphrey suggests that a software developer should take personal responsibility for the quality of the software module he/her produces (Humphrey 1995), he refers to having an internalized pressure that obligates him/her to produce defect-free software. In fact, the proper way to behave, according to Humphrey, is to strive for excellence. Therefore, if one were to be

a proper software engineer, it would be the moral and right way to act in abovementioned manner. Thus, the type of commitment that Humphrey is seeking for relates closely to that of normative commitment as outlined in this paper.

2.7.4. The idea that commitment is an all-positive phenomenon

The last underlying assumption is the thinking that commitment is something that should always be looked for. Conner and Patterson (1982) claim that commitment "is the cement that provides the critical adhesion between people and change goals." Later in the article they remind that "commitment building is time consuming and expensive". Both arguments may be true in one sense but by definition the desire of wanting employees or managers to become committed to something is a paradox since commitment is known to have negative aspects as well. Practitioners call for commitment-oriented culture (Hadden 1999) without acknowledging the disadvantages such as resistance to change and an irrational perseverance in behavior, which both have been well documented in the literature (Pfeffer 1997). Randall (1987) argued that high levels of commitment might hamper individual growth, limit opportunities for mobility, lead to stress in family relationships, etc. Her arguments lack the empirical support however. Wastell and Newman (1993, p.139) reported how committed to an information system a group of librarians became once having being closely involved in the process of designing it.

> The attachment of the librarians to "their system" was striking […] When all pieces start coming together and you see it coming alive then of course for everybody they get very emotional about […] they started to cry. They were very attached to it.

Commitment by definition indicates a notion of restricting one's freedom of action. The basic effect of a commitment, therefore, is to make an act less changeable (Kiesler and Sakumura 1966). The purpose of a commitment in software development projects is similar – reducing the changeability of the set goals as in the sense of restricting one's freedom. The problem here may be the notion of escalation of commitment to a failing project as it is a well-established phenomenon (Keil 1995) in the IS field, i.e., the more committed one is to a project, the less likely is it that one will abort the project even though serious setbacks are faced. In the SPI world this translates to an effort trying to improve the 'wrong' process when the fire is somewhere else. The more committed f. ex. the senior management is in achieving CMM level 2 by a certain date, the more resources are spent regardless of the problems faced elsewhere as a recent case (Bang 2001) from industry shows. Moitra (1998) labels this as a 'certification hunting' –problem. Problems arise in SPI efforts when commitment targets are conflicting, f. ex. a metric person is committed to a statistical metric analysis while a software project manager is only interested in a quick summary type of feedback. A further discussion on this and other implications to research and practice is included in the following section.

3. Implications for the software process improvement field [8]

Having identified a number of common misconceptions in existing commitment models, some implications of these findings are now discussed beyond the examples given in earlier sections. In short, (a) SPI researchers should direct their efforts in conceptualizing the commitment phenomenon, and (b) new models of commitment development should be proposed based on empirical data. For practitioners, it is suggested that they should (c) focus on building an environment that enables affective commitment to develop, (d) promote voluntary involvement in SPI activities, and (e) embed SPI as strategic target into the usual work practices to develop better software.

3.1. Implications for Research

3.1.1. Concept and target of commitment

As noted by March and Smith (1995) conceptualizations are extremely important in both basic and applied research. Conceptualizations define the terms used describing the phenomenon under study, and are valuable therefore for both researchers and practitioners. SPI research has not yet started to consider the concept of commitment deeper than the mere reflection of it used in everyday

life. Conceptualizations can also make researchers and practitioners blind for critical issues (March and Smith 1995). Commitment researchers (Reichers 1985) have acknowledged this in their work on the concept. Since commitment has been acknowledged to play an important part in SPI initiatives, SPI researchers should explore the concept in relation to process improvement activities. In particular, the problem what commitment means in the context of a SPI endeavor has to be investigated.

Based on findings in commitment research, if one were to become committed to SPI, it should play an important role in one's work life. In particular, SPI research should be interested in understanding what is important for today's IT specialists, i.e., are they able to become committed to SPI activities at all. It has been argued that IT professionals are best motivated through intrinsic motivators. SPI research could use the categorization - control, arousal, achievement- provided earlier to investigate under which conditions SPI work has characteristics that would be intrinsically motivating, thus, increasing the possibility that a software developer would be able to become committed to SPI.

