THE GAME OF SOFTWARE PROCESS IMPROVEMENT: SOME REFLECTIONS ON PLAYERS, STRATEGIES AND PAYOFF

Petter Øglund, Department of Informatics, University of Oslo, P.O. Box 1080 Blindern, 0316 Oslo, Norway, petterog@ifi.uio.no

Abstract

When starting the software process improvement (SPI) journey, there are many SPI standards to select from. Selecting good SPI standards can be a technical problem, from a software engineering point of view, but it can also be a political problem, some standards fitting more with internal political agendas than others. As it is well-known that SPI without management commitment can have disastrous effects on SPI, so can also be the consequence of selecting standards that are technically unfit. The dilemma on how to select SPI standards provides a picture of SPI as a political game played out between managers, software engineers and SPI people. Starting with SPI from the viewpoint of control theory, the paper identifies different conflict situations within the control theory framework, and suggests using game theory and drama theory for finding optimal control strategies. Drama theory is further explored through a SPI case study that illustrates how SPI standards stabilize in spite of conflicts and social disaster. The contribution of the paper consists of introducing the concept of 'evolutionary drama theory' (derived from evolutionary game theory, EGT) as a tool for describing and analysing how an artefact like a SPI standard evolves towards equilibrium (evolutionary stable strategy, ESS) by looking at repeated dramas where equilibriums may not necessarily be found or, if found, may not necessarily fit with the ESS.

Keywords: Software process improvement, standards, control theory, game theory, drama theory

1 INTRODUCTION

In the software process improvement (SPI) literature there are numerous SPI models, such as ISO 9000, ISO 15504, CMM, V-model, Bootstrap (e.g. Zahran, 1998; Hoyle, 2006), CMMI (Christiss et al., 2003), various agile methods (Schwaber, 2004; Cockburn, 2002), attempts at balancing discipline and agile (Boehm & Turner, 2004), general overviews based on best practices and/or research findings (e.g. Dybå et al., 2002; Sørensen, 2001) or models focusing on social issues and critical theory rather than technical guidelines (e.g. Nielsen & Kautz, 2008). How should we choose?

As most quality management systems require a process of quality audits, a way of improving the system that is already integrated in the design of the system is to go with an audit driven improvement approach (e.g. Schlickman, 2003). The diagram in figure 1 illustrates the concept of audit driven approach as a simple closed-loop control system, the main dynamics of the system being the relationship between process assessments $y(t)$ made by the quality control team and the control signal $u(t)$ given by line management to software engineers. The concept of audit driven improvement in this context means that, while the software engineers may produce quality and productivity indicators $x(t)$ as a part of running the software process, it is the role of quality control to audit $y(t)$ whether the current practice is in compliance with the quality standards $r(t)$ and make sure that the result of the comparison $e(t)$ is communicated to management.

The logic of the control system in figure 1 stresses the need for having quality standards (process standards) in order to do process improvement, and as pointed out by Legge (2002), the success or failure of process improvement depends to a large degree on "selling the models and methods" to management, creating management commitment. It is often argued in quality management literature that the single most important issue for succeeding with quality management is management commitment (e.g. Beckford, 2002). Nevertheless, according to Seddon (1997), selecting the wrong process improvement standards may have disastrous consequences for the organization.
The purpose of the study documented in this paper is to investigate the dilemma of how to select a SPI framework that fits with the requirements of doing measurement driven SPI and also fits with organizational culture and management style inherent in the organization. More precisely, the hypothesis of the study is that SPI can be understood as a game (conflict) between managers, software engineers and auditors, a game about software production, knowledge management and management commitment, where the best way to ensure stability in the control system, represented in figure 1, is to make sure that the choice of process standards can be interpreted as "Nash equilibrium" for the game, i.e. that choice of SPI standards produces a situation where neither management, engineers nor auditors benefit from moving from the strategy implied by the standards into different strategies. Drawing upon the theory of Evolutionary Game Theory (Alexander, 2009) and Drama Theory (Howard, 1971), a new concept of 'evolutionary drama theory' will be introduced.

In section two there will be a literature review covering some elementary aspects of game theory and the "soft extension" of game theory into drama theory, including the introduction of the new concept of 'evolutionary drama theory', arguing the relevance of such theories in the case of SPI. Section three explains methodology for empirical research designed for analysing the hypothesis more properly, using data from a longitudinal action research-driven SPI study conducted by the author. The results are reported in the shape of a drama theoretical case study narrative in section four. In section five, the narrative is discussed with respect to the model in figure 1, trying to give meaning to the politics of selecting SPI standards through the perspective of game theory and drama theory. The study concludes, in section six, by summarising how the new concept of 'evolutionary drama theory' puts the question on how to select SPI standards in a new perspective, emphasising the long-term importance of having an evolutionary stable strategy and how local or temporal conflicts should be solved with this in mind.

