

Improve your Competitiveness through Collaborative Engineering Management

“Projects that properly apply systems engineering practices perform better than projects that do not.”

This is one of the conclusions from a Carnegie Mellon® survey [1] on the effectiveness of systems engineering.

The survey was carried out on projects identified with the aid of The United States' National Defence Industrial Association (NDIA), the Institute of Electrical and Electronic Engineers (IEEE), and the International Council on Systems Engineering (INCOSE). Each project was assessed as to whether it could be regarded as *challenging*, e.g. if the customer requirement is not well defined, or there are insufficient resources to complete the project.

The survey team identified eleven systems engineering capabilities:

- Project planning.
- Requirements development and management.
- Verification.
- Product architecture.
- Configuration management.
- Trade studies.
- Project monitoring and control.
- Product integration.
- Validation.
- Risk management.
- Integrated product team utilisation.

The team also identified other factors that might affect project performance, including:

- Experience of similar projects.
- Contract type: fixed price, cost-reimbursable, or other.

Through the survey questionnaire, the survey team assessed the level of systems engineering applied to each of the projects. They also assessed the project performance against meeting the schedule, meeting the budget, and satisfying technical requirements.

What is a system?

A system is a combination of interacting elements organised to achieve one or more stated purposes.

As defined in ISO/IEC/IEEE 15288 [2].

An element is any identifiable entity.

As defined by Kuhn [3].

What is systems engineering?

Systems engineering is an interdisciplinary approach governing the total technical and managerial effort required to transform a set of stakeholder needs, expectations, and constraints into a solution and to support that solution.

As defined in ISO/IEC/IEEE 15288 [2].

The figures to the right show some of the results of the survey, giving the proportion of projects with high, middle, and low performance against whether those projects applied a low or a high overall systems engineering capability (i.e. across all the identified systems engineering capabilities).

The benefits of applying a high level of systems engineering capability are even more pronounced on the challenging projects.

The survey also found strong correlation between increased project performance and application of the first nine identified systems engineering capabilities. There was still a positive correlation between the last two identified capabilities (risk management and integrated product team utilisation), but it is not quite so strong.

As might be expected, the survey also found a strong correlation between project performance and experience, but performance does not depend significantly on the project type.

These results show that there is a significant competitive advantage to be gained by applying systems engineering processes in product development projects, especially if the projects are challenging.

References:

- [1] "The Business Case for Systems Engineering Study: Results of the Systems Engineering Effectiveness Survey", Joseph P Elm and Dennis R Goldenson, November 2012, Carnegie Mellon® University. Available at: https://resources.sei.cmu.edu/asset_files/SpecialReport/2012_003_001_34067.pdf
- [2] "Systems and Software Engineering – System Life Cycle Processes", ISO/IEC/IEEE 15288, 15 May 2015.
- [3] "The Logic of Social Systems: A Unified Deductive System Based Approach", Alfred Kuhn, 1974.

Collaborative Engineering Management describes SyntheSys' approach to systems engineering with expert personnel and appropriate tool support. We have helped many organisations increase their competitiveness through advice on processes, training and the introduction of software tools.

Please contact us to find out more.

About SyntheSys

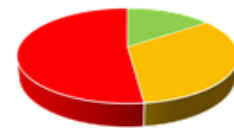
SyntheSys provides defence systems, training, systems and software engineering and technical management services over a spectrum of different industry sectors. Along with distinct support and consultancy services, our innovative product range makes us first choice provider for both large and small organisations. Established in 1988, the company focus is on fusing technical expertise with intuitive software applications to solve common industry challenges.

High Systems Engineering Capability



■ High ■ Middle ■ Low

Low Systems Engineering Capability



■ High ■ Middle ■ Low

The Systems Engineering Effectiveness Survey [1]

The survey was developed and conducted through a collaboration between the US National Defence Industry Association (NDIA) Systems Engineering Division, the Institute of Electrical and Electronic Engineers (IEEE) Aerospace and Electronic Systems Society, and the Software Engineering Institute of Carnegie Mellon University. The purpose was "to identify systems engineering best practice on projects, collect performance data on these projects, and identify relationships between the application of these systems engineering best practices and project performance."