



Introduction

The hardness of managing projects, especially large scale projects, are largely because project conditions and performance evolve extremely complex, consisting of multiple interdependent components; they are highly dynamic and many evolving nonlinear relationships; they go overtime as a result of multiple feedback responses. System dynamic is the origin of the current trend of 'whole systems thinking'. It deals with complex interdependent components and enables the strategic modelling of nonlinear relationships. It is a risk-free way of refining plans before implementation using computer simulation and can facilitate ideas for both specific solutions and generic rules. These advantages make system dynamics a greatly suitable way to model project management problems.

This paper introduces a generic model to single project management by system dynamics. The reason of focusing on single project management in this paper is because that using system dynamics to model multiple projects is beyond the scope of this paper. But even models of single projects vary widely depending on their structures or applications in detail. Therefore in this paper, only most important and general model structures in conceptual form are focused, and references to additional details are provided.

Dynaplan smia is the modelling tool that is used in this project. It contains an object-oriented feature which is different from the traditional features of system dynamic tools, such as Vensim and Powersim studio. Since the traditional way is to map all the problems out in single instance, adding object-oriented features

to a system dynamic model becomes a new attempt on system dynamic modelling in this paper. More details are specified in the following chapters.

Solution

The generic project management model is built up based on the rework cycle, which is the one of the most canonical structures for project models.

The rework cycle means that, in a project model, most of the original tasks are done correctly and

need not to rework, while a fraction of tasks being done with errors needs to rework and the rework will generate more rework. The rework cycle causes performance gap, such as delay on deadline and deficit of labour resource. So the first step we took in the model is controlling feedbacks, including slipping the deadline and adding resources. There is a threshold for working overtime. Once the people reach it, their performance on the project will be reduced, resulting in a low progress rate. The whole model is shown below:

Object-Oriented feature has been added to the model. It is implemented by creating individual instances (or classes) and filling them with factors that influences the problem. The instances (or classes) are shown as the blue blocks in the picture.

Conclusion

In the research, a generic system dynamics model of project management has been successfully established. It contains the primary causes of project dynamics---project features, rework cycle, project control and ripple effect. An object-oriented feature has been added into the model, which makes the model clearer and easier to understand comparing to traditional project management model.

The model correctly represents the project management problems. The verification and validation of the model are satisfying. Policies that apply to the problem have also been analyzed in this paper, which turns out some of the policies are useful to deal with the problem, while some of them do not work as we expected.

The future work should focus on the knock-on effects generated by the ripple effects, such as turnover of the workforce, morale depressing and etc.