2 LITERATURE REVIEW

Game theory is a mathematical theory for analysing models of conflict and cooperation, drawing insights from games like Chess and Bridge with applications in economy, sociology, biology, and computer science, among others, using the concepts of players, strategy and payoff as framework for analysis (Bicchieri, 2004). The aim of this literature review is first to address the topic of social research in SPI and then focus on the two axes of conflict in the SPI game in figure 2.

2.1 Social aspects of software process improvement in general

Sommerville and Rodden (1995) comment that from the very beginning of SPI literature in the late 1980s, influential SPI writers were aware of human, social and organizational considerations which affect
software processes and the introduction of software technology, but given the scientific background of most people working in the area of software engineering, continued research in software process technologies has paid little attention to these problems. There are, however, examples of software process researchers who have focused on issues like the importance of qualitative observations and ethnographic research, understanding how cultures work, the importance of involving users etc. (Conradi & Fughetta, 2002; Dybå et al. 2002). Nevertheless, there is little advice on how to handle situations where the organization say they are following SPI standards while not actually doing it (Brunsson et al., 2000), or what to do when there are obvious conflicts due to SPI challenging the knowledge/power structure of the organization (e.g. Beer, 1968).

Some political issues are addressed by Scandinavian researchers from the information systems community suggesting SPI standards like CMM may be biased towards American management styles, making organizational assumptions that do not necessarily fit with Scandinavian organizational reality (e.g. Nielsen & Kautz, 2008), but even if this kind of research motivates the image of SPI as a political game, there are not so many insights on how to play this game in a successful way.

2.2 The game played by quality auditor and software engineer

If the quality control personnel can be seen as the extended arm of management, meaning that the management function in figure 1 automatically transforms the error signal $e(t)$ into a control signal $u(t)$, figure 3 illustrates a simple game theoretic model of the quality control game played between quality auditors and software engineers. For both the auditor and the engineer the four outcomes (payoffs) in figure 3 are ranked as $2 = $ best, $1 = $ second best, $0 = $ second worst and $-1 = $ worst. The payoffs for the auditor are designed in the manner to fit with the aim of quality control, namely that the auditor wins if the software engineer follows the process standards, but gets no payoff if the software engineer chooses to ignore. As following standards has no value per se for the software engineer, he wins by following standards while being controlled and loses, the variable $k$ equal to one, if not following while being controlled. If there is no control, the software engineer prefers following his own standards rather than being forced into some framework.

<table>
<thead>
<tr>
<th>Quality auditor</th>
<th>Software Engineer</th>
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<tbody>
<tr>
<td>Ignore</td>
<td>Ignore</td>
</tr>
<tr>
<td></td>
<td>(0,2)</td>
</tr>
<tr>
<td>Audit</td>
<td>(1,0)</td>
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<tr>
<td></td>
<td>Ignore</td>
</tr>
<tr>
<td></td>
<td>(−1,k)</td>
</tr>
<tr>
<td>Audit</td>
<td>(2,1)</td>
</tr>
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Figure 3. Normal-form representation of the game played by quality auditors and software engineers

Initially, in figure 3, the software engineer’s best strategy appears to be to comply, in order to avoid the outcome of audit (“minimax”). However, in repeated games, if the auditor assumes the engineer is basing his strategy upon this assumption, he may ignore to audit, as he expects the engineer to comply. But, as this may result in the engineering evolving the belief that there will be no audit, he may choose to ignore instead. Consequently, if the auditor acknowledges that he has to maintain the belief that he is going to audit, he may either decide on repeated auditing or develop a random strategy, alternating between the two strategies, thus forcing the engineer to choose the comply strategy.

A Nash Equilibrium specifies players’ actions and beliefs such that (i) each player’s action is optimal given his beliefs about other players’ choices, and (ii) players’ beliefs are correct (Bicchieri, 2004). In the case of the game in figure 3, audit and comply appears to be a Nash Equilibrium.

The assumption so far was that the auditor was able to function as an extended arm of management, thus setting the variable $k$ equal to one. If this is not the case, if management does not transform $e(t)$ into $u(t)$, then the variable $k$ may be equal to zero, meaning that there are no negative consequences for the engineer, regardless of what strategies the auditor chooses, thus making the strategy of ignoring an optimal choice for the engineer, and as there is no point in auditing if auditing has no impact, this makes the joint strategy of ignore-ignore into a Nash equilibrium.
2.3 The game played by quality auditor and management

One of the most fundamental criteria for succeeding with quality control and process improvement is to have management commitment (Deming, 1986; Humphrey, 1989; Beckford, 2002). As argued in the section above, the quality control game of making software engineers follow standards is a game that is determined by management. If there is strong management commitment, there is a Nash equilibrium in auditing and complying, but if there is no management commitment, there is a Nash equilibrium of no control and no compliance. According to McClelland and Burnham (1976), for managers, particularly those in complex organizations, increasing power may be a much more important motivator than improving results. In other words, while the control loop in figure 1 may represent the world as seen by the SPI practitioner (quality auditor), it may not correspond with the way management sees it.

