

REINVENTING PROCESS IMPROVEMENT AND CHANGE MANAGEMENT THROUGH SYSTEMS THINKING AND SYSTEM DYNAMICS

Bengt Nilsson

Janzon&Nilsson Management AB

Anders Sixtensson

Kipling Information Technology AB

ABSTRACT

Existing process improvement models in the SW industry are often based on a static analysis of the individual processes. The analysis is often made without an understanding of the dynamic behaviour when the processes interact and are dependent on each other. A case study in this paper describes how a holistic viewpoint and Systems Thinking were used to reveal substantial improvement opportunities which may not have been detected with more conventional improvement methods.

INTRODUCTION AND BACKGROUND

Both authors have long experience from process improvement initiatives in software and telecom industry. We have been deeply involved with the introduction of methods for ultra high quality SW-development, e.g. Cleanroom Software Engineering, and efforts to climb on the Capability Maturity Model (CMM) from the Software Engineering Institute (SEI). We have had the privilege of working with truly great solutions to problems which we at the time were convinced all our customers were suffering from.

Our exposure to Systems Thinking and System Dynamics has transformed our way of looking at organisations. Suddenly we have found a viewpoint from where we see how our improvement efforts relate to the business objectives of the organisation, over time. The view is stunning and in some cases alarming. Historically we would analyse an organisation from the point of view of the quality of the processes. We would look at each process, from a predefined maturity rating viewpoint, and we would evaluate the process and the capability of the organisation to utilise the process. Our analysis would probably lead us to suggest improvements of the processes with the lowest quality in the maturity range of the

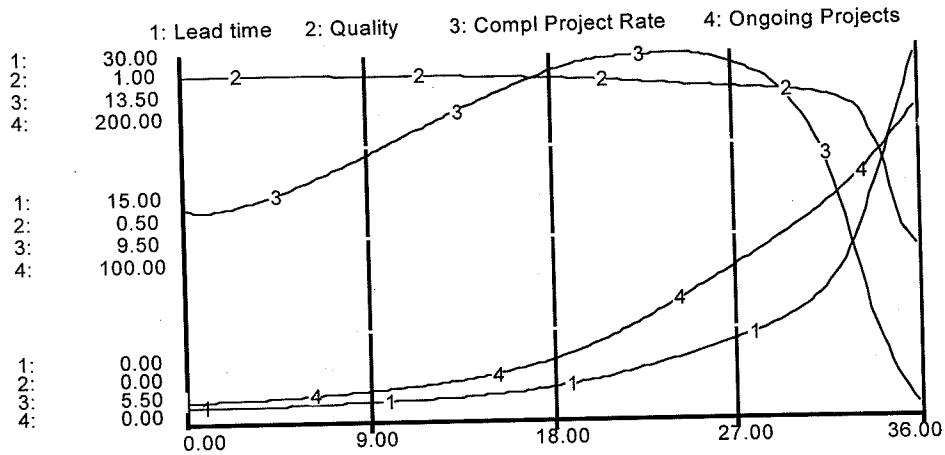
organisation. Since the predefined process model is derived from studying large numbers of successful companies, the result of such a comparison is often quite good.

With the holistic viewpoint of Systems Thinking and the rigour and precision of System Dynamics we now have the means to find what is actually constraining an organisation from performing as intended. In many cases our conclusions would coincide with the results of the maturity model based analysis. In other cases the results would differ substantially. In some cases the result of the analysis would be completely contradictory. This is the alarming part. Some improvement efforts which from a traditional viewpoint may seem rational are not only a waste of money, but they may even be counterproductive.

