# PhD Status Report

## General information

<table>
<thead>
<tr>
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<td>Institution</td>
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<td>Supervisor(s)</td>
<td>Jens Kaasbøll (UiO) / Lars Bratthall (SpareBank1 Gruppen)</td>
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<tr>
<td>Stage of PhD</td>
<td>Fourth Year, First Semester (8 months left)</td>
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<tr>
<td>Title of PhD</td>
<td>Quality management as reflective practice</td>
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## Papers

<table>
<thead>
<tr>
<th>Title of the paper</th>
<th>Publication</th>
<th>Future</th>
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<tbody>
<tr>
<td>[1] Using internal benchmarking as a strategy for cultivation: A case of improving COBOL software maintenance</td>
<td>IRIS-29</td>
<td>-</td>
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<tr>
<td>[2] Improving research methodology as a part of doing software process improvement</td>
<td>IRIS-30</td>
<td>?</td>
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<tr>
<td>[3] Designing quality management systems with minimal management commitment</td>
<td>Systemist, 29 (3), 101-112.</td>
<td>-</td>
</tr>
<tr>
<td>[4] Software Process Improvement: What gets measured gets done</td>
<td>IRIS-31(^1)</td>
<td>SJIS (screening resulted in acceptance for resubmit with major revisions)</td>
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<tr>
<td>[5] Designing quality management systems as complex adaptive systems.</td>
<td>Systemist, 30 (3), 468-491.</td>
<td>-</td>
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<tr>
<td>[6] Measurements, feedback and empowerment: Critical systems theory as a foundation for software process improvement</td>
<td>ECIS-17</td>
<td>-</td>
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<tr>
<td>[7] Implementing continuous improvement through genetic algorithms</td>
<td>QMOD-12</td>
<td>Rejected by INFORMATION SCIENCES but requested for resubmit with major revisions.</td>
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<tr>
<td>[8] In search of a Ciborra strategy for CMM-based software process improvement</td>
<td>IRIS-32(^2)</td>
<td>?</td>
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<tr>
<td>[9] Using game theory for producing quality plans: A Pac-Man simulation experiment</td>
<td>Systemist, 31 (3), 86-103(^3)</td>
<td>-</td>
</tr>
<tr>
<td>[10] Action Research and Design Science Research – More Similar than Dissimilar</td>
<td>NOKOBIT-16</td>
<td>-</td>
</tr>
<tr>
<td>[11] The game of software process improvement: Some reflections on players, strategies and payoff</td>
<td>NOKOBIT-16</td>
<td>-</td>
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1  Best paper award  
2  Nominated for best paper award  
3  Nominated for best student paper prize at the 13th international conference of the UK Systems Society, September 2009
Research Description

Background and motivation for your research

Total Quality Management (TQM) projects and Software Process Improvement (SPI) projects have high failure rates. The reason for failure is often said to be a mixture of technical and social issues, some researchers stressing the importance of taking issues like social power and structure seriously (e.g., Brunsson, 2000). When it comes to developing TQM strategies for dealing with socio-technical complexity of this kind, Dooley et al (1995), among others, suggests that Complex Adaptive Systems (CAS) might provide a successful approach when conditions for running the classical approach freeze-change-unfreeze are not present.

A body of literature on how to use the CAS framework for the development of organizational theory and management theory is gradually evolving (Nelson & Winter, 1982; Axelrod & Cohen, 2000). However, CAS issues are mostly used in a metaphorical sense in this literature, seldom in terms of explicit methods in the algorithmic sense. In computer science, on the other hand, CAS-concepts like Genetic Algorithms (GA) are used for developing computer software (Holland, 1988). What is largely missing is how to use something similar to GAs in order to formulate explicit methods for designing, implementing and continuously improving TQM systems.

![Figure 1: Model of the research domain](image)

In figure 1 the research domain is presented as a game between the quality department and the organization where the quality department tries to carry out strategies that will make the organization comply with the rules and regulations of the quality management system. TQM interventions are used for probing the organizational culture, success and failure of the interventions being used for learning and designing new interventions.