Consequently, in order to win the game of making people following standards, it is necessary for the quality control people to take part in the political game of trying to attain management commitment to the SPI system. In the world of politics, however, it may not be so obvious what the alternative strategies are and how they will play out against each other. In fact, for messy problems of this kind there is a body of literature called Problem Structuring Methods (PSM) (Rosenhead & Mingers, 2004), with drama theory being a “soft” extension of game theory for the purpose of simulating and analysing messy game-like situations (conflict and cooperation).

The history of drama theory appears to have started with Goffman’s (1959) ideas of applying game theory through the metaphor of the theatre in sociological research, with Howard (1971) linking it more deeply with game theory and leading the development of drama theory into how it is being used in PSM today. Drama theory allows for meaningful analysis of different game-like situations, often using classical game theory examples such as Chicken and Prisoner’s Dilemma as part of the vocabulary for classifying episodes within the drama. In fact, drama theory consists of a large and systematic set of concepts, tools and methods (Bennett et al., 2004), but it is beyond the scope of this paper to go into this.

However, we now define the new concept ‘evolutionary drama theory’ to represent the viewpoint taken by Evolutionary Game Theory (Alexander, 2009) to be used in drama theory. The concept is intended for analysing how an artefact like a SPI standard evolves towards equilibrium (evolutionary stable strategy, ESS) by looking at repeated dramas where temporal equilibriums may not necessarily be found, or, if found, may not necessarily fit with the ESS. In other words, what this concept signifies is the drama theory equivalent of not only analysing a single game of, say, Prisoner’s Dilemma, but what are the winning strategies for populations playing endless sequences of this game.

3 METHODOLOGY

In order to provide insights on how to select SPI standards and get management commitment, in the context of the model in figure 1, the author will be using his own experience with SPI in a large public sector organization during the period 1999 to 2005. Also, some of the prehistory from working with SPI in another public sector organization 1992-1999 will be used, and the style of narrating the story will be that of a play, using an exemplary play from drama theory as guideline (Howard, 2004).

As the purpose of the research method is on trying to explicate conflict and drama, organizations and individuals are made anonymous, and as those who know the author may still be able to identify some of the models behind the play, characters, places and events from Shakespeare’s Hamlet have been used in order to provide further disguise.

The organization where the SPI study takes place will thus be named Elsinore, run by the present king Claudius, while the experience from the older organization Wittenberg will be explained through Hamlet’s conversations with the ghost of his father. Although the narrative of the play did not unfold exactly like the narrative of Hamlet, there are some similarities, so the overall structure of Hamlet will be used as a rough guide. The characters and their formal relationships are shown in table 4.
Claudius  | Director of IT department | Elsinore, Denmark
Laertes  | Director of projects management | Reporting to Claudius
Guildenstern | Director of information systems | Reporting to Claudius
Rosenkrantz | External ISO 9000 auditor | England
Polonius | Head of information security | Reporting to Claudius
Hamlet | Director of quality management | Reporting to Laertes
Horatio | Quality coordinator | Reporting to Hamlet
Ophelia | Quality coordinator | Reporting to Hamlet
Fortinbras | Director of HR department, future CEO | Norway
Ghost of Hamlet’s father | Manager at organization where Hamlet used to work | Wittenberg

Table 4. Dramatis personae

Despite this elaborate pretence, the purpose of the play is to investigate real problems experienced by the author in trying to design and implement model-based SPI.

4 CASE STUDY - THE PLAY

4.1 Act I

Scene 1. Hamlet meets the ghost of his former employer. They discuss ISO 9000, and we have an exposition of what will lead to the development of the tragedy.

GHOST: How are you doing in your new job at Elsinore?

HAMLET: After having worked for seven years with SPI from an engineering perspective, I find it fascinating to work with social issues, but, as Osterweil famously states; “software processes are software too”.

GHOST: Beware of your stubbornness, Hamlet.

HAMLET: The most important things I learned at Wittenberg were the mathematical principles of measurement, abstraction and generalization, and the general values of academia; intellectual integrity, community of peers and respect for knowledge.

4.2 Act II

Scene 1. Hamlet is supposed to help Polonius, head of the information security unit, in working with quality control and process improvement. Polonius’ formal background is in legal informatics. He is highly competent in this field, and is deeply focused on developing rules and regulations for information security.

POLONIUS: The first I want you do to is to read what we have written about process improvement and quality control, the way we have integrated this in the part of the security regulations dealing with information integrity, and after you are beginning to feel comfortable with this, I would like to have you as a part of a committee working on how to improve and expand this part of the legal system.

HAMLET: I see, but what about audits? Are we certain that people are following rules and standards without auditing or doing some kind of control?

POLONIUS: Hrmmm, as I said, what we need to improve upon is how these internal policies, strategies and standards are defined.