3.1.2. Commitment process

One fundamental problem for researchers to solve is to explore deeper whether to focus on the individual level commitment process, to concentrate rather on exploring the organizational commitment process or to advance knowledge in both. Lately, the individual's role played a minor part in organizational studies (Nord and Fox 1999). The emphasis has been moved to the context where the individual operates, on its attributes and effects. While the exploration on the commitment concept in this paper has been mainly on the individual level, a more context dependent approach might also be useful. However, one may argue that it is ultimately the individual who makes the decision whether one changes his/her behavior, which is the ultimate goal of any SPI activity. Still, individuals differ on every psychological dimension that has ever been investigated (Deci and Ryan 1980), how then would a generic model of the individual level commitment process - if such a model could be developed at all - benefit the SPI community? SPI activities are rarely targeted to only one person, but to a group of persons, f. ex. to a software developer team. If SPI research was to pursue an understanding of the individual level commitment process, new models should be based on empirical evidence rather than on theoretical speculation or discussions. A researcher pursuing this path should keep in mind that a danger in performing research of this type lies in the self-fulfilling prophecies that may occur when a researcher expects or presupposes certain stages of development or a certain process to occur (Poole 1981).

Therefore, researchers should not presuppose a process to be found since there might not be one at all. If new models are not proposed, old ones remain in use even though they are based on faulty assumptions as demonstrated in this paper. Rather, than looking for a commitment process directly, researchers should look for issues, concepts, themes or processes that depict developmental aspects of any type of the commitment phenomenon. Strategies have been suggested on how to perform research with such type of complex process data (Langley 1999). Moreover, new models should be useful to practitioners as well as to researchers. When lifting the level of abstraction to the team or organization level, it would appear to be relevant to understand how a new behavior becomes institutionalized (Conner and Patterson 1982) or 'painless' (Zahran 1998). In other words, how does a team or an organization become committed, stay committed and loose that commitment. The individual level commitment typology as suggested by this paper may provide a vehicle to deal with organizational commitment as well.

3.1.3. Commitment profiles

Recent literature on commitment suggests that employees' attachment to specific foci may be distinguished by a certain pattern. This pattern is described by a person's commitment profile. Becker and Billings (1993) formed four profiles describing individuals' pattern of organizational commitment: they distinguish the locally committed, the globally committed, the committed and the uncommitted. In their study locally committed persons were more attached to their immediate team than to the overall organization while the globally committed were attached to the top management and organization. The committed were attached to both (local and global)

levels and the uncommitted were attached to neither local nor global targets. It could be hypothesized that a software developer committed to his/her profession is more willing to participate in SPI activities than someone who is strongly committed in meeting the project delivery date. These commitment profiles could be extended to both individual and organization level commitment research. Advancing the notion of commitment profiles could prove to be beneficial for SPI community since it would provide a way to introduce an extension of the focus dimension, namely the breadth of commitment focus.

3.2. Implications for Practice

This paper has maintained that commitment develops naturally not following any predefined stages, is difficult to control, takes different forms, and the phenomenon has negative implications as well. In what follows, finally also the main implications for SPI practice are discussed.

3.2.1. Commitment-enabling environment

This paper has suggested that people become committed to SPI in different forms – affectively, continuously and normatively. When the affective component is dominating, a person truly wants to be part of a SPI effort. In the case of continuous commitment the dominating component is an awareness of costs associated with leaving the initiative, and the normative commitment implies a sense of obligation to perform SPI activities. While measurement instruments have been developed to measure the strength of different forms of commitment (see Meyer and Allen (1997) for details and discussion), they may be difficult to apply in practice. An open discussion with SPI team members about the motives driving their participation is a more effective approach to discover the dominating form of commitment.

