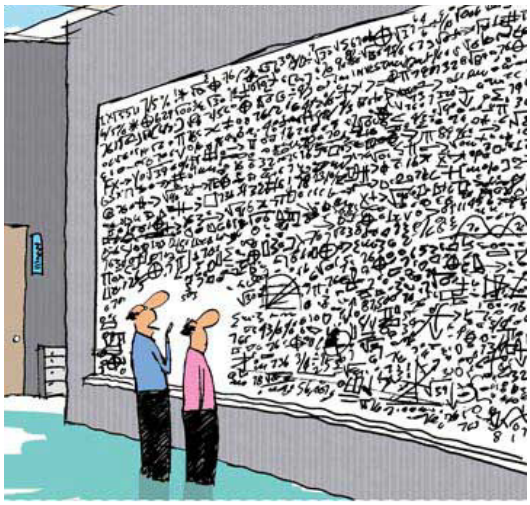
Controlling Complex Projects



"...And that, in simple terms, is what's wrong with your software design."

Complexity is not a synonym for complicated or large is just one of the dimensions inherent in every project. The four basic dimensions of a project[1] are:

- Its inherent size usually measured in terms of value
- The degree of technical difficulty in creating the output
- The degree of uncertainty involved in the project, and
- The complexity of the relationships ('small p' politics) both within the project team and surrounding the project.

Complexity theory[2] helps us to understand the social behaviours of teams and the networks of people involved in and around a project - its *stakeholders*. The basic concepts of complexity theory include:

- ***The Tipping Point***, which describes the way natural systems can absorb influences with minimal (or predictable) change until the *tipping point* is reached and then there is a sudden catastrophic change[3].
- ***Nonlinearity*** builds on from this. Nonlinearity suggests that you can do the same thing several times over and get completely different results. Small differences may lead to big changes whilst big variations may have minimal effect. The 'butterfly effect' describes the situation where minute changes in the starting condition can have major and unpredictable consequences in non-linear systems. Importantly, all human relationships are non-linear.
- ***Emergence*** is defined as 'the arising of novel and coherent structures, patterns and properties during the process of self-organization in complex systems' The common characteristics of an emergent state are:
  1) Radical novelty (features not previously observed in systems)
  2) Coherence or correlation (meaning integrated wholes that maintain themselves over some period of time)
  3) A global or macro "level" (ie, there is some property of "wholeness")
  4) It is the product of a dynamical process (it evolves), and
  5) It is "ostensive" (it can be perceived)

  The problem is you cannot predict the emergent state until it emerges.

---

1 For more on ***project size and categorization*** see: https://www.mosaicprojects.com.au/WhitePapers/WP1072_Project_Size.pdf

2 For more on ***complexity theory*** see: https://mosaicprojects.com.au/WhitePapers/WP1058_Complexity_Theory.pdf

3 For more on the ***tipping point*** see: https://mosaicprojects.com.au/Mag_Articles/P004_The_Tipping_Point.pdf

As all projects have a degree of complexity, these concepts apply equally to small in-house projects as to large complicated programs. The four key assumptions within complexity are:

- All elements of a situation are interconnected
- Partial knowledge is all that is available
- Individual perceptions, thoughts and emotions are as important as actions and events
- Outcomes are probable, never certain.

However, the degree of complexity is exponentially magnified by size, and influenced by technical difficulty. Attempting to manage the dynamic, unpredictable environment that characterises a modern 'complex project' using a static plan developed in the past is a recipe for failure.

Planning remains vitally important but as the military have recognised for more than 200 years, *'no plan of operations extends with any certainty beyond the first contact with the main hostile force*[4]*'* - once the project's work commences the plan needs to be continually adapted and modified to deal with the ever changing dynamics of the workspace and the surrounding stakeholder community.

Charge of the 21st Lancers at Omdurman, 2 September 1898
The last full cavalry charge by the British Army – they thought they were attacking a few hundred Dervishes, over 2000 appeared out of the dry riverbed. Training, adaptation and individual initiative prevented a major disaster.
(View the movie clip: https://www.youtube.com/watch?v=f6UmKsqz6aQ)

Following the defeat of the Prussian armies by Napoleon at the battles of Jena and Auerstedt in 1806, the concept of ridged process-oriented command and control structures has been progressively replaced in

[4] Field Marshall Helmuth Carl Bernard Graf von Moltke (26 October 1800 – 24 April 1891). Often paraphrased to: *No plan survives intact, the first contact with the enemy*.

military circles by the concept of 'auftragstaktik', or directive command. These ideas were originally championed by Major General Gerhard von Scharnhorst and were formalised by German Generalfeldmarschall Helmuth von Moltke who was the chief of staff of the Prussian Army for thirty years from 1857.