HAMLET: And you want me to look at the standards from the perspective of, say, ISO 9000?

POLONIUS: No, no, no. We have already looked at ISO 9000. What we need to do is to set up a committee. As your formal position in the organization is that of an advisor, you should only speak with people who are below the level of assistant directors. If we could assemble an interdisciplinary group of ...
HAMLET: Sorry to interrupt, but, in your estimation, how long do you think it will take until we have done sufficient analysis to start implementing and improving the quality management system?

POLONIUS: Well, in the case of the security management system, it took six years to analyse what we need, so we are actually only starting to look at what the system will do in practice.

HAMLET: Six years?

POLONIUS: And perhaps even longer, as I expect the quality management system is much larger and more complex than the information security system.

HAMLET: In my seven years of experience with this sort of thing, what I have done is much more test-driven; starting quality control and improvement as quickly as possible, in order to get a feel of what are the strengths and weaknesses of the current system, and then to systematically improve from there, building upon existing practice, existing standards etc.

POLONIUS: In your experience, yes. Well, you see, in the information security department, I am in charge, and the way we do things here is by committees and policy development.

HAMLET: Even if this is contradictory to TQM, SPI, experts like Deming, Juran etc.?

POLONIUS: I am no expert in TQM and SPI. That is your field of expertise. The only thing I am saying is that formal competence ranks higher than real competence. You may not be aware of how bureaucracy works, so let me explain: Even though your real competence as an expert in SPI tells you that SPI should be implemented according to certain principles, being your boss, my formal competence is higher than yours, so regardless of what you believe is the best approach, it is my judgement that is final, and I have already explained my opinion in these matters.

HAMLET: I see.

POLONIUS: So what do you think of the quality strategies and policies we have so far?

HAMLET: Well, it is a bit difficult to say without knowing how they relate to practice...

4.3 Act III

*Scene 1. Hamlet continues to work according to Polonius terms, feeling he is not utilizing his expertise in a productive manner, so when Polonius leaves the castle, thanks to king Claudius, head of the IT department, Hamlet gets promoted to director of quality management.*

HAMLET: Thank you very much. It's nice to talk to somebody who understands.

CLAUDIUS: Congratulations, and best of luck. Now we need to figure out where to place you in the organization.

HAMLET: Hmm, yes. In ISO 9001 there is a requirement about the person being responsible of TQM and SPI should report to the top manager, which would be you in this case.

CLAUDIUS: Well, you see, there are already so many people reporting to me, so I think we have to think of some other way.

HAMLET: Of course, although the intention of that particular ISO 9001 clause is, naturally, to stress the importance of management involvement. As most of us know, without management involvement, things like TQM and SPI are difficult to get to work.

CLAUDIUS: Yes, indeed. In our case, however, we have to go for second best.

HAMLET: Then perhaps I could work with Laertes, head of project management. The theory of projects management is in many ways linked the theory of quality management, and it is always good to solve quality related problems as early on in the life cycle as possible.

*Scene 2. Hamlet starts working with Laertes. Mostly this works quite well, although it becomes gradually obvious that project management and quality management often work in two different directions.*
LAERTES: The guy working as quality coordinator on project X just left. We need somebody to take his place. Would it be possible for you to do that?

HAMLET [avoidingly]: Well, that could be an interesting experience, but now that I have started auditing and improving the business processes, that would mean that I would have to leave what is important in the long run in order to do fire fighting.

4.4 Act IV

Scene 1. Claudius and Laertes are working out strategies.

CLAUDIUS: Your idea, Laertes, about outsourcing the Y2K problem to India was a brilliant idea. We got lots of good publicity that way, even the prime minister was impressed.

LAERTES: Heh heh. I’m lucky to have a friend working as a consultant in the outsourcing business. Let’s see if we can find further use of him.

CLAUDIUS: One thing that impresses many people concerning these Indian software factories is that they are often certified against something called CMM level 5. Perhaps we could use them in finding out whether we could get a similar certificate? Hah hah. At least I know of quite a few people who would be impressed if we managed that!

LAERTES: Good idea. I will talk to Hamlet.

Scene 2. Hamlet works with an Indian CMM assessor. The result of the assessment is that the organization is on level one, so Claudius and Laertes loose interest. Due to the discrete maturity ladder of CMM, Hamlet does not find the model particularly useful for measuring continuous improvement and gets external help for doing an ISO 15504 assessment. This results in an even lower maturity level score, creating even less enthusiasm. Hamlet, however, continues testing different models, EFQM, CAF, ISO 12207, CobiT and ISO 9004, trying to convince Claudius on the importance of using international SPI standards for benchmarking and continuous improvement. Laertes and Claudius meet and assess the situation.

CLAUDIUS: This idea about using people from India in helping us reach CMM level five didn’t work out.