Research questions

The purpose of the PhD research is to contribute to the theory of how to develop TQM strategies in environments characterised by socio-technical complexity, searching for solutions within the domain of complex adaptive systems.

"Everything?"
As the PhD research is conducted in an industrial context, there are three questions that are of particular practical interest:

- How can we describe socio-technical complexity in a manner that makes theoretical knowledge useful for the practitioner trying to implement TQM?
- How can we describe TQM strategies that will be effectively useful for the TQM practitioner?
- How can convince ourselves and others that the suggested TQM strategy is worthwhile?

Research approach

Theoretical ideas informing the research

TQM theory can be defined from the perspective of systems theory (e.g. Beniger, 1986; Deming, 1994), something that would make it part of systems theory within social science (e.g. Parsons, 1951; Luhmann, 1995). As pointed out by Berlinski (1976), the concept of a ‘system’ in General Systems Theory correspond to what logicians and mathematicians call a ‘model’ for a given theory, and, Berlinski continues, the theory most frequently used in GST is the theory of differential equations.

One way of differentiating between Systems Theory and French Structuralism might consequently be to say that systems thinkers focus on conceptual models while structuralists focus on mathematical theory. However, the demarcation is blurred as systems thinkers (Bertalanffy, 1968) acknowledge structuralism as important input and structuralists (Piaget, 1970) acknowledge systems theory as important input. Parsons’s structural functionalism contains elements of both schools, as is also transferred into the more contemporary sociology of Luhmann.

In order to have a general framework for discussing the theory of TQM, I have chosen to use Category Theory as this theory plays in important role in modern mathematics, physics and computer science while also being debated within the philosophy of mathematics and science when it comes to structuralism in mathematics, structuralism in physics and structuralism in the social sciences (Sica, 2006). The only way I use Category Theory, however, is in defining the framework of research, as illustrated in figure 1 by defining the engineering problem as a problem in game theory (category of games), the solution as a flowchart, algorithm, finite state machine, Markov chain of similar structure (category of automata), and the realization of the automata in terms of probability models. Outside the dotted line of theoretical concepts, I have the categories of physical systems. The arrows connecting these categories, design, prediction, implementation and run, are then seen as functors. The final arrow “error signal” consists of comparing the results of the predictions and the running of the experiment, thus signaling back to the beginning of the loop whether results indicate we still have a problem or whether the problem has been solved (Box, 1976).
Using game theory for framing the problem is based on the assumption (Gintis, 2009) that game theory can be used as a theory for the unification of the behavioural sciences. Although not specifically used in soft systems methodology (Checkland, 1981) and critical systems theory (Flood, 1992), I use elements of both traditional game theory, evolutionary game theory and “soft game theory” (i.e. drama theory) to investigate the problem domain.

In the case of developing strategies to find game equilibria, apply automata theory from a similarly wide perspective, including heuristics, guidelines, methodologies etc that are not algorithms in the sense that they will run on a computer, but nevertheless sufficiently detailed that they give clear instructions or guidelines on how to implement the TQM strategy for a given organizational game-like situation.

While statistics and probability theory play a fundamental role in TQM (e.g. Deming, 1986; 1994), I present results in the shape of statistical process control (SPC) diagrams, carry out some hypothesis testing and such, but using the name “probability theory” in the box has more to do with the logic of scientific management (Taylor, 1911) and TQM (Deming, 1986) as a framework for doing engineering research (design science research, DSR; action research, AR), and is something I only touch upon briefly when I try to contribute to the theory of research methodologies.

**Empirical research strategy**

I have been working as a TQM practitioner in the IS industry since 1992. Based on experience with the failure of waterfall methods and traditional project management, I discovered CAS as an alternative approach in 1996. My research strategy partly consists
of reflecting upon my previous work, articulating situations and strategies that resulted in success and failure. I have also continued experimental TQM on a lesser scale, using insights from personal reflections and literature studies on how to design and evaluate TQM interventions.

