Managing Complexity in SE Development

Applying Theory in Practice

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Introduction

Systems Engineering organisations often fail to deliver SE Development projects that meet customer expectations in terms of delivery date, cost, and performance [1][2]. Systems Engineering development projects are technically complex, and their state of completeness is dynamic. The activity of SE development explores the possibilities of technical capability and proves within a frame of reference whether desired technical capabilities can be achieved through the use of the developed system. It is an activity that inherently explores unknowns, and learns through action.

Plans and expectations of how Systems Engineering development will evolve, and the methods used to manage development often assume a mechanistic organisation, and that reliable and predictable cause-and-effect relationships govern the development process. These approaches are not effective when engaging in exploratory and innovative work.

Complexity Leadership Theory describes three leadership behaviours that interact with each other. They support the administrative, tightly structured needs of the organisation alongside less bounded and structured aspects of the organisation which are necessary to enable innovation and change. The theory was developed by leadership academics as one that describes how complexity can be managed within a bureaucratic organisation.

It was thought that this theory may offer some value to the problem of managing complex projects within systems engineering development organisations.
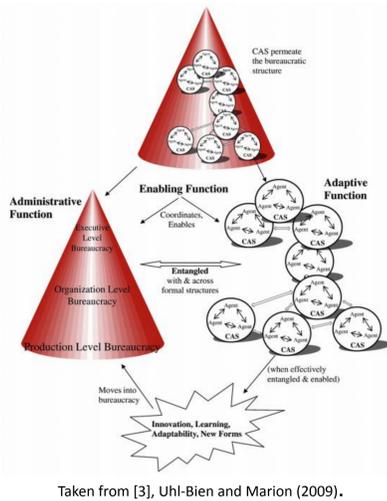
Taken from [3], Uhl-Bien and Marion (2009).

This research is the first attempt that is known of to apply the theory in practice.

Collected Data

Case Study 1
The email exchanges, notes from phone calls and meetings, and photos of whiteboard workings were gathered during the phase where CLT was outlined to the Key Stakeholder (The Thales UK Head of SE). The week-long session with architects was video recorded, and photographed, and field observations were recorded by the author. Email feedback was requested from participants the week after the session was held.

- *"In just 4 days...we have achieved what had previously taken (in my experience at least three times now) at least a year, if not more"*
- *"I have not seen any initiative in Thales that has been as dynamic, constructive and productive, or achieve the level of cooperation and cohesion within a team that covered many disciplines and business lines"*
- *"The approach to the workshop removed normal project/organisational constraints, thus enabling the team to realise their potential"*

Case Study 2
Data include the powerpoint presentations that were delivered to the SEMs, and audio recordings of their delivery and the open discussion. The completed before and after surveys, 1:1 email exchanges, and write-ups of the follow-up discussions where SEMs reflected on the use of CLT in their practice have were also gathered and retained.

- *"I find myself flitting about the three behaviours all the time...the framework keeps you sane, you need something to help you navigate when you have to flit around"*
- *"I can clearly see it applied to the business we are in...I certainly had no problem in seeing how it related"*
- *"I'm not sure whether it changed what I did. I probably would have done the same thing, but maybe the clarity helped me do it earlier"*

Objectives

- *To determine whether Complexity Leadership Theory was understandable to Systems Engineering managers (SEMs), and if so, whether they considered it potentially useful.*

- *To determine if an understanding of Complexity Leadership Theory could lead to more informed decision-making by Systems Engineering managers (SEMs).*

Methodology and Methods

On-going systems research engagements across Thales UK identified two opportunities to attempt to apply Complexity Leadership Theory in practice.
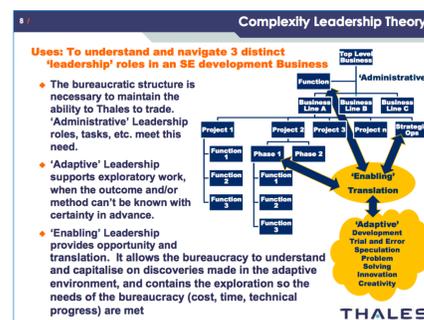
Case Study 1: The Thales UK Head of Systems Engineering
Complexity Leadership Theory was described and contextualised within the organisation. The balance of behaviours that the theory says would be needed to deliver the long-term strategy of the organisation was discussed. The Key Stakeholder in this case study (the UK Head of SE) took specific steps to behave in an enabling way, as a departure from the traditional predominantly administrative behaviour expected of the role. This enabling behaviour created the necessary support and latitude to allow a group of Systems Engineering architects to work together adaptively on a problem for a week solid. The architects and key stakeholder were asked to feedback their thoughts on this approach to work and its value.

Case Study 2: 16 Thales UK Systems Engineering Managers
A Thales-contextualised version of Complexity Leadership Theory was presented as part of an open discussion to a group of 16 SEMs. Prior to the presentation, the SEMs were asked to complete a survey which assessed how each SEM perceived the level of complexity involved in their current roles. After the presentation, they were asked to complete a second survey which asked whether Complexity Leadership Theory behaviours were recognisable in the workplace, the extent to which they are used, and whether they are thought to have impact. SEMs were then invited to consider CLT in their work during the upcoming month, then follow up with the author to reflect on whether understanding the theory was useful to them, and whether it supports more informed decision-making in practice.

Reflections and Conclusions

The research showed that Complexity Leadership Theory can be understood by Systems Engineering managers (SEMs). It's attempted application by a number of SEMs demonstrates that it was considered to be potentially beneficial. The feedback from Case Study 1 showed value was realised.

Case Study 2 showed that an understanding of CLT could lead to more informed decision-making. In other cases, pressures to 'fire-fight' and externally driven restrictions around resourcing, limited the ability of SEMs to act in a way that was informed by CLT.

References

1) Honour, E. *Systems Engineering Return on Investment* Defence and Systems Institute School of Electrical and Information Engineering, University of South Australia, 2013
2) Robitaille, SF. *Principles and Practices for the Application of Systems Engineering to Heterogeneous Research Partnerships,* Doctoral Thesis, University of Loughborough, 2011
3) Uhl-Bien, M and Marion, R. Complexity Leadership in Bureaucratic forms of Organizing: A Meso Model, *Leadership Quarterly*, 20:4, August 2009, pp 631-650

Acknowledgements & Contact Details

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