LAERTES: The problem is the line management. Nothing is documented. There is no discipline. Each time one of my projects delivers a new information system, the organization is totally unprepared to handle it, and we have long periods of chaos until they get the hang of it.

CLAUDIUS: Yes, I know. We are dealing with layers and layers of incompetence, but perhaps we could use the people from India for documenting the systems? Hamlet has been working with Rosenkrantz in England on doing an ISO 9000 assessment of the SPI system. He says the way towards CMM, EFQM and such starts with reaching compliance with ISO 9000.

LAERTES: He does? Hmmmm. What if we hired Rosenkrantz to work directly for us instead, designing the project in a way that will give it the proper prestige it deserves? It seems to me that we might have a quick win here.

Scene 3. Hamlet is gaining momentum in process improvement and is granted his request for two assistants, Horatio and Ophelia, to help him doing audits and measurements. Horatio turns out to be of tremendous help while Ophelia quickly becomes a source of problems.

OPHELIA: This ISO 9004 model doesn’t work. It is impossible to know whether a process is on level one, two, three or five. Besides, people only get annoyed when I try to fill out these numbers.

HAMLET: The ISO 9004 model is perfectly simple. We have gone through this several times, and you have lots of examples to look at. I also experience people resenting being evaluated, but you must remember that we are in the business of measuring continuous improvement. Without measurements, it is impossible to apply statistical process control.
OPHELIA [angrily]: I don’t believe statistical process control works. With statistics you can prove
anything, but it doesn’t mean that it is right. You never explain anything to me, you just complain.
Last week you complained about how I simplified the EFQM model, the week before that you
corrected the way I was using CobiT. As far as I can tell, none of these models fit together, and,
besides, I don’t think quality can be measured in the first place. I think we should focus on meeting
people on their own terms.

4.5 Act V

Scene 1. Laertes is focused on getting projects completed and sees Hamlet’s audits and measurements as
disturbance. As he observes Ophelia’s similar dislike for audits and general distrust in numerical SPI
methods, he ponders how to remove Hamlet without causing too much organizational havoc. He asks
Hamlet to enter his office.

LAERTES: Have you ever thought about doing research?

HAMLET: Research? Yes, I used to be a research scientist once. That was an interesting period of my
life. Now, however, I enjoy being director of quality management.

LAERTES: Well, you see, I’ve had some complaints, and I have been thinking, perhaps you would enjoy
life better as a research scientist, doing research related to quality management, of course.

HAMLET: Complaints?

LAERTES [opens a large folder]: Yes, you see, this is where I collect everything about you, every mail
you write etc. There are several complaints here, people complaining about your quality management
methods.

HAMLET: Is there something wrong with my methods? I just measure practice against process, giving
people feedback in an objective manner, in order to help them improve.

LAERTES: Well, over a long period a series of complaints have piled up, I will not go into that...

HAMLET: I still don’t understand. If people object to what I am doing, why don’t I hear anything?
During our last development conversation, only a few months ago, I cannot remember any talk about
problems?

LEARTES [getting irritated]: Well, I think you should consider what I have explained to you during this
conversation. Think about it, and then we will talk more.

Scene 2. After a few days there is another meeting, now with Claudius also present.

CLAUDIUS: I here there have been some complaints?

HAMLET: People are always complaining about quality management, that is the nature of the work I do.
If only I could get more specific feedback, somebody telling me what the problem is.

LAERTES: To be frank, Guildenstern addressed me last week and said he was not too happy with Hamlet
upsetting the software engineers.

HAMLET: Guildenstern? I have regular meetings with him every month. I can’t remember there being
anything problematic there?

LAERTES: Well, he told me there were serious problems.

CLAUDIUS: It seems to me that the next thing to do is for you, Hamlet, to visit Guildenstern and find out
what these problems are.

Scene 3. Hamlet visits Guildenstern.

HAMLET: I have this feeling that Claudius and Laertes want to get rid of me, but I don’t understand what
is behind it. I feel our conversations have always been easy going. Perhaps you could give me some
advice on what to do. Laertes says that you have complained to him about my behaviour?
GUILDENSTERN: Claudius and Laertes have decided that they want to get rid of you? Well, to tell you the truth, I don't think our monthly conversations have been all that good. Besides, as I have told you earlier, I think you focus too much on auditing my software engineers. It causes stress, and sometimes it isn't possible to follow standards. You pointing out how various processes deviate from standards is simply not very useful.

HAMLET: But that is my work!!! That is what I'm paid to do!

GUILDENSTERN: Actually, I often have problems understanding Claudius and Laertes, but they are the two most powerful people in the organization. I don't want to get my nose rubbed against those two guys.

HAMLET: So there is no hope for me?

GUILDENSTERN: I didn't say that. There is always hope. I only said to Laertes that doing quality audits while we were developing new standards and methods is causing problems.

Scene 4. Hamlet has another meeting with Claudius and Laertes.

HAMLET: Well, now I have spoken with Guildenstern in order to find out what the problems were.