The core concept of auftragstaktik is 'bounded initiative'. Provided people within the organisation hierarchy have proper training and the organisational culture is strong, the leader's role is to clearly outline his/her intentions and rationale. Once this is understood, subordinate personnel can formulate their own plan of action for the tasks they are allocated and design appropriate responses to achieve the objectives based on their understanding of the actual situation, exploit opportunities and mitigate problems.

The investment necessary to achieve this capability is not simply a question of financial and material resources – time is critical both for the training of individuals and the development organisations. In von Moltke's army, a junior Prussian commander exercising his initiative on the battlefield was most likely drawing upon a variety of resources at his disposal including:

1. His understanding of his commander's explicitly stated directive that would have provided him with an appreciation of the situation, a specific task, and a description of the commander's intentions
2. His beliefs about his organisation, his role within that organisation, and the degrees of freedom available to him in the exercise of that role
3. His expertise in the technical aspects of the military profession, and
4. His understanding of his commander and his peers.

These latter aspects are captured in the notion of 'implicit intent', would provide him with the basis for his course of action and bound the solution space available to him.

A General may wish to defend a city, a Brigade Commander defend his designated sector and within the sector, a Platoon Commander may be tasked with establishing a road block which involves one of his NCOs establishing a strongpoint. The General does not need to instruct the NCO on how to site the strong point, camouflage it or man it. At each level, good leaders will think 'two levels up' and provide oversight 'one level down'. The process is not random, Standard Operating Procedures (SOP)[5] define how specific tasks should be accomplished and 'bounded initiative' allows the individual leader to optimise the SOP for the specific circumstances he or she encounters to best support the overall intent of the commander. Von Moltke emphasised that he wanted to 'steer' initiative in the right direction.

These concepts are closely aligned with the human resources approach to management, which developed in the 1950s and 60s and emphasise a symbiotic relationship between individuals and organisations where 'democratic leadership is the most effective means of managing' and 'openness and participation are the most effective means of demonstrating democratic leadership'[6].

On very small projects, a project manager may be capable of directing and controlling the work of everyone in the team. However, as soon as the team or the technology grows beyond a relatively simple system, direct 'command and control' becomes impossible and attempting to impose a ridged hierarchy based on formal instructions and static plans will lead to inefficiencies at best, disasters at worst.

Effective project leaders need to establish clear guidelines and a system of protocols, chain of command, and standard operating procedures so that everyone in the project team knows what they to do and who is

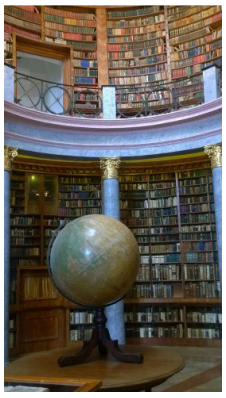
[5] For more on ***Standard Operating Procedures*** see: https://www.mosaicprojects.com.au/WhitePapers/WP1086_Standard_Operating_Procedures.pdf

[6] Scientific management pioneered by Frederic Taylor in the early 1900s focused on ridged 'command and control'.

accountable. The overall action of the team is unified by the leader's intent; within this space sub-teams and smaller work groups are allocated their individual missions and tasks within that higher intent.

Auftragstaktik is not an easy option, the team needs better leadership, better training and the willingness to engage in taking 'bounded initiatives' but overall it offers a much better way of achieving the project's objectives. Once this framework is in place, properly trained team members will have the capabilities to support the project's overall objectives whilst dealing with the emerging complexities.

Applying these concepts does not reduce the importance of the normal project management artefacts such as the schedule and cost plan; what changes is the way these artefacts are used. In a decentralised management structure, the Project Plan defines the guidelines and framework the team will work within rather than attempting to prescribe how they will do the work. And the framework is routinely adapted to deal with the ever-changing environment within and around the project. 'Schedule density' is one technique designed to operate effectively in this environment[7].



[7] See more on ***schedule density***: https://www.mosaicprojects.com.au/WhitePapers/WP1016_Schedule_Density.pdf