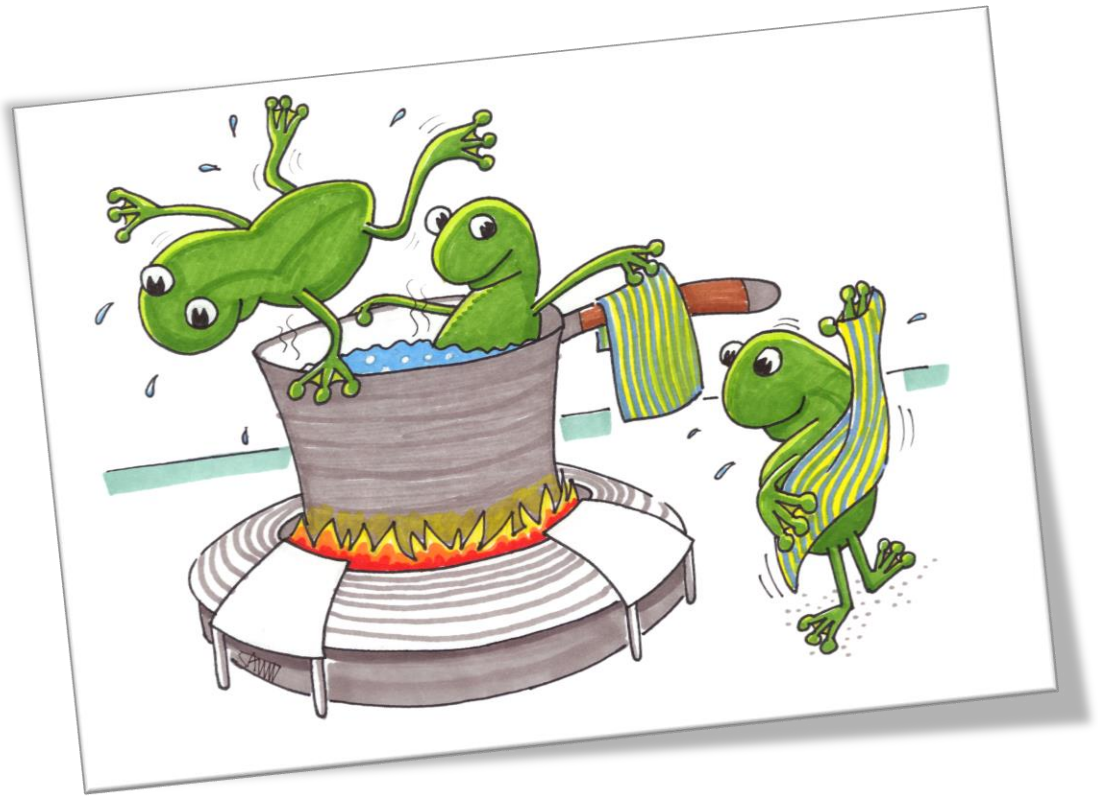
GCHQ: BOILING FROGS?

Technology organisations need to change radically to survive increasing technical and business disruption



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Russ B, Mike M, Steve H

FOREWORD

GCHQ works extensively with technology and software to support our mission and to support the operation of our business, communications, infrastructure and management needs. We deal with high complexity issues in terms of technology and engineering and so like any progressive organisation we keep an eye on the future, emerging trends and schools of thought so that we can adapt and evolve to be the best we can be.

The technology industry is always changing, and it seems that the pace of that change is increasing. We feel it as much as other government departments and commercial organisations and so we offer this internal research paper publicly, not to present policy or guidelines, but to stimulate debate.

This paper examines a series of change characteristics and the directions they appear to be travelling in – the authors recommend that organisations consider how they wish to move along these scales and how those changes may need to be considered together to achieve systemic improvement rather than localised changes. I think the debate is healthy and useful as despite the "Boiling Frogs" changes not being right for every organisation, they do offer an opportunity to discuss where an organisation might need to be.

Change is never simple, and this paper doesn't offer a quick fix, specifically it doesn't cover how to change a complex organisation or what an end state would look like. Part of the point of embracing this kind of change is that there isn't an end state because change is constant.

Dr. Niel Kempson
Director General Technology
GCHQ

EXECUTIVE SUMMARY

GCHQ has a reputation for being the best technical delivery organisation in UK Government. This reputation has been built on years of successful delivery of complex systems in challenging environments. Looking at business, management and technical trends globally we see an increasingly disruptive environment for technical businesses and organisations, including GCHQ and its partners. In fact, the pace of change is becoming so rapid that traditional approaches to managing large organisations (in both the public and private sectors) are struggling to keep up. This challenge is not just about technical change, it is also about the way we need to think and behave in order to get the most out of new technology.

There are a number of global drivers affecting organisations in significantly disruptive ways: Consumer IT, Big Data, Cloud, Social Business, Mobile and more. As a result, disruptive innovation in products, ways of working and strategy is increasingly the only game in town for technology-focussed organisations. In order to maintain competitive advantage, old ways of working for our more predictable solutions are no longer appropriate when we need to create new value by working on speculative, creative solutions. Overall, this pressure is causing a desire in the wider ecosystem for business and technical agility in the pursuit of reduced time to market, elastic flexibility, reduced waste and promotion of creativity.

This paper identifies and examines critical business characteristics that promote business and technical agility describing how organisations need "less of" some characteristics and "more of" others. Rather than changing one of these characteristics in isolation, we believe that organisations need to improve holistically, not in terms of a binary step change, but in terms of force-multiplying cohesive change. For each characteristic, we propose a direction of change covering:

- Operating Model (inc. structure and interaction styles)
- Organisational cultures
- Use of accommodation
- Approach to measurement
- Skills management
- Use of commercial suppliers
- Leveraging Big Data
- Approach to architecture
- Use of processes and techniques
- Approach to Security
- Approach to HR

Finally, this paper includes some of the background reasoning collated from internal blogs related to organisational structuring, types of jobs and the effects of Conway's Law on business change.

Contents

Boiling Frogs

The story goes that if a frog is placed in a saucepan of cold water, which is slowly heated, the frog adapts its body temperature to the changing heat of the water and gradually goes to sleep. In fact, it goes to sleep at 40 °C, unaware that at 100 °C it boils alive. However, if the frog is placed in already boiling water it immediately jumps out to safety.

This is a useful metaphor to illustrate that although humans think they are very clever at adapting to the changing world, they don't necessarily recognise the need to jump out of that world and take charge of it, not just adapt to it. There is a risk of being blissfully unaware that the world is changing so dramatically that there is danger of boiling alive whilst asleep.

Please note, no frogs have been hurt in writing this paper

Organisations are systems, not just the sum of their business units and departments but also the product of interactions amongst all their elements – including both internal interactions as well as those with customers and suppliers. The system is changing - but how aware are the system's inhabitants of the direction and impact of those changes?

The pace of disruptive change is increasing, from the rise of cloud technology, social business, the Internet of Things and others. We need to jump out of our world and consider the big picture. This paper proposes a holistic approach to driving change in our organisations, strategies, practices and business activities. Technology businesses need to understand and include a wide range of elements and their interactions to ensure they are in the best possible shape to face a disruptive present and future – before it's too late.

External Changes & Disruptions

Consumer IT
Big Data
Social Business
Internet of Things
Cloud
3D Printing
Competitor Innovation
Other Political and Environmental factors

1. So why do we need fundamental change?

The pace of disruption and radical change used to be measured in decades. If a business knew what it was going to do for the next 10 to 15 years, then focussing on efficiency and predictability made sense. However, the pace of disruption is accelerating, and as it does so focussing on efficiency and predictability actually becomes detrimental to an organisation's health. Business agility and delivering new business value become the only game in town.

In many organisations the last ten years, although not without great challenges, have been a period of relative stability as far as technology and business needs are concerned. Success has been judged against this background of stability with an emphasis on control of budget and plan variance.

Organisations have evolved and increased in scale during this period of stability into highly structured machines with well-defined processes and procedures designed and developed to maintain and enhance their current capabilities.

"They shouldn't build those Death Stars anymore. They keep getting blown up"

Lt. Col. Dan Ward's Daughter - "Don't come to the Dark Side – 2014"

2. Don't come to the Dark Side

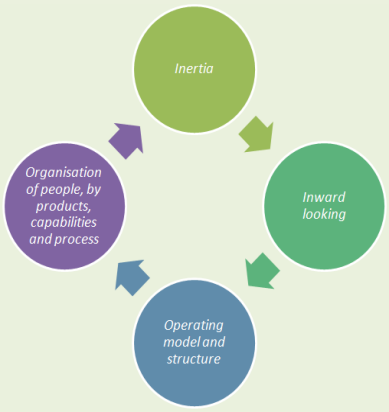
During stable times organisations are tempted to build big systems – multi-year projects of brain melting complexity, like the Death Star. Despite these large programmes and projects rarely working they've become the standard approach in many organisations. The technological environment is now moving too quickly for us to take years building big solutions. If we try we'll get blown up.