Consistent with general recommendations on how to do change management research, I have used an action research approach. Although there are many ways of conducting action research, I have not found an obvious match in any of the AR methods I have looked into, so I have consequently mixed ideas from different sources (Taylor 1911; Schön, 1983; Simon, 1996; Avison et al, 1999; Braa et al, 2004; McNiff & Whitehead, 2006).

Current Status

Research activities to date
Below I have grouped my eleven papers from the list on the front page into three categories corresponding with the three boxes within the dotted boundary in figure 1.

Focus on understanding the problem:

- In paper [11] I write explicitly on game theory and use Hamlet as a drama for illustrating the conflicts and game-like situations.
- In paper [6] I use the Brunsson’s concept of “organizational hypocrisy” for describing a game-like situation with a non-optimal Nash equilibrium where the organization (as a whole) happily believe they have reached a high degree of TQM while subconsciously hiding TQM measurement information that they are at a low level.

Focus on articulating the solution:

- I use video game theory for describe the TQM strategy as Pac-Man strategy in paper [9].
- I use complex adaptive systems ideas for describing the TQM strategy as a Genetic Algorithm in paper [7]
- In paper [4] I use the idea of “what gets measured gets done” for showing how to move out of non-optimal Nash equilibria by producing and disbrituting “facts”.
- Use of measurements as a motivational issue is discussed in the context of internal benchmarking is discussed in paper [1].
- In paper [3] I discuss how it may be necessary to “fake quality” in terms of designing the quality management system in a way that makes it look like there is management commitment when the management commitment is close to none.

Focus on methodological issues:

- In paper [2] I focus on how to design action research for TQM in the way of self-improvement.
In paper [10] I discuss how to use the TQM framework itself as a basis for designing operational research questions when doing TQM as action research and/or design science research.

A theme in paper [8] is how mathematical phenomenology (Husserl) provides a framework for understanding transfer of knowledge and how unsuccessful design of quality circles in industrial may learn from successful design of peer review groups in academia.

Future research plans
This document is supposed to meet the requirements of what I have described as “milestone zero” in my monthly status report, providing a model that put the research and different papers produced so far into a consistent whole. The next step is to discuss this document with my supervisor and my co-supervisor in order to get feedback as to whether it makes sense.

The next step is to rewrite and elaborate the thesis (“kappa”) by making it fit with figure 1 and then position myself within each of the typical IMRAD-chapters. At the most abstract level, I deal with information systems theory and general systems theory. I need to elaborate more on how I see the organizational problem as compared with how it is seen by Checkland, Flood and Jackson and perhaps also IS people like L. Mathiassen and K. Nygaard.

When it comes to positioning how to construct strategies in the context of automata theory, I need to position myself more clearly within the literature of genetic algorithms among other things. I also need to position myself within strategy theory.

The methodology chapter needs positioning. In my current understanding, the illustration in figure 1 should be an improvement on the process I try to describe in the DSR/AR paper [10], but I need to compare my thoughts on this with what others have written.

In the discussion chapter I need to explain how my papers make a contribution within the tradition where I have positioned myself, i.e. systems theory of the type SSM/TSI and how such “soft” systems need mathematical theory to be properly understood (category theory).

I also need to position the conclusion in terms of explaining how my findings compare and contrast with related work especially in terms of how I plan further research.

Areas to be discussed
Issues/concerns related to your research
At the moment of writing this status report, I feel confident that the model in figure 1 put all my thoughts and papers into context. However, I have had many such impressions before, only to realize that I have not really understood anything at all. How can I be confident that the framework makes sense? Should I try to formulate a paper based on
this framework for the UKSS-2010 international systems conference and see what kind of feedback I will get from the systems society?

**Issues/concerns related to the progress of your work or PhD in general**

I feel the milestones on the monthly status report are totally random. I have absolutely no idea how much work is needed and how long it will actually take for reaching each milestone.