CLAUDIUS: Yes?

HAMLET: He mentioned to Laertes that it was causing distress among the software engineers being measured against standards that they were already considering rewriting. Clearly he was frustrated in this respect, but he didn't frame any serious complaints. Besides, in order for me to measure continual improvement, the basic idea is to measure all the time. I don't see what he finds so difficult in this, as this is a topic we have discussed several times, but I do understand that he dislikes his engineers getting stressed. Perhaps I could discuss more with him how to solve this.

CLAUDIUS: No, no. Forget about Guildenstern. What we want you to do now is to write a formal letter where you state that you want to change job description. You no longer want to be director of quality control; you want to become a research scientist.

HAMLET: But that is not what I want. My whole life and personal identity has now been interwoven with what I am doing now. I am part of a professional community. I have achieved more dramatic SPI results in this organization than what most people would believe were possible.

CLAUDIUS [angry]: You write this letter, or else!!!

Scene 5. Laertes, as head of project management, gets the idea that ISO 9000 could be a high prestige project, makes sure that those within the organization who are competent at ISO 9000 are kept away and hires consultant to do the analysis and implementation, as consultants are easier to handle. However, the consultants turn out to be incompetent. The project is costly and makes no progress. With the arrival of Fortinbras as a new CEO, there is a total reorganization, many of those until now in power being removed or given other jobs.

HORATIO: I was asked to become quality manager after Hamlet was asked to leave, but the politics of the organization made me frustrated. I am now doing projects management instead.

FORTINBRAS: Every reorganization and change is difficult, but even though people are changed, ideas remain. I want new people to continue working on what has already been done.

4.6 Analysis

Similar to Shakespeare's Hamlet, this version of Hamlet is divided into five acts and the characters behave in a slightly similar manner as known from the classic drama. In the first act, Hamlet uses the conversation with the ghost of his father to contemplate the importance of standards and also reflect on SPI as pure engineering science without any understanding of the politics involved. The second act is focused on misalignment of interests in terms of introducing a SPI framework. Polonius is developing a security management system based on domestic strategies, policies and standards (SPS) for security and quality management, deliberately avoiding international standards and scientific methods. For Hamlet
this strategy is not optimal, but in lack of anything else he uses the SPS for auditing purposes and tries to figure out how the SPS fits with international standards such as ISO 9000.

In the third act, Polonius is no longer part of the game, and Hamlet’s conflicts are primarily related to working with Laertes who is head of the projects department. From the viewpoint of SPI, a project is just one single dot on a run chart, while the aim should be to predict how projects behave in the long run and what can be done in order to achieve process improvement. For Laertes, however, power, influence and prestige is tied up with each particular project, meaning that the rise to power comes form being involved in the right committees, right contacts, doing things that looks impressive etc., rather than doing what is necessary on a long term perspective in the sense of what is required of the ISO 9000 and CMMI standards. For Laertes, Hamlet means problems, and, through the influence of Ophelia, who has her own reasons for being in conflict with Hamlet, Laertes decides to have Hamlet removed. Although following SPI models is not in the interest of Laertes, he is nevertheless aware of the prestige in complying with ISO 9001 and CMMI/5, so at various stages he tries establishing CMM- and ISO 9000 projects.

The fourth act is focused on the scheming of Laertes and Claudius, and on the domestic conflicts between Hamlet and his assistant Ophelia, contrasted with the harmonious relationship between Hamlet and his other assistant, Horatio. The conflict with Ophelia is based on Ophelia being good at handling people but poor at handling statistics and the technical sides of SPI, making her uncomfortable in the role of auditing various groups and processes through the use of numerical assessment methods. Despite the conflict, it is useful for Hamlet and the quality management department to receive the frustrated criticism from Ophelia as incentives for improvement, but eventually the conflict drives her destructively mad.

In the fifth act, the sum of all previous episodes has produced two kinds of results. On the one hand, the SPI activities have risen to a maturity level never beyond experienced within the organization, but on the other hand, the efficiency of the SPI also makes processes more transparent and several people are feeling uncomfortable by having what was previously unknown or only known to a few become public knowledge in terms of improvement trends or lack of trends etc. The sum of forces in favour of having Hamlet removed becomes greater than those keeping him, so he is asked to resign. This results in the SPI system collapsing, and shortly after, other political games result in total reorganization and a fall-down of the empire as it was defined.

In the epilogue, however, it is suggested that despite people coming a going, some of the ideas and structures, like those of ISO 9000, were strengthened, meaning that the organization today may be more ideally suited for SPI development.

5 DISCUSSION

5.1 Use of drama theory for understanding the dynamics of the SPI game

As suggested by drama theory, presenting the case study as theatrical episodes makes it possible to think more clearly about the situation, exploring more fully some of the more dramatic aspects of the story, possibly also making it possible to enter the mind of the theatre critic, comparing a play constructed in this manner with the classics from world drama, Shakespeare, Ibsen, Chekhov etc., using the catalogue of exemplary dramas from drama theory for comparing and contrasting in order to see what is special about the particular case of SPI implementation and how similar cases have been given the PSM treatment and turned into more structured problems that can be analysed by the use of game theory.