The "Big planning" approach to building a Death Star just isn't relevant to speculative exploratory work. In fact, it's wasteful. Instead, technology organisations need a number of flexible, small solutions that can be easily combined in different ways. To survive we need to incubate ideas quickly, failing fast and learning from the experience. A project failing isn't a bad thing if it fails early, in fact that's something to celebrate!

We need different ways of working to build an astromech droid rather than a Death Star and it'll be a lot more useful. However, it isn't that easy of course. Years of success in taking the same business approach deters people from trying new methods. Change itself becomes something upsetting, to be resisted or worse, denied (like the frogs slowly coming to the boil).

3. Why is complex change so difficult?

1. Inertia built up through consecutive years of past success
2. Inward looking behaviours on spend, budget, staff metrics
3. Creation of a high number of roles, job descriptions, process and structures that are organised around the way we've *provided* value not the actual *value* that we provide
4. Organisation of people around existing products, capabilities and process, not by the skill & expertise they provide



These four reinforcing factors constrain people to current methods and approaches, focusing on inward pressures and thinking about how to improve the things we currently do, rather than the value we need to provide. This is why so many people miss the need to change radically. While it can seem counter-intuitive, when our primary focus is to manage the ***way*** we provide value our workload goes up simply because there's more "management activity". When we learn to manage ***value***, our workload and costs reduce because we're managing the output of our processes, not the processes themselves.

An effective response to accelerating technical disruption requires many changes across multiple aspects affecting people, process and technical concerns. Traditional sequential change to the way we conduct our businesses will be, in the main, inadequate and too slow to implement. In times of rapid technological and business change, organisations need faster decision making, fostering greater innovation for survival and growth.

As the pace of technology disruption increases organisations need to innovate to survive and so the types of work that many technology organisations do is changing.

Complicated	Complex
Problems can be made simpler by decomposition into smaller units.	Problems can't be reduced for simplification.
Successful execution increases chances of subsequent success	Successful execution does not assure subsequent successes
High expertise in a wide variety of fields is necessary for success	Expertise contributes to success but is no guarantee
Problems are similar in a number of critical fields; standard methods work well	Each execution is unique and must be understood as an individual problem, unique approaches are needed
Problems are linear in nature and can be tackled sequentially	Problems are interconnected and need simultaneous resolution
relationships between contributing parts is simple and well understood	relationships are interconnected, cause and effect is difficult to comprehend
High degree of certainty of outcome	Uncertainty of outcome persistent

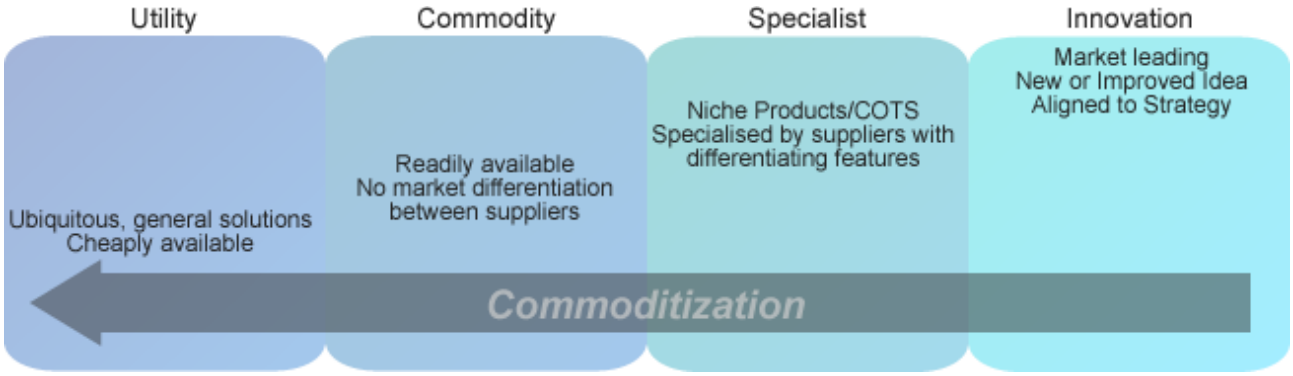
Complex vs. Complicated inspired by "Wicked Problems" – Keith Grint

There is an increasing proportion of complex work, new types of problem, which are rare, unpredictable, speculative, undefined, and constantly changing. Consequently, there is a reduction in the proportion of simple complicated work that is predictable, stable and large.

4. Commoditization Scale

A useful mechanism for understanding different types of work, and the different approaches that may be applicable to delivering them within a portfolio is the "Commoditization Scale". The Commoditization Scale describes a range of types of work from innovation (undefined, rare, speculative and high risk) to more commodity/utility (well defined, ubiquitous, and less differentiated with lower risk).

These different types of work require different ways of working, contractual models, technologies, supply chains, cultures, processes etc. Well-understood work is more predictable and manageable by its nature, whereas the opposite is true for less well-understood work.



Commoditization Scale inspired by Simon Wardley's Evolution Curve

If an organisation primarily works in the Specialist space then it is building unique products to solve specific business problems, in this situation, it does not make sense to build utility or commodity components, systems or products, they can simply be bought/acquired from suppliers or open source communities. For example, an organisation building public service websites would not build a software configuration management system for itself, this is a commodity capability that is best served by well-established tools such as the open source Git.

Alternatively, if an organisation is primarily focussed on utilities or commodities (e.g. power supply) then working on innovation and specialist products is most likely to be either as part of an efficiency improvement or a long term strategic play as it's not part of the (current) core business.

However, there are many complex organisations, which work on solutions that are distributed across the commoditisation scale; these organisations have complex value streams internally and with supplier ecosystems. For these organisations, no single method is applicable across work of such variation, indeed the methods and cultures at the extremes of the commoditisation scale will be very different potentially causing conflict. An approach to solving this issue is described later in this document in section II.A.2 the Hybrid Dynamic Model.

5. Less and More

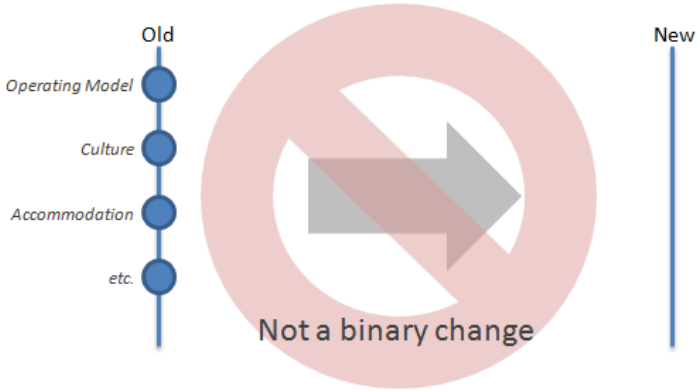
As an organisation is affected by disruptions, characteristics of that organisation which may have been perfectly functional in the past may no longer be best suited to times of instability. As a result, many organisations may need to change fundamentally to react to instability.

The following table indicates the various characteristics and the types of change that organisations need to inspire, incentivise and implement. The "less of" characteristics are not inherently bad, they have served well in the past and they do have a place in the future, however moving towards the "more of" characteristics will put organisations in a better place to deal with periods of disruption.

Less Of	Type	More Of
Predefined Structure for everything	***Operating Model***	Mixed Dynamic
Functional Silo / Service Centre	**Structure**	Service / Cell / Pod
Transactional	***Interaction***	Collaborative
Inertia	***Culture***	Progressive
Bespoke / Fixed	***Accommodation***	Commodity / Configurable
Analytic	***Corporate Focus***	Outcome based
Single Discipline / Silo'd	***Skills***	Whole Lifecycle / Full Stack
Large + Time-Hire	**Suppliers**	Large, Medium & Small (inc Time-Hire)
Used	***Big Data***	Driven By
Bespoke, Scale-up, Design for Resilience	***Architecture***	Commodity, Scale-out, Design for Failure
Single Type	***Technique***	Mixed
Preventative	***Security***	Permissive / Enabling
Centralised / Generalist	***Human Resources***	Decentralised / Specialist

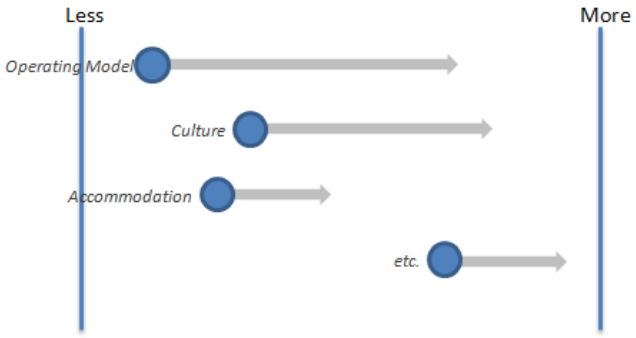
Many of these changes in characteristics are already diffusing in organisations around the world as they strive to be more effective and responsive to change. Other organisations that refused to move have declined in value, or gone out of business altogether.