While the affective form of commitment is desirable, it is also difficult to achieve due to its uncontrollable nature. Affective commitment is a phenomenon similar to that of intrinsic motivation. It is an inherent natural propensity that can be catalyzed, but not caused. This involves the building of an environment that enables affective commitment to develop. Open communication, effective collaboration, taking responsibility, having a shared vision and active experimentation are characteristics of such an environment (Porras and Hoffer 1986). An instrument to analyze such an environment has been developed (see Abrahamsson (1999) for details). A commitment-enabling environment is more than a simple reward structure designed to support SPI activities. These kinds of tactics, i.e. reward systems, may initially work but if incentives remain as the main motive, they may be easily circumvented and become dysfunctional (Iversen and Kautz 2001). Stronger motives than incentives are the perceived impacts of the SPI activities that become visible early on. For this reason many lessons-learned reports from industry [9] emphasize the need of having concrete benefits visible for the participating software developers and project managers rather quickly, i.e., in a few months. Similarly, many metric programs fail in part due to the lack of adequate feedback from the metrics personnel (Hall and Fenton 1997; Herbsleb and Grinter 1998). In a failing case often the environment does not enable commitment to develop.

3.2.2. Voluntary involvement

Commitment research has established that if a person should become committed towards any entity - an organization, a team, co-workers, a goal, a vision, s career, etc.- the entity itself should be placed in the center of the person's experiences (Brown 1996). In the case of SPI, this means that people from all organizational levels should be involved (Humphrey 1989). Involvement is also crucial in innovation diffusion success and this is also valid for SPI as an organizational innovation (Green and Hevner 2000; Kautz and Larsen 2000). Put simply, if software developers are not involved in the process of defining SPI activities, no affective commitment can be achieved. In fact, non-involvement invites alienation, which is the opposite of commitment (Meyer and Allen 1997). Involvement, however, does not directly indicate that something becomes important for the person involved, but it is an important enabler for an affective commitment process.

Involuntary involvement, however, may be even more damaging than beneficial (Locke et al. 1986). Having truly a free choice is a corner stone in the process of becoming committed (Argyris 1970; Salancik 1982). It is also intrinsically motivating (Deci

and Ryan 1980), and enhances one's perception of control over how the SPI innovation is used (Moore and Benbasat 1991), which in turn affects the use of the innovation and the satisfaction with it (Green and Hevner 2000). Thus, rather than trying to induce someone becoming committed, practitioners should be concerned with having people volunteering in SPI activities. This requires activities that ensure that people are equipped with enough information to develop a sense of clear understanding of software process improvement.

3.2.3. Embedded SPI

The last implication here is concerned with the difficulties of having SPI as a target of one's commitment. Quality managers should not expect or look for cult-type commitment as recent literature suggests (Burgess and Turner 2000) but rather treat software professionals "as what they are: intelligent creative professionals" (Rodenbach et al. 2000). If software developers or managers were to become committed to SPI, the SPI program has to be perceived as significant in a personal and organizational sense (Brown 1996). By nature however, SPI is not an easy commitment target. Anecdotal evidence suggests that SPI is support work where the results are often non-, or not directly visible, the used vocabulary is uncommon, the work is often done on an abstract level, and SPI is difficult to be perceived as a business issue (Jones 1999). Systematic SPI requires activities that initially are not part of usual software engineering practices, i.e. software is not produced through SPI.

Conflicting priorities exist when an organization values means and ends that conflict with SPI thinking. If project manager's first and foremost priority is to deliver the software by due date, it has the potential to become his/her target of commitment. Introducing such a project manager with time-consuming data collection activities can be troublesome. The quality department's – if existing - sense of priority should be aligned with that of the project department's and vice versa. These conflicting priorities create frustration, confusion and are detrimental to the organization's productivity in the long run. Thus as a strategic intent, the organization should work towards making software process improvement the normal approach of enhancing work practices, not necessarily a set of separate initiatives (Yamamura 1999). Having SPI embedded in daily routines enables software professionals to concentrate on their core work – producing better software. Thus, the more natural target of one's commitment would be one's profession and competence development. Practitioners argue for "commitment-oriented software culture" (Humphrey 1997; Hadden 1999). In fact, they call for normative commitment towards developing the software 'the engineering way'. Having a sense of obligation to produce software the engineering way would require, in part at least, maturation of the software engineering profession along the lines suggested by Ford and Gibbs (1996), f. ex. through official approval by a professional body. Thus, if a software developer would be accredited to the software engineering profession through some type of licensing and certification practice, s/he would then be obligated, in a normative sense, to follow defined or standardized software practices. While efforts in this direction have been taken (Speed 1999), it will be only a partial solution. Organizations should also promote the software engineers' professional development, which involves developing essential skills such as abstraction, problem solving and communication, technical knowledge and team orientation (Wynekoop and Walz 2000). SPI provides a mechanism with conceptual and operational tools to work in that direction.