As explained in the methodology chapter, the play was written in the style of Hamlet as the real story behind the play is a story of intense conflict, on many levels, partly in order to go more deeply into such aspects of conflicts, and partly in order to make the real people in the organization anonymous. A challenge in using this model, however, is that Hamlet is a rather complex play, and rather than telling a story about, say, a hero scientist fighting against the stupidity of the bureaucracy, it becomes a story about one event that leads to another, following the logic of tragedies where the solution at the end of the play is hinted at in the very beginning. From this perspective, the narrative becomes more like the narratives of “systems archetypes” used in dynamical systems theory (e.g. Senge, 1990) than a rational investigation of mappings between decision and payoff.

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What the story is supposed to ask, however, is whether there is anything to learn about process improvement and organizational politics by using Hamlet as a theoretical lens. In order to answer this question properly, on a general basis, a thorough review of the literature on Hamlet is needed, and unless the SPI researcher happens to be an expert in literature theory, perhaps already having done PhD studies in Hamlet, the comparison between the real case and the model case can easily become shallow if the researcher has only a shallow understanding of the model. If the SPI researcher is interested in drama, however, drama theory can be an interesting approach. As pointed out by Kott (1974), in his analysis of Shakespeare in the context of Eastern Europe in the fifties and sixties, it is remarkable how rich and insightful Shakespeare can be if one manages to make a good match between the right play and a contemporary political situation.

One common way to interpret Hamlet is to think of it as an existential play (Kott, 1974), something that turns the story about SPI in the bureaucracy into a story about life and death, a story similar to Kakar's analysis of Fredrick Taylor (1970), where the message is that there is a deep connection between Taylor's enthusiasm with control and process improvement and how he had difficulties in coping with certain aspects of social life. Kakar has later been accused of misrepresenting Taylor, making him more neurotic that he actually was (Kanigel, 1997), but the idea of trying to go beyond the surface of his model in order to search for phenomenological explanations is an interesting approach that fits very well with most of the PSM styles, like, for instance, soft systems methodology (SSM) (Checkland, 1981). Although Kakar may have provided a distorted model of Taylor, Kakar's caricature could perhaps give sufficient ideas about SPI psychology for hypothesizing solutions for the SPI game. Similarly, there are different interpretations of Hamlet giving the SPI researcher flexibility in comparing his analysis of the SPI drama with different type of Hamlet interpretations.

The question remains, nevertheless, whether using Hamlet versus Claudius, the main conflict in Shakespeare's play and main conflict in the SPI play in section four, as a model for understanding what Beer (1968, p. 22) calls the "natural enemies" of process improvement scientists (quality auditors) and managers in an organization is a useful model. Bram (1994) provides a game theoretical analysis of the conflict between Hamlet and Claudius, using his own mathematical expansion of game theory ("theory of moves") for illustrating how the underlying rationality of the conflict can be understood. However, as the mock-Hamlet in the SPI case study is not an exact replica of Shakespeare's Hamlet, the arguments presented by Bram do not seem to fit in this particular case.

In order to bring insight on what to do if there appears to be little or no connection between e(t) and u(t) in figure 1, resulting in the quality game in figure 3 reaching a Nash equilibrium in ignore-ignore rather than audit-comply, does a hermeneutical understanding of the collaboration between Claudius and Laertes, or a phenomenological understanding of the managers hiding between these masks, provide guidance on how to link e(t) with u(t)? Although the case study as reported in section four does not answer this, it is the belief of the author that there are some general insights to be found from this approach. Much of the success of the SPI in the reported case study had specifically to do with a persistent attempt to try to understand each and every person in power. As Checkland (1981, p. 351) points out, a system owner is defined by the person able to destroy the system. From a SPI perspective, the system owners are the most important people in the organization, and although there are theories of motivation and behaviour in general, when it comes to real life SPI, it is necessary to get a deep phenomenological understanding of how certain people think, feel and behave, in order to make the proper "game moves" that prevent the SPI system in getting destroyed.