Adopting these changes will not be enough to make an organisation successful without a well-executed business and technical strategy. The reverse is also true; a great technical and business strategy is all too often undermined by an ineffective organisation.



To survive rapid disruption technical businesses and organisations need to do less of some of the "old" ways of working and move towards doing more of the "new" ways of working to become more reactive, more innovative – better, healthier and happier organisations.

This is not a binary change; instead it's a collective shift in emphasis of these characteristics. Some organisations will have further to change than others as each organisation has a different starting (and finishing) position for each characteristic. The key is keeping these changes moving together in the same direction and ensuring that changes force-multiply, moving organisations into the best possible shape for the future.



As with all change, there will be pockets of enthusiasm but also there are pockets of resistance and indifference. Of course, there are also a fair number of boiling frogs.

The rest of this paper examines each characteristic and the required direction of change in more detail.

II. CHANGES

A. Operating Model: Predefined Structure → Mixed Dynamic

An "Operating Model" describes how an organisation does its business in terms of both its structure and its behaviour – it is the business architecture. An "Operating Model" exists in every organisation, whether it is explicitly written down or simply a collection of processes and practices. The Operating Model includes how strategy flows through planning and delivery, how money is spent and controlled, how governance works, how people are organised and how quality is assured. If the Operating Model is inefficient or unable to react well to change, everything else suffers.

1. Common Operating Model Problems

Many organisations evolve an Operating Model that fits their stable way of working, allowing for a focus on efficiency and improvement, driving out variation. This approach works well in periods of stability but makes organisations brittle and unable to react well to change because the only way the organisation knows how to deal with things is to apply its tried and tested approaches.

Common problems often cited are:

- Predefined structures often reinforce themselves, serving the structure rather than need.
- Communication across hierarchy can be slow and ineffective.
- Information flow through multiple layers top to bottom and vice versa is slow.
- Policies, rules, procedure become barriers to strategic speed and decision-making.
- People cling to their habits and fear loss of their power bases and stature.
- Repeatedly returning to the same small number of trusted people to lead key initiatives.

The following examine some of these problems in more detail.

Predefined structures in large organisations are typically built by focussing on the core business, the specialist or commodity services and products that the business produces. Many organisations split their development workforce into functional areas (e.g. lines of business, service centres, departments and similar) in an attempt to reduce management complexity.

These constructs promote organisational stability over workflow. If required work is closely aligned to the structure of the organisation, and a big engineering project is suitable, these rigid structures can work very well – in fact, that's what they're designed to deliver. However, structure reinforces barriers, creating inertia and constraining the organisation to produce capabilities, which reflect that organisational structure. (Conway's Law) (page: 43)

> "Any organization that designs a system... is constrained to produce a design whose structure is a copy of the organization's communication structure."
>
> ***Melvin Conway, 1968***

Structure affects the way work and information flows in the organisation. Often work is forced through workflows with multiple handoffs; each handoff point is both a queue and buffer in the

system. For example: A request for work initiates a definition phase, this is broken down into smaller parts resulting in formal Change Requests which are passed to various functional areas and so go through take-on-work processes, triage groups, change control boards etc., etc.

This kind of structured process is a primary impediment to business agility in many organisations, effectively negating any benefits of agility gained by product delivery teams.

Functional areas are typically intended to take responsibility for a range of products (roadmap, strategy etc.) as well as managing a pool of people (employees and/or contractors/suppliers) to cope with a set of potentially competing demands from different project/programmes. In practice where multiple demands for services are made this dependency management and coordination is often performed by management structures *above* the functional areas (such as projects and programmes) *and* the functional areas themselves thereby duplicating or even triplicating processes and structures. “Take on work” processes in functional areas and the main Portfolio Selection process are a common instance of this overlap.

These structures tend to reinforce themselves, hiring more people into each separate group further entrenching the “standard” approach into an organisation. Complex organisations that work across various areas of the Commoditization Scale (page: 8) often need fundamentally different working practices for distinct areas of the scale, and indeed to evolve work across those areas. Attempting to apply a single form of working (e.g. classic Project Management or Emergent Agile Architecture) across all areas, as a single predefined structure simply does not work.

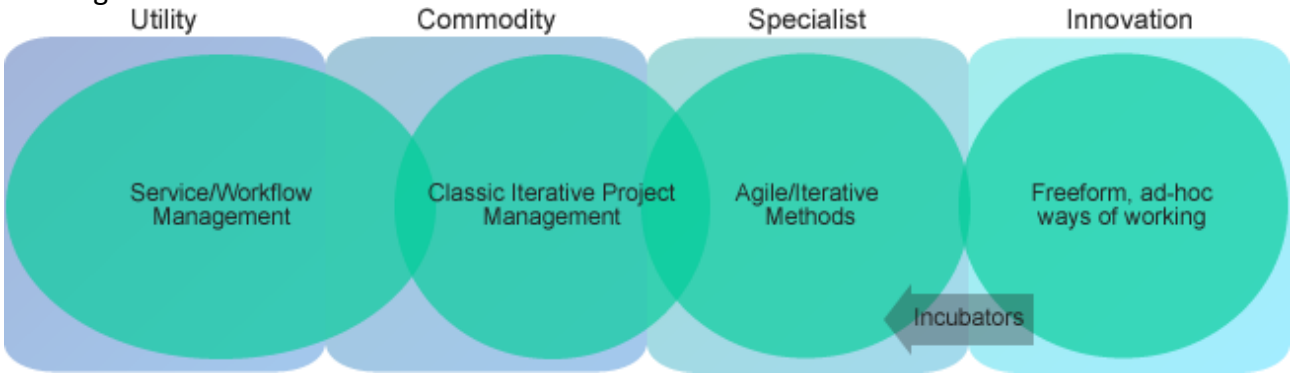
We shouldn't be averse to all organisational structure - it temporarily crops up in many forms all the time. However, for responsive and agile organisations able to deal with emerging requirements for products where the work is complex, speculative, undefined, and constantly changing we need a more radical approach to how we are structured; applying predefined template organisational structures to speculative work constrains the teams’ work capacity, often to the point of near paralysis.

It is much better to allow project teams to form structure temporarily to suit the group’s needs rather than having automatically invoked predefined structures. People are more than capable of reaching out to collaborating teams without imposition of formal structure. We should create structure when, and only when, it is required. When we have no need for structure, it should not exist as it has no value in and of itself.

Forward leaning organisations need less structure not more. You don’t make work faster, better, cheaper or happier by adding more layers of management.

2. Hybrid Dynamic Model

Large, complex organisations have significant effort and coverage across the commoditisation scale. Implementation of a ***hybrid*** model caters for this variance using unstructured ***and*** structured models where necessary. Structure is introduced only by exception when explicitly needed to orchestrate effort across divergent teams and portfolio(s) not as the default approach. Importantly, as pieces of work become more understood, or product sets evolve they will likely begin to move on the commoditisation scale and so may need to ***dynamically*** change their ways of working.



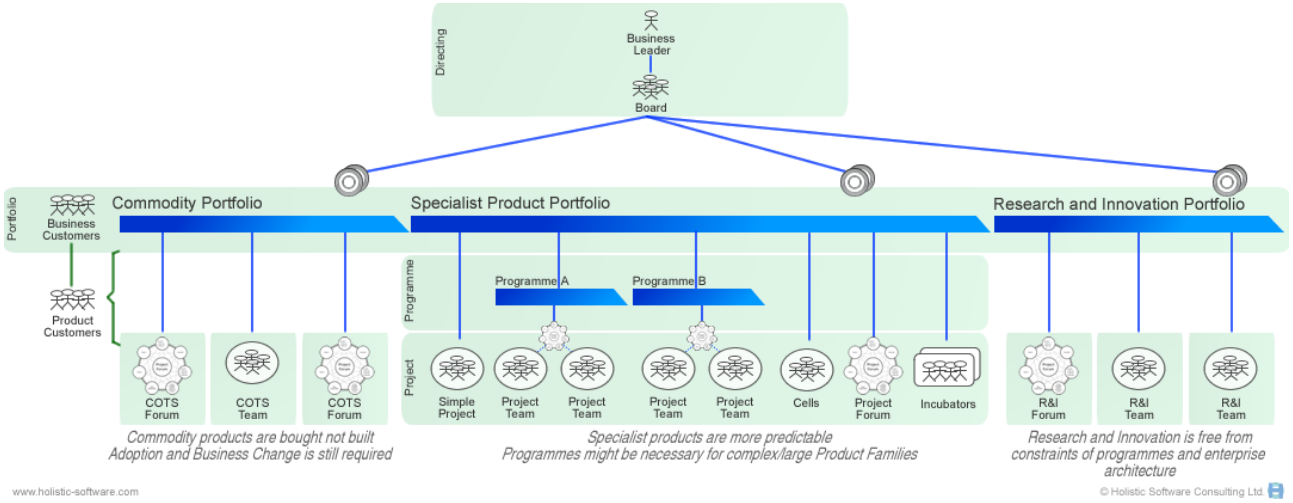
Innovation and research work is typically riskier, complex and more speculative than mainstream specialist products and so will be less tolerant of up front planning and definition approaches. "Failing fast" is particularly important in innovative/inventive work and this type of work is typically very unpredictable. Surrounding innovation work with significant structure (in terms of project, programme and Solution Architecture) is unlikely to be productive.