In all organizations commitment exists at several levels. A lack of a certain type of commitment towards SPI does not mean that dedicated, objective, enthusiastic and motivated people do not exist. People in modern organizations operate in tight schedule and resource constraints. Much blamed change resistance does not necessarily involve lack of commitment to SPI but can be seen as organization's natural surviving mechanism (Perren 1996) that challenges the usefulness of SPI activities.

4. Conclusions

SPI literature and practice has identified commitment as an important factor in determining the success of SPI initiatives. The importance is not likely to diminish in the future. As Curtis (2000) outlined, the future challenges of SPI – process integration, harmonization and acceleration – will make a difference in tomorrow's business success. Addressing these challenges is not possible without organization-wide commitment to

process improvement thinking. Still, in spite of the agreed importance about the need for commitment, the SPI community has not considered how commitment to SPI develops, nor has it explored the conceptual base for it.

The intention of this paper was to provide the SPI field with a set of analytical tools to discuss commitment related issues on a more meaningful level. This study explored the commitment construct, provided a synthesis on contemporary commitment literature and linked it conceptually to the software process improvement world. Furthermore, existing models of commitment that denote the ideology behind current SPI models were analyzed. The analysis revealed four critical misconceptions in current thinking: (1) the assumption of linearity in the human cognitive processes, i.e., commitment in this case, (2) the controllability of this process, (3) the notion of a singular commitment construct, and (4) the idea that commitment is an all-positive phenomenon. Finally, implications of these findings were discussed from a SPI research and practice perspective.

This paper has provided researchers and practitioners with an alternative look at the commitment concept. By identifying common misconceptions in existing commitment models the field is in a better position to elicit requirements that new, more appropriate models of commitment development should satisfy. The purpose of this paper was not to undermine existing commitment models but rather to suggest that new models have to be proposed - models that are based upon empirical data. If new models are not proposed, old ones remain in use even though they are based on misleading assumptions as demonstrated in this paper. Furthermore, by using a typology of the commitment construct that is suggested by commitment researchers SPI research specialists can share their findings with a larger body of the scientific and practical audience.

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Notes

[1] Early versions of this paper were presented at the International Conference on Software Engineering (ICSE 2001) and at the Information Systems Research Seminar in Scandinavia (IRIS23).

[2] Throughout the paper, the term misconception is used to refer to assumptions underlying the models of commitment.

[3] Even though Kiesler (Kiesler 1971) made the suggestion early on, it was not up until recently that Beck and Wilson (2000) seriously challenged the argument. Their findings supported Kiesler's argumentation.

[4] Commitment as an explicit pact refers to goals, forms of cooperation and responsibilities that the participants agree upon in a project (Kontio et al. 1998).

[5] There are sevral other than software developers' or managers' points of view present in SPI (see e.g. (Zahran 1998) or (Messnarz and Tully 1999) for further discussion). However, in connection with the concept of commitment, SPI literature is mostly concerned with the viewpoints of these two stakeholder groups.

[6] A manager is considered to be a person who possesses the following characteristics: a) an authority to fund the process improvement initiative, b) an authority to provide resources for SPI, or c) an authority to decide to what extent the SPI activities are carried out in respective software development projects.

[7] Personal costs in this context refer to competence development, achievement of personally set goals, career ambitions, work relationships, etc.

[8] While the focus here is on SPI research and practice, inferences with related disciplines, namely IS Implementation, organizational and innovation diffusion, are possible.

[9] Readers are urged to study the Process Improvement Experiment (PIE) repository, which contains 250 industrial SPI cases that have participated in the ESSI (European System and Software Initiative) program (http://www.esi.es/VasieSearch/).

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