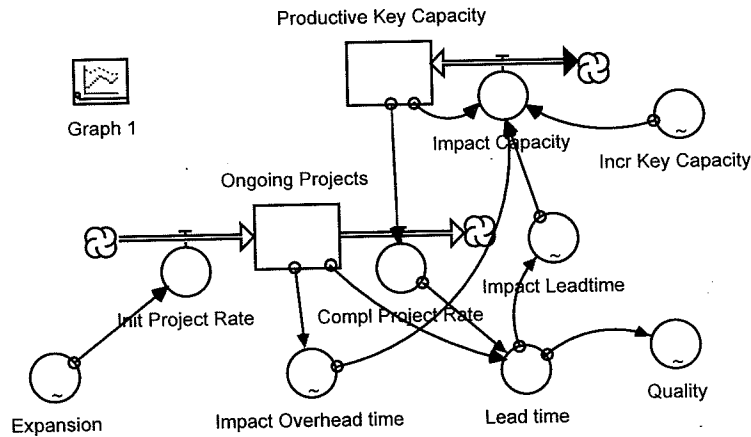
CASE STUDY - A FAST GROWING ORGANISATION

The reported case is from a fast growing organisation. An analysis of their symptoms showed, low due date performance, low adherence to plans, high error density and significant requirements instability. With conventional analysis we would have been tempted to suggest improvement efforts in requirements management, project management and software design techniques. This would fit both the symptoms and the typical CMM Level 1 organisation.

A Systems Thinking approach gave us more insight. The organisations ability to deliver project results had during the a fast expansion kept pace with the expansion. I.e. the delivered results per person had been maintained at a steady state for the first part of the expansion. Then something happened. Not only did the output per person drop but the actual output from the organisation dropped significantly although it was still growing. This made us understand that their underlying problem was a capacity problem that was hidden as a typical tragedy of the commons, see the graph below from a itthink-model of the organisation.



Analysis showed that a few key resources participated in almost all projects. From each projects point of view it was essential to have the key persons on the team. Without anyone really noticing when, the key persons deliveries where on the critical path of all projects. All of a sudden the availability of the key persons would immediately impact the time schedule of all projects. All projects had hit the limits of a shred critical resource. The figure below shows a simplified itthink-model over the situation.



The model shows how the project completion rate is dependent on the productive key capacity. The key capacity is increased by the organisation to keep pace with the planned expansion but the productive key capacity is also dependent on the number of ongoing projects and the lead time. Participation in discussions and meetings related to

synchronisation and coordination when the number of ongoing projects goes up, results in a higher ratio of "waste" capacity, thus reducing the available capacity for the individual projects. After a while a viscous loop starts to eat up all key capacity leading to even longer lead times etc.

Once this understanding is clear it is quite simple to come up with a proper solution. In our case we developed a project control mechanism which focused on setting up a board which would decide on what projects would receive the available project resources. We installed an efficient flow control filtering what projects were allowed to be initiated with a corporate overview assuring that the resources were used as intelligently as possible. This flow control efficiently focused the projects on their tasks and the project results could be reached with the quality and the lead time that was the norm of the company. Note that the change obtained by this measure was substantial. Also note that all metrics were improved simultaneously. Lead-times were reduced, quality was increased and the stability of the requirements enhanced. The lead-times were reduced since the resources on the critical path were assured. The quality increase could be explained by the more focused project effort due to the reduced lead time. The stabilisation of the requirements was also largely due, to the reduction in lead time, from the ordering of the project till the completion. The stabilisation of the requirements could also be a result of the deeper involvement that senior management was able to give each of the concurrent projects when this number was substantially reduced.

CONCLUSION

We believe that it is specially difficult for the non Systems Thinking based methods to detect and understand when a process is constrained by the limits of a larger system. To see the analogy of the archetype, tragedy of the commons, in a product development organisation. What looks like a quality problem is really a problem of unintentional over commitment

What, at least to us, is interesting is to analyse the conclusion that may have been reached if a Systems Thinking approach had not been used. The typical CMM analysis would come to the conclusion that process adherence with regard to requirements management and project management was in poor shape. Depending on the status of the defined processes programs to assure process adherence or initiatives to enhance the documented processes and their use

would be launched. These improvement efforts could have the opposite effect as the strained key resources would most probably be involved also in these efforts. Efforts to track and trace requirements and requirement changes would drain the projects further from energy and distract focus from the goal of completing the assignments even further.

These hypothetical thoughts are purposely written provocatively. We do not know that anyone has made this type of errors, but we do actually know from our own experience that it is possible and that Systems Thinking with a System Dynamics approach is a powerful tool in sorting out what matters from simple matters.