Importantly, this work should also be unconstrained by Enterprise Architecture (and indeed "standard" ways of working) with very flat management structures. Innovative work is best treated as self-organised Product Delivery/Research teams that are directly part of the portfolio, with no programme structure free to borrow bits of other delivery models as they wish.

Similarly, and perhaps counter intuitively, there is also less structure required in the Utility Portfolio and Commodity areas (because the products built are often well-understood, predictable, related to system integration and frequently COTS). This type of very predictable work often benefits from workflow management techniques such as Lean, Kanban or service management processes.

Structure is typically used, although only when needed, in the part of the organisation building Specialist Product Portfolio(s). A typical mistake organisations make is in imposing standard structure (e.g. programmes and projects) to all Specialist work. This is unnecessary, a variety of delivery models such as cells, incubators, simple projects and others are all available and can directly contribute to the portfolio. We need to use the right tools to solve each different problem.

Using the hybrid dynamic model organisations can have multiple operating models co-existing harmoniously within a single enterprise portfolio in an organisation. Using different ways of working, practices and techniques across the portfolio helps bring together the otherwise extremely different extremes of innovation and research work with predictable project delivery. Other business models, such as Incubation, can also be used to help bridge the gaps between areas such as innovation and mainstream engineering practices.



Hybrid Dynamic Model from holistic-software.com

Many organisations evolve a Portfolio → Programme → Project → Team model, which is then applied to all work in the portfolio due to its past success at delivering large predictable engineering projects. However, this model is wasteful when complexity is low and can actually inhibit communication and feedback cycles in more speculative work.

Programme and project structures cause layers of separation, which result in emergent transactional behaviour, effort duplication and confusion over roles and responsibilities. As a result, programmes should only be used when there is a genuine requirement for co-ordinating multiple projects that must be integrated for a cohesive product family or business capability. In other cases, programme structures should be condensed - removing programmes that are simply funding lines; Portfolio Management can and should manage funding lines and stand-alone projects can simply be part of the portfolio.

Reduction in structural complexity will reduce costs, increase flexibility and adaptability while simultaneously improving an organisation's ability to react in a rapidly changing environment. Additionally, simplifying structure will reduce the sheer numbers of people involved in project management and definition work, removing unnecessary barriers between delivery teams and their customers.

What is an appropriate ratio between Project Managers and team members? What is the actual ratio in your organisation, department or team?

As soon as structure is introduced it influences the communication flow and working patterns, constraining architecture and eventual solutions as described by Conway's Law. Organisations should adopt the general principle that the default starting point is the smallest operating structure possible and only increase the structural complexity as and when it becomes necessary. Generally, organisations are not building Death Stars, and even where they are doing so, they probably shouldn't be.

3. Interaction: Transactional → Collaborative

Where work is becoming more complex, organisations must be designed to enable continuous emergent outcomes. The global software industry needs less transactional forms of communication and more collaborative co-creation between people. This is increasingly important across teams, business units and commercial boundaries as value streams diversify to increase productivity and ensure that the right products are built for customers.

A recurring underlying problem with failing projects is a lack of join-up between stakeholders and the working practices throughout the development stack, in contrast to the local interaction inside teams or between teams.

Co-locating interacting teams allows human communication between those teams to improve organically, increasing understanding between teams, which leads to improved technical interaction. Organisations need to focus less on "horizontal collaboration" across their development teams and more on "vertical collaboration" between teams and business customers.

There are significant benefits in co-locating teams; collaborative working becomes easier and more efficient due to direct communication. Fewer meetings are required and fewer misunderstandings occur as feedback on ideas, problems, and solutions can be immediate. Where co-location is not possible, or complexity requires the power of a crowd or networked ecosystem, then communities can be brought together by collaboration technology and open source ways of working. Of course, the underpinning human networks are still critical enablers for effective teamwork and so technical collaboration should always be considered secondary to direct face-to-face communication.

Conversely, it can sometimes be advantageous to *not* co-locate teams when barriers to communication, duplication of work and output may actually resonate with strategic goals. For example, if we wish to build a number of different, resilient, diverse capabilities, which can exist independently of each other, even in the event of catastrophic failure, then using different teams with different supply chains in different locations will enable this strategy.

The industry needs to develop a culture of "Customer Obsession" where teams and individuals throughout the organisation understand who their true customers and stakeholders are (not an intermediary in the organisation or planning hierarchy) and work to deliver value to the point of service.

Modern iterative development methods stress the need to refine requirements constantly to check that they are still correct, have been elaborated correctly and have then been implemented correctly. This means that end customers and users must be directly involved in development processes. If a product's consumers are not humans, instead, they are other systems requiring services then programmatic interfaces still need to be explored and elaborated. Errors creep in through layers of translation and are exacerbated by the use of representatives in place of customers/users.

"Customer proxies" in the form of Project and Programme Managers, Technical Leads and even delivery team members acting as customers is an endemic problem in large complex organisations and part of the reason why so many IT projects fail. Customer Proxies create multiple layers of

translation and separation, which cause a divergence between true requirements and the mass of requirements documentation and/or items in work-item tracking systems. Misidentification of customers and stakeholders also completely breaks the corrective feedback loop of requirements review and iterative/release demos.

Industry has recognised the customer proxy problem and has responded with both the Agile movement and Lean movement. Unfortunately, when badly applied, both approaches can mask the customer proxy problem rather than solve it, further extending the cone of uncertainty and moving delivery risk into the business rather than reducing it.

Sometimes use of Customer representatives instead of actual customers is genuinely necessary but in many organisations users/customers are calling out to be more involved in delivery and many development teams are similarly calling out for user involvement. Businesses may feel that they cannot afford for their operational business personnel to be spending a good proportion of their time involved in software development. In reality these organisations cannot afford ***not*** to spend time ensuring their software investment is directed properly, resulting in real business value.

There is still a place for project management professionals and requirements professionals, but it is not in owning and controlling requirements or their acceptance criteria. These specialist roles still exist because some of their functions have significant value. If we deconstruct the functions that Project Managers typically provide we can list:

- Leadership
- Communication
- Coordination
- Stakeholder Engagement and Management
- Local risk and issue mitigation
- Continuous Improvement
- Conflict Resolution
- Planning

Despite traditional planning techniques, being largely unsuited to modern knowledge work there is still value in these other functions – however they should not necessarily all be the responsibility of a single person. Many teams are capable and better suited to performing these functions themselves - however, other teams may want someone to take care of some these functions for them. The root cause behind the need for many of these functions is the complexity of the planning, management and structure of the organisation itself (an example of the Homomorphic force - page: 49).

The technology industry needs less Programme and Project Structure causing layers of separation and transactional behaviour. Organisations need less of the specialist roles believing that they own and control requirements (such as Project Managers and Requirements Specialists/Business Analysts). The industry needs less Project and Programme Managers, less plans and documentation, less abstract architecture, less bureaucracy, less process and less structure.

All of these practices have evolved to try and join up customers to delivery teams and yet are now the impediment to direct, rapid communication. Instead the industry needs more developers and operational business people working together to deliver valuable business outcomes. The technology business needs less passive plan followers and more active problem solvers.

Software and technology are pervasive and critical to our societies and yet are often misrepresented through the use of production or construction metaphors leading to mistreatment by organisations. Both of production and construction metaphors lend themselves to traditional Project Management approaches and transformational approaches to requirements, which often do apply to work in the utility and commodity spaces. Unfortunately, as evidenced by large numbers of high profile failures, software does not fit those metaphors well across the whole range of different types of work.

The software industry needs to reduce the burden of management overhead and complexity; this would reduce costs, communication confusion and even overcrowding. This overhead does not just inhibit communication between customers and delivery teams but also obstructs communication between strategic management and delivery teams.

B. Culture: Inertia → Progressive

Culture is a function of the mind-set of the people. It's a product of thought and behaviour; it doesn't exist in isolation.

Culture is the set of beliefs that drive behaviours. These can be things everybody in the organisation knows and shares, as well as unspoken rules. The ranges of acceptable employee behaviours are based on these underlying beliefs.