5.2 Establishing agreement on rules for playing SPI games

In figure 5, the PSM-based phenomenological approach towards SPI is put in a greater explanatory picture that makes a map out of the sciences, in the style of Burrell and Morgan (1979), by putting the "hard" sciences on the right hand side of the matrix and the "soft" sciences on the left hand side, and having sciences where the researcher is a part of the system being investigated at the top ("action"), while the bottom represents research done by a distant researcher ("perception"). In the case of the SPI problem presented in figure 1, the problem was an engineering problem belonging in the world of the stick man at the upper right corner of the model in figure 5. However, as the SPI engineering solution did not work
according to theory, it was necessary to open the black boxes of conflict and negotiations in figure 1, moving the focus in figure 5 from engineering to psychology. Although there are motivational theories, like those of McClelland and Burnham (1976), suggesting that getting management commitment may be reached more efficiently if we assume that management is motivated by power than if we were to assume they were motivated by achievement, this makes it necessary to understand what kind of social reality we are dealing with. Social reality, the nature of the organization that breeds certain types of psychological behaviour, is a social science research theme belonging in the lower left corner of the model. Although drama theory is primarily a psychological research tool, it can also be seen as a sociological tool in the way that it is linked with Goffman's ideas of applying the theatre as a lens for understanding society.

The fact that drama theory is an extension of game theory also makes it into an extension of a positivist perspective of society, thus the arrow from social science to physics in the lower right corner of the model. Although drama theory is not a mathematical science, the aim of the approach is to investigate episodes in the same way as game-like situations are analysed in game theory, searching for optimal strategies, equilibriums and such. Even though one should be of the persuasion that strategies and equilibriums are phenomena that exist in reality, the language of game theory and natural science is a social construct (van Fraassen, 1980), thus finally leading us back to the engineering position at the upper right corner of the diagram where we started, i.e. mathematical models and their extended verbal models as engineering constructs.

![Figure 5. Circle of explanation along paradigms of science (adapted from Burrell and Morgan, 1979)](image)

Relating the model in figure 5 with the case study, the ISO 9000 standards have been placed in the lower left corner of social science rather than the upper right corner of software engineering. This is done in order to illustrate the major point about the case study in terms of how the SPI standards were chosen by management in order to fit with the politics of the organization. As illustrated in the case story, several standards, such as CAF, EFQM, BSC, ISO 9001, ISO 9004, ISO 12207, ISO 15504, CMM, CobIT and ITIL were discussed and implemented for test purposes, some models more useful and promising than others. What finally and gradually emerged as an equilibrium strategy was a cluster of standards, using ISO 9001:2000 as a core and interpreting the others in compliance with this.

In this particular case, as explained in act five, the game between SPI and management resulted in the SPI people being thrown overboard; first Hamlet being asked to resign, then Ophelia leaving the organization, and finally Horatio giving up. The fact that a new castle was built after Fortinbras burned the old one down could be subject for further empirical research, supporting narrative for a new play. Returning from PSM to game theory, the equivalent to investigating how a SPI strategy evolves over a sequence of dramas corresponds with evolutionary game theory (Alexander, 2009), and what appears to be the key insight from this particular case study is that engineers, auditors and managers may come and go, but the evolutionary SPI game is played out through many generations, in this case indicating that the ISO 9000 strategy may represent an equilibrium in the long run.

6 CONCLUSION

The starting point for this study was the observation that there are many methods, models and standards for doing software process improvement (SPI). From the perspective of the people in charge of SPI, it is
important to select the SPI standards that fit the purpose of the improvement activities, while also making sure that management gets sufficiently committed to the framework. Using control theory (DiStefano et al., 1990) for analysing the problem of SPI design, the model in figure 1 assumes the role of management being that of responding to the difference $e(t)$, between accepted performance $r(t)$ and perceived performance $y(t)$, in developing and communicating control signals $u(t)$ to the software engineers. Without management commitment to SPI standards, it is unlikely that the error signals will be efficiently transformed into control signals.

Referring to organizational literature (e.g. Legge, 2002) and looking at a narrative produced by a SPI case study, getting and maintaining management commitment can be a challenge. There may be perfectly rational reasons why the level of management commitment required in SPI theory may be difficult to achieve in practice. What was suggested in this paper, however, was to look at social tension between the three boxes in the control theory model in figure 1 as a three-player game of engineers, managers and quality auditors in figure 2 and then focus on the conflict between engineers and auditors in figure 3. The equilibrium in this latter model depends on management commitment.

As pointed out by Brunsson et al (2000), there is a fundamental difference between management saying they are committed to ISO 9000 and management being committed to ISO 9000. When game-like situations are too complex or obscure to define a mathematically well-defined problem, the literature of problem structuring methods (PSM) (e.g. Rosenhead and Mingers, 2004) suggests drama theory as an extension of game theory. Using the tragedy of Hamlet as a template for analysing a particular SPI case study, it is suggested that single SPI projects can be seen as repeated games in the context of evolutionary game playing (Alexander, 2009), with the ISO 9000 standards emerging as equilibrium SPI strategies.

The key contribution to the theory of social aspects of SPI lies in the PSM perspective on SPI as an evolutionary game, the new concept of 'evolutionary drama theory'. As illustrated by the case study, engineers, managers and auditors may come and go, but the SPI game continues from generation to generation, paving its way towards strategic equilibriums. For the organization as a whole, as represented by management, the idea is to have good auditors involved in the SPI game, watching how long they survive, and then replace them to make sure the SPI game continues without end.

References