> *"Organisation culture is a product of the system"*
>
> *John Seddon*

Organisations and individuals don't have one culture, but many. Just as a person doesn't belong to just a town, or a country, but easily belongs to both organisations don't have just one homogenous culture.

Culture is seen as relatively fixed, difficult to change and often a source of inertia. However, for greater responsiveness and adaptability cultures must be fluid and progressive. Culture should be steered to align with the business strategy, not vice-versa, where existing culture is at odds with future strategy and constrains opportunities.

Some organisations have a strategic focus on innovation: Employees are encouraged to think creatively and share new ideas. If the culture is aligned with innovation, employees are rewarded when their new ideas hit the jackpot, and they aren't penalised for constructive failures. In fact, "failing fast" is an encouraged behaviour.

Research: Google and Apple are two companies that promote this kind of culture. These organisations promote a dynamic, entrepreneurial, and creative, innovating culture. Risk taking and spending time on "Passion Projects" are embraced by employees and leaders as they strive to be on the leading edge. Within reason, the best innovators tend to be protected from bureaucratic processes and structures that might constrain their creativeness. This is the culture needed in research departments, where there is a commitment to experimentation and thinking differently – and unconstrained by corporate bureaucracy.

Mainstream Engineering: The work of mainstream development is different from research and it needs a slightly different, but overlapping, culture. Engineering culture should drive behaviours focusing on success through delivering unique and new products, learning from successful research, collaborating with partners and improving existing services. This should be done within an environment where individual initiative and freedom to do cool things are encouraged both independently and through organisational constructs such as Incubators.

IT Services: "Fail fast" is not the kind of culture that would suit an organisation like Amazon that competes using a strategy that is highly focused on efficiency. In Amazon's case, it's important to

have clearly defined job roles and for everyone to know their place. Amazon doesn't try and do expensive high-risk innovation, it actively discourages it, through procedures like their "internal press-release".

> *The "internal press release" involves writing an outcome focused press release describing the solution as though it's already been done. This encourages people to think about the impact of changes rather than the mechanisms of change and justify change in terms of tangible business improvement.*

Amazon expect others to do the innovation for them and have been incredibly good at spotting external innovation, copying it and commoditising solutions to offer high-value services such as books, cloud infrastructure, groceries at low cost.

Amazon train their operation leaders in high formality, low tolerance quality approaches (such as six-sigma) to inject more efficiency and productivity into the company's predictable systems. This focuses the organisation on operational excellence and on doing things right. This approach is what is needed from IT Services departments, where a culture of customer obsession, a commitment to continuously improve and commoditise services for the benefit of the rest of an organisation and its partners. These services in turn enable Engineering and Research to create new value for the organisation.

Amazon, Apple and Google are all tremendously successful companies, but have very different cultures. There is no such thing as good or bad culture, just one that is effective or ineffective.

Ultimately, effectiveness depends largely on how well the cultures align with the business strategies of an organisation, and how aligned culture is to context. Progressive cultures that support the types of people and jobs we need (page: 38) are required to deliver successful products.

What about balance?

What should the balance be between research, mainstream engineering and core services? When a company focuses its efforts on executing today's business model, and ignores R&D (investment in the future) short-term revenue and profits initially go up. But ignoring the future has consequences and those chickens will eventually come home to roost. Many organisations look at putting 10% of their investment into R&D – of course this ratio is based on the other 90% doing productive and useful things.

Without a holistic approach to cultural change individuals will reverse engineer the success of others to see how they should act – indirectly inferring what the organisation truly values.

Desired culture should be explicitly defined and promoted by senior leadership to inform and guide the wider community towards that which is needed. The proof of commitment to that culture is then in the behaviours that are incentivised and rewarded and behaviours that are actively discouraged.

Leadership is required to drive culture and changes are necessary throughout recruitment, HR, promotion practices, training and workforce development.

C. Accommodation: Bespoke/Fixed → Commodity/Configurable

Accommodation with a standard fixed layout that is difficult to flex & adapt to the rapidly changing types of people & work causes friction which people either work against accepting loss in productivity, or leave in pursuit of an environment that is more congruent.

Successful accommodation could be compared to a TARDIS, it doesn't need to look amazing on the outside (in fact it looks commodity – much like a boring office building), but inside, it feels enormous and is packed full of variety that suits the diverse needs of its occupants.

Technical organisations often seem to focus on a SIDRAT – it looks pretty cool, huge and space-age on the outside, but on the inside it feels rather small, and looks fairly uninteresting - much the same throughout – a one-size-fits-all approach that doesn't best meet the needs of the work and the changing needs of an organisation.

Good accommodation should provide layouts to suit varied types of work with individual and collaborative spaces, isolated quiet spaces, standard offices, labs, integrated IT and mobility.

Accommodation is a key strategic resource; however, it is not an end in itself. Accommodation must serve the business strategy – an accommodation strategy that is not aligned to business needs is pointless and self-serving.

Accommodation must be designed to be flexible and diverse to match working needs; all these things are part of the holistic work environment and are big contributors to employee engagement and passion. Similarly, accommodation must be aligned to strategy with the right kinds of accommodation being available for the different kinds of work an organisation needs to do.

Resonating accommodation and strategy helps drive strategic results e.g. using diverse supply chains in a range of locations to develop alternative solutions to complex problems.

D. Corporate Focus: Analytic → Outcome based

Through stable times there is a tendency to focus on the parameters of stability: percentage budget variance, milestone pass rates - the typical business metrics. This is referred to as the "Analytic Organisation" where the focus is on measuring and analysing aspects of work, environment and people in an attempt to demonstrate control and understanding.

Although measurement and understanding are the basis of empirical improvement the Analytic organisation can easily fall into the traps of measuring intermediary artefacts and dysfunctional measurement driven behaviour.

Frequently, planning is based on the need to spend the allocated budget effectively. This is caused by a negative pressure on managers to maintain original milestones and reduce unplanned overspend. An extreme of the analytic organisation is "Spend Driven Planning" when business decisions are made purely to avoid over- or under-spend.

An analytic focus typically leads to a focus on elements such as milestone pass rates, often creating a pressure towards very high pass rate in milestones and low financial variance. However, this pressure leads to milestones, which are largely dissociated, from the actual work (or incremental delivery of business value). Such milestones are simply measuring that time has passed with 6 monthly milestones passing every 6 months. Recursive layers of planning structure obfuscate and further exacerbate this problem.

Where an effort is made to link milestones to functional delivery or quality such efforts are often undermined by the pressure to deliver a low financial variance against budget, which leads to continual re-baselining of milestones.

Tracking milestones is only useful when the milestones are defined in terms of:

- Scope - typically in terms of linking to high level requirements (e.g. features)
- Quality - Linked to a "Definition of Done" or "Acceptance Criteria"
- Time – Linked to a target time or estimate

Analytical focus can often lead to knowing the cost of everything and the value of nothing. To understand "business value" it is necessary to think about who the customers actually are. All too often teams consider someone in the planning hierarchy as their customer, missing the point somewhat.

In for-profit organisations “value” can often be simply defined in terms of profit – but for non-profit organisations it’s a little more complicated. To understand value in these organisations the work of Akao and Mizuno is useful:

> Value is recognized when Customers perceive one or more of the following:
>
> - A problem of theirs is solved or minimized
> - An opportunity they desire is seized, maximized or enabled
> - That they “look good” to significant others
> - That they “feel good” about themselves

It is possible to apply these tests to understand the value of a piece of work – the question then becomes: “Is it worth it?” which is a subjective decision for Business Leaders. If a piece of work (or part of a process) does not meet any of these tests then it should be stopped, as it is not providing value.

In a world where organisations need to respond to new business opportunities or customer requests within weeks, a 6 or 12-month multi-level planning cycle is not good enough. The impedance to getting work done that is built into organisations for previous, more predictable work is now a source of considerable inertia. In many organisations, the planning hierarchy is often cited as a barrier to getting work done. Interestingly, this criticism comes from all angles with executive management, customers and delivery teams sharing the same feeling.

Planning methods can’t, and aren’t, keeping up with the pace of change. Less time needs to be spent “learning to plan” and with more time “planning to learn”.

E. Skills: Single Discipline/Silo'd → Whole Lifecycle / Full Stack

Professionalization of disciplines has encouraged the development of "I-shaped people" who have narrow, but expert skills in one specific area. This has also encouraged growth in silo or part-lifecycle skills. For example, in IT infrastructure there are specialists in storage, network, processing, specific applications, support and many other fields.

Historically these "discipline" silos have been efficient in getting the job done, as they've built deep technical expertise in their assigned silo having a very clear understanding of their individual goals.

In software engineering, some business areas have grown separate roles for requirements, developers and testers (or indeed Project Managers and Architects). However, as software engineering has evolved as a practice, the world has learned that increased productivity can be gained from software engineers who understand and address the whole lifecycle, where each cross-functional team member is able to work on the majority of the team's work. This reduces internal bottlenecks and contention for a single person's time (the best software engineers are those who can understand customer needs, develop and test against that need). That's not to say there isn't ever a need for a deep specialist but what is required are experts that also have the underpinning foundations to enable a wider understanding of technical and business problems.

Separate business and technical areas make a collaborative focus on customer business value difficult as everyone thinks various parts of the equation "aren't their job". This mentality leads to transactional waterfall behaviours, which impede collaboration.

It means different things to be IT-savvy, for a technologist working in a software development role as opposed to an operational user in a business role. Metaphorically, some may refer to this as needing more "T- shaped people" who have two kinds of abilities. The vertical bar of the T represents depth of expertise in a single field (being a software engineer, Information Assurance, IT Infrastructure, networking, etc.), whereas the horizontal stroke of the T is the ability to collaborate across disciplines with experts in other areas and to apply knowledge in areas of expertise other than one's own (being collaborative and empathetic).

The cross bar of the T is not about technology, but about the relationship between converging technologies (and the business) and how much people understand about these relationships. As you increase the number of relationships (or technology linkages), the broader the crossbar on the T becomes. You don't get these cross-discipline/skill linkages, or become IT savvy without career development and support, through placements, secondments and working closely with others.

Business users also, increasingly need a lot of technical "domain" knowledge to be "IT-savvy" as the world is more Internet connected and technically enabled.

Organisations are learning that post-graduate degrees and professional qualifications offer little guarantee of real-world engineering and innovation skills, especially in cross-domain communication. In progressive technology organizations with multidisciplinary teams, there's an ongoing search for, and incentive to develop more "T-shaped" people. Growing the breadth of

skills and the diversity of people enhances the ability to flex and adapt for changing requirements. Above all people need to be skilled in collaboration and communication.

Technology has converged with the rise of virtualisation and cloud – additionally practices have evolved with the maturing of software engineering. Technology focused organisations need to incentivise both depth and interdisciplinary/whole-life cycle skills, not fragmented part-lifecycle or silo ways of thinking. Today's organisations need people with a deep understanding of technology, software development and how that can be applied in the context of business strategy and business goals.

F. Suppliers: Large + Time-Hire → Large, Medium, Small (inc Time-Hire)

It can make good business sense to use external suppliers. Examples of effective use include:

- To provide commodity IT infrastructure services (more efficient & cost-effective than in-house)
- To provide commercial off-the-shelf products
- To customise & integrate commercial offerings, why self-build, when you can buy?
- To bolster internal skill & provide specialist skills (being careful not to inadvertently outsource niche and core future strategic value)

Through stable times, the prevailing characteristics of work has meant there has been a large proportion of common, large, complicated system integration, and government has traditionally engaged with a small number of large system integrators.

There are an increasing proportion of new problems, which are rare, complex, speculative, undefined and constantly changing, with a corresponding diminishing proportion of large, complicated, stable engineering problems.

Technology evolves quickly and as the rate of change continues to accelerate, organizations must be careful to avoid lock-in to long-term contracts. No one can realistically anticipate what services will be needed in terms of technology and skills more than 5 years into the future.

The current environment with its new challenges demand people and partners who are capable of working in business contexts with dynamic requirements, where innovation and collaboration bring success. This requires access to a wider and diverse market of specialists and niche suppliers to complement in-house specialist skill.

In recent years the UK government has expressed an increased appetite to make more use of small medium enterprises (SMEs) seeking an increased value realised from smaller suppliers. Government departments should make more use of SMEs, which can provide valuable diversity of capability and specialist skills, suitable for non-commodity work. To take full advantage of this, government organisations need to do much more to reduce barriers such as security classifications and strive to produce frictionless IT connectivity around the work and people to widen access to this increased supply base.

It is important to learn from examples of Government, and other, IT failures. There are many reasons for these failures: combinations of incorrectly sized contracts, inappropriate change control, lack of supplier diversity, but also from cultural reasons resulting in inflexibility and poor responsiveness to change.

There are risks in engaging SMEs through large suppliers (where the large supplier becomes the middle-man between government and the SME) as this removes the responsiveness, agility and customer focus and increases the risk of failure (and cost) of SMEs; effectively undermining the SME engagement strategy. The further you are away from the client the further you are away from the user need. Although it seems compelling to allow large suppliers to manage SMEs the benefits of using SMEs may be significantly reduced, for both SMEs and their client, by imposing one-size-fits-all management, procurement and governance procedures.

Many SMEs do not wish to work via large companies, preferring direct engagement. Public sector and other large organisations must ensure that they do not dis-incentivise SMEs engagement by exposing them to an indirect model that diminishes their individual value proposition and brand identity.

Care must be taken to ensure it is not difficult to have direct routes for SMEs to deal with government. Such constraints would limit the market, as there are many SMEs who will not go near a large Systems Integrator.

Examples of risks to an SME working via a large supplier:

- Reduces SME margin and increases cost to end customer
- Reduces SME freedom to innovate as Intellectual Property is typically controlled by the prime contractor
- Introduces a layer of management and communication (increasing resource costs)
- Reduces an SMEs scope for growth as business opportunities are controlled by the prime contractor
- Misalignment of cultural fit and reduced agility

There are certainly SMEs who prefer to work indirectly with government through large suppliers, for a variety of reasons but the underlying reason for this is mainly because SMEs find existing government procurement to be frustrating and expensive to deal with.

It is important to ensure change in procurement and commercial strategy so that dual access methods (direct and indirect) are available with agile and flexible commercial underpinnings to offer a continuously updating wide-network of supply options. This will provide access to a diverse supply base having a good coverage across the market. The supplier base must not be limited to a small minority but include large commodity system integrators, small/medium sized companies and the niche specialist companies.

It is essential that business leaders understand how to align the value propositions of these types of companies to the characteristics of the work being undertaken, matching appropriate suppliers to the work characteristics so that the most cost-effective & efficient supply decisions are made without outsourcing core or future strategic value.

G. Big Data: Used → Driven By

As the world, and businesses, have become more connected more and more data is being produced. Collectively looking at the very large data sets now created by people, internet connected things, machine to machine communication and other sources presents us with new challenges and new opportunities. Taking advantage of Big Data opportunities is more than just gathering the data, it's about understanding the information space to understand the opportunities offered by Big Data and the exploitation of those opportunities when found.

When working with big data the most important things are the models of understanding and not the volume of data itself. Huge amounts of the wrong sorts of data don't normally get you anywhere. Companies that don't know what they are looking for (i.e. without a model of understanding) collect everything and cross their fingers. Luck isn't a great approach.

Big Data can let companies become more data driven, so that they make strategic and tactical moves based on evidence rather than guesswork and hope. Big Data can help companies understand their customers, suppliers, partners and even competitors. An unnerving example from retailing is that by using data analysis supermarkets have been able to work out that someone is pregnant and offer discounts on maternity products simply based on changes in their purchasing habits.

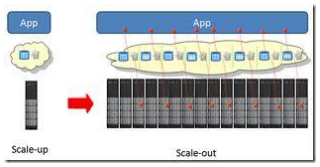
That kind of analysis may have gone a little far, but the idea of knowing what customers are likely to want, and offering it to them could be the business differentiator that determines which companies will succeed or fail.

Is it possible to use the ideas of being data-driven within an organisation to understand?

- What is the organisation's business value, where and how is it produced and consumed?
- Can business processes be tuned in near real time to respond to new opportunities or challenges?
- Can understanding of the current workforce, by skill and associated business context facilitate better workforce planning decisions?
- Can data be used to model the right retention packages needed for staff, based on performance, skills and leaving data?

Big data has become a competitive edge for many organisations that look to improve decision-making and advance business performance. Whilst the focus is not on the data per se but the models, these big-data systems are not simply used for information gathering but to actively run the organisation. Big data enriched with insights and analysis represents a powerful new way for charting business strategy and influencing decisions.

H. Architecture (Resilience + Capacity + Commodity)



The technology industry has favoured the use of architectural practices such as scale-up (bigger machines) for capacity planning, N+1 (more reliable machines) for resilience and single, time critical disaster recovery tests for testing of failure modes. These architectural practices tend to determine choices for enterprise class machinery.

That's not to say there is no longer a need for enterprise-class and bespoke infrastructure, but for the majority a commodity solution is good enough. The world is moving from one of treating infrastructure as pets, each one hand configured and given a cute name, monitored and nursed back to health when displaying problematic behaviour, to a world where infrastructure services are viewed as commodity; systems are just numbered and if they get sick are simply replaced by an off the shelf clone.

Cloud approaches, mind-sets and principles, such as elastic, metricated, on-demand self-service approaches should be extended across the enterprise removing reliance on expensive manual and front-door mechanisms which absorb resources by making priority calls against business priorities.

When making architectural choices in the design of new capabilities and services, publicly available cost effective commercial cloud solutions should be considered in preference to other options. These publicly available solutions should only be rejected if there are specific system requirements that cannot be met by them.

With a move to a more infrastructure as a service commodity approach, entirely different architectural practices are needed such as: scale-out or distributed systems for capacity planning, design for failure for resilience and use of chaos engines (i.e. the deliberate and continuous introduction of failure to test failure modes). These mechanisms enable highly capable systems to be built using low cost commodity components such as cloud storage.

I. Technique: Single Type → Mixed

Organisations have tended towards singular techniques (governance and methodologies) often referred to as best practice, e.g. Agile, Scrum, RUP, ITIL, Balance Scorecard, Lean, MSP or PRINCE2 for development. Single approaches to out-sourcing e.g. fixed price contracting to partners instead of time and materials; single governance approaches for governing work rather than a varied toolkit of techniques.

Examples of singular approach:

- Using the same delivery process for every piece of work, regardless of risk, size, technology, no. of people and other factors.
- Fixing the price of a piece of work that is novel, speculative and high risk will likely cost significantly more and risk failing to deliver value through restrictive change-control process.
- Using a standard enterprise framework approach that applies Programme, Theme and Project structures with many specific jobs for every piece of work.
- A single governance approach, where the governance level is high, but is likely to cause friction with novel and speculative work.

When new activities and techniques emerge and evolve their characteristics change. What starts as rare, uncertain, unpredictable and speculative becomes common, defined, measureable and industrialised through commoditisation. The governance and methods that need to be applied vary with those characteristics. At the extremes of uncharted and industrialised, the appropriate methods are essentially polar opposites. Given that any large-scale organization or venture will contain at least some components at each extreme, no 'one size fits all' method can ever be optimal.

A Better approach:

- Use continuous flow processes for maintenance and well defined, easily decomposed work
- Use agile/iterative/incremental processes for developing new products and capabilities
- Use fix-price contracts when asking suppliers to provide commodity solutions & utility services, providing cost-effect value.
- Use short-periods of (capped) time and materials contract models to de-risk speculative solutions followed by a flexible sequence of fixed price periods
- Train various roles across teams to use enterprise architecture tools and systems thinking, where appropriate, to ensure that value is added to the organisation and not just the local team
- Use Lean & Systems Thinking to optimise provision of operational IT Services and Capabilities to reduce waste from the supply chain.

The choice of techniques is driven by the risk impact of the project and the experience and expertise of the people involved. There are many examples of people with a lack of experience misunderstanding the purpose of a methodology, practice or technique leading to wrongly or badly applied techniques. Popular business axioms and management theories/fads are thrown around in such cavalier fashion that they frequently result in flawed decision-making.

Much commonly accepted management wisdom is not actually wise at all but based on misunderstandings and misapplication of “best practice” resulting in poor, incomplete, incorrect or outright obsolete thinking.

Just because a professor says it’s so, a consultant recommends it, a book has been written on it or a product has been developed for it, doesn’t mean that whatever “it” is constitutes a right option.

There are many documented case studies of public and private sector organisations that embarked on an enterprise-wide initiatives having been sold on “best practices” with associated toolsets, in one example, two years into a seven-figure implementation program the organisation discovered there was no material benefit to an implementation that was consuming considerable resource and revenue.

Single techniques can be detrimental if used as panaceas or “silver bullets”, without consideration of the context. A more considered approach must be to understand the nature of problems to be addressed, and apply a range of techniques from the toolbox to solve the problem. Just because we have a hammer doesn’t mean everything’s a nail.

J. Security: Preventative → Permissive/Enabling

Many organisations have implemented security approaches which are preventative. Unintentionally, preventative approaches have in some cases reduced usability and driven growth in Shadow IT and which can result in increased corporate risk and financial cost.

With the need for increased productivity and better digital literacy for our people organisations are going to see more requirements for consumerisation within the enterprise, with employees using a wide variety of consumer-oriented devices and apps for business purposes, e.g. laptops, tablet computers, wearables. In fact, with the growing ubiquity of commodity consumer-oriented technology, it's no longer going to be an option to ignore it. With commoditisation of activities creating new forms of technology, new opportunities present themselves for us to create value for our organisation with increased productivity.

The sheer volume of devices and access vectors implied by a digital workplace, coupled with the increase in sophisticated, dynamic attack methods and insider threats, makes the traditional approach of focusing on preventive controls increasingly ineffective.

While the value of, and need for, preventive controls will never go away, the digital workplace reinforces the need to focus more on detective and reactive controls, but security approaches need to be enabling and not restrictive. There are many examples of innovation in this space, like releasing a version of the Security Monkey, that automatically goes around a data centre detecting where data, or capabilities have left doors wide-open for exploitation and highlighting such weaknesses for the attention of their owners.

In practice, this means increasing investments in context-aware security monitoring for business environments, threat intelligence assessment capabilities and incident response. Pervasive, context-based monitoring and security information analytics will form the core of next-generation "enabling security" architectures.

Strategies such as the digital workplace implicitly recognise that users will be given more freedom in how they use technology and information. This implies a higher level of trust that users will exhibit appropriate behaviour in dealing with enterprises' information resources.

People-centric security (PCS) is a strategic approach to information security that emphasises individual accountability and trust, and that de-emphasises restrictive, preventive security controls. Increasing levels of trust to improve capabilities requires better training and education of users to potential dangers of the digital workplace and will have repercussions on the design and implementation of the systems they use.

Owners of information assets involved in the initiative must be informed of the risks, and the organisation's security team must help them assess the potential impact of the risks against the expected business benefits of the digital workplace. The affected information owners must be aware of and willing to accept any additional risk balanced against the benefits of the connected digital workplace.

K. Human Resources: Centralised/Generalist → Decentralised/Specialist

The technology industry needs less centralised, top-down, generalist HR, and more decentralised, agile, and specialist HR, which is better suited for flattened structures and cross-functional teams. Supporting these changes will benefit changes in performance and goal management, reward strategies, leadership skills and recruitment.

The yearly performance review is no longer good enough for fast moving talent management. Research shows that companies that revisit goals for employees quarterly, for example, outperform those that set goals annually by more than 30% (Deloitte 2013).

Many companies are aggressively redesigning their appraisal and evaluation programs to focus on coaching, development, continuous goal alignment, and recognition. The days of standard one-size-fits all competencies frameworks are slowly going away in today's talent-constrained workplace, to be replaced by a focus on engaging people and helping them perform at extraordinary levels. High performing managers play a hands-on role, redefining the role of leadership.

These fast-movers focus heavily on decentralised, hands-on, technical leadership. All these things are part of the holistic work environment and are big contributors to employee engagement and passion.

With a move to decentralised HR specialists, organisations are better placed to understand and deal with skills shortages where they need to build a supply chain for talent, partner with universities, establish apprentice programs, create developmental assignments, and focus on continuous learning.

Traditionally, the trend is to reward and promote individual evidence and competency over working together in teams. Evidence of performance is in the form of individuals taking credit for achievement rather than enabling others. A detrimental side effect of this approach is that measurement driven behaviours arise and the organisation tends to blame individuals for problems rather than looking at dysfunctional processes.

Modern HR processes must be designed by specialists with a deep understanding of current and future business needs to ensure organisations not only recruit, but also retain and develop the people that organisations need for today and the future. HR processes must take into account not only generic organisational values but also the necessary variances in culture, behaviours and skills required by specialist areas.

The way personnel are recruited, retained, rewarded and promoted needs to move from a one-size-fits-all approach to a tuned and tuneable HR system that actively drives the right incentives and rewards skills and behaviours vital to an organisation's changing needs.

III. CONCLUSION

The IT industry is in a period of disruption and organisations that respond positively, innovatively and radically will be in the best position to succeed. Many of the old ways of working aren't suitable for tackling the pace of disruptive change.

To be in the best possible place for the future, organisations need to take a holistic view of how to change towards flexible, efficient businesses, not just improving a small part or single characteristic in isolation but with an understanding of the big picture. They need less structure, not more; existing structures need rationalising to become flatter. Organisations must strive to be as lean as possible, without sacrificing learning and creativity, to enable the people to work together to solve tomorrow's problems.

There's no point in improving architecture without improving the provision of support. There's no point adding more structure and management when the need is to be more flexible and responsive to changing strategies and market conditions.

Caution must be exercised so that local optimisations are not made at the expense of the entire system. Many processes, structure and methods that were used previously made sense at the time of adoption, but the world has changed, the challenges have changed and the nature of responses must change. It's not what isn't known that should be scary. It's knowing that current practices are no longer effective that should be frightening. Organisations mustn't be scared of radical change, or of removing processes, systems and structure that are no longer as beneficial due to the environment changing around them, clinging onto ineffective methods further delays necessary change.

Effective response to disruption requires making many changes across multiple aspects affecting people, process and technical concerns. Traditional sequential change programmes to transform the way of conducting business will be inadequate and too slow to implement. To keep pace with the rapid advances in technology organisations need to achieve faster decision-making, foster greater innovation for growth and smoother, more direct, communication.

Organisations need to change their structure, culture and methods so that they can absorb and adapt to change rather than being destroyed by it. A popular quote often misattributed to Darwin and the "Origin of Species" is:

> *"It's not the strongest, fittest or most intelligent that survive, it's the ones that are best able to adapt to change."*

IV. APPENDIX

The appendix includes a number of posts collated from internal blogs, which provide useful background to this paper.

1. BLOG: DISRUPTIVE CHANGE

The incessant march of technical progress means that methods of communicating, processing, and dealing with information are exploding in volume and diversity.

Disruption and innovation are the foundations of technical progression, creating new ideas through research, invention and innovation, finding new opportunities and exploiting them.

As the technical landscape changes, either through our own invention and innovation or from external factors we face waves of disruption. The commoditisation of a technology has historically been a key disruptor. How we respond to that disruption is the difference between surviving or not.

> *"A central question to disruption is whether it is inevitable or preventable. History would tend toward inevitable, but an engineer's optimism might describe the disruption that a new technology can bring more as a problem to be solved."*
> ***The Four Stages of Disruption - Steven Sinofsky, Board Partner, Andreessen Horowitz***

In between points of disruption there are periods of stability when ways of working, operating models and department structures settle down to deliver known solutions in known ways. Of course disruption doesn't mean that there's no value in the output of previous stable times. We're at our best when we combine the old with the new, when we derive strength from diversity in terms of ways of working and experience.

However, past successes, bring with them an inertia that ripples throughout the whole organisation. This inertia can prevent and slow down change which is much needed when disruptions happen. Existing structures and ways of working, however functional in the past, may no longer be fit for the future.

Blockbuster and Netflix

Blockbuster and Netflix faced radical disruption in the home entertainment market with the rise of broadband internet. Both went into internet streaming but Blockbuster went bust and Netflix has been very successful.

Why did Blockbuster fail, and Netflix succeed?

- Was it because Blockbuster weren't first to market with online rental?
  - No, in fact Blockbuster were the first to market with online rental
- Was it because Blockbuster didn't have a compelling platform?
  - No, there wasn't much to differentiate the two platforms

The Answer: There was significant management inertia in Blockbuster that prevented them realising quickly enough that revenue was substantially declining; that the rental price of the real estate they had was crippling their ability to pivot towards a new business model. Netflix, being a new business, had none of this legacy either in terms of assets, structure, ways of thinking or resources. In short, they were a more agile business.

There are 4 stages of disruption. Four stages that comprise the innovation pattern for technology products:

1. *Disruption of incumbent*
2. *Rapid and linear evolution*
3. *Appealing convergence*
4. *Complete re-imagination*

Any product line or technology can be placed in somewhere in this sequence at a given time.

Stage 1 – Disruption of Incumbent

The stage starts the moment when we start talking about disruption, it is the first recognition that it's happening. This moment is typically clearer in hindsight than during the event (e.g. when did the iPhone disrupt Blackberry, digital photography disrupting the photo film industry, Amazon with bookstores and so on).

Reacting to this point means innovating and changing our approach (both business and technical).

Stage 2 – Rapid Linear Evolution

This stage involves the rapid development of new technologies or approaches. Characterised by evolution of initial concepts into a more "filled out" solution, incorporating some of the value of previous solutions, this stage is the normalisation of a disruption towards a stable period.

This period is still disruptive itself however, there's a strong emphasis on early adopters and on how the changes will impact the entire organisation. Often in an external market a company that can react first, and better, that can evolve more quickly will outlast a legacy company that is slow to move.

We will need new ways of doing things, new approaches and new solutions. We will need to rapidly evolve these things, sometimes in parallel as some will fail as we explore the future.

Stage 3 – Appealing Convergence

During this period, we can look for efficiencies in ways-of-working, operating model, scaling-up of our capabilities and delivery.

As our new products become more proven they'll become more mainstream, more ubiquitous and well-defined. There will be an increased supply of skills and delivery options. The treadmill of rapidly evolving features begins to feel somewhat incremental, and relatively known to the team. The business starts to feel saturated. Overall, the early adopters are now a maturing group, and a sense of stability develops.

At the same time, there is also a risk of second-system syndrome that must be carefully monitored

> *"The second-system effect refers to the tendency of small, elegant, and successful systems to have elephantine, feature-laden monstrosities as their successors." – Wikipedia*

The term was first used by Fred Brooks in his classic The Mythical Man-Month

It is not uncommon for the renegade disruptors, fresh off the success they have been seeing, to come to believe in broader theories of unification or architecture and simply try to get too much done, or to lose the elegance of the newly defined solution.

Stage 4 – Complete Re-imagination

The last stage of technology disruption is when a category or technology is re-imagined from the ground up. Although this can be thought of as just another disruption it's a fundamental shift based on previous forays into new solutions that causes significantly different behaviours both in

innovators and incumbents of current technology. For example, what does it mean to take an image? Share computation? Search the web?

> *"Reimagining is important because the breakthroughs so clearly subsume all that came before. What characterizes a re-imagination most is that it renders the criteria used to evaluate the previous products irrelevant. Often there are orders of magnitude difference in cost, performance, reliability, service and features. Things are just wildly better. That's why some have referred to this as the innovator's curse. There's no time to bask in the glory of the previous success, as there's a disruptor following right up on your heels."*

The Four Stages of Disruption - Steven Sinofsky, Board Partner, Andreessen Horowitz

This type of disruption is typically radical, and so requires a radical response. Combining old ideas with new ideas, to create an entirely new set of products and market, a new ecosystem to evolve and disrupt. Cloud computing is a good recent example or the re-imagination of both the mini/mainframe and PC-Server models (some would consider it to be a hybrid of the two).

Cloud computing involves combining the commodity hardware of the PC world with the thin client/data centre view of the mainframe world. It's not that simple however as the fundamental innovations in cloud computing deliver entirely new scale, reliability and flexibility, at a cost that upends both of the previous models. Literally every assumption of the mainframe and client/server computing was revisited, intentionally or not, in building modern cloud systems.

Typically, re-imagined technology will bear little relation to legacy approaches, requiring a reinvention of the usage, production and supply chains used. Applying the old approaches to a radically disrupted market leads to Blockbuster, whereas re-imagining leads to Netflix.

What stage of disruption is your organisation in?

2. BLOG: THERE ARE ONLY 4 JOBS?

I often get a fair few questions about performance management, objective setting and professionalization. With it being the start of a new reporting year I thought I would share some of my thoughts and perspectives, hopefully relevant to everybody. I recently read, and liked, an article that provided an interesting viewpoint:

> *"For the past 30 years my company has been involved in creating over 2,500 different performance-based job descriptions that define the actual work a person needs to do to be considered successful.... I can conclude that there are only four different jobs in the whole world."*

Lou Adler

The four jobs that Lou identifies are:

- ***Thinkers*** – they start things off with an idea, they innovate away from disruption. There are the visionary's strategists, intellects and creators.
- ***Builders*** – turn an idea into a new reality, they implement innovation taking a new idea from scratch and turning it into something tangible
- ***Improvers*** – improve an idea and the implementation of that idea, finding efficiencies and industrialising solutions
- ***Producers*** – repeatedly and predictably deliver known solutions in known ways

Of course people don't fit into simple boxes. Real people have a varied mix of skills and I think all jobs require a mix, in different proportions, of these four work types. There's merit in mapping skills to jobs however, and I think we can consider jobs on this kind of scale to align the right people with the right jobs. Lou refers to the risk when organisations don't focus on growing the right balance of talent:

As a company grows and reaches maturity, more of the work gets done by the Producers and Improvers. However, without a culture of consistent improvement, the Producers soon take over and implementing change becomes slower and slower until it stops. Long before this the Thinkers and Builders have left for some new venture. Improvers soon follow to join their former co-workers and hire new Producers to add some order to the newly created chaos. The old Producers who aren't continually evolving, learning new skills and processes, are left behind to fend for themselves. Maintaining balance across all four work types is a constant, but a necessary struggle for a company to continue to grow, adapt, and survive.

Lou Adler

Pioneer Culture

A blog I liked by Simon Wardley (CSC) offered a different but resonant scale. Simon suggested that there are 3 primary work types using an exploration metaphor. He talks about there being:

- ***Pioneers*** *(similar to Thinkers above)*
- ***Settlers*** *(similar to Builders/Improvers above)*
- ***Town Planners*** *(similar to Improvers/Producers above)*

The point is that when you're exploring a new area, taking on speculative risky work, you need a *pioneer*, someone creative who will find interesting and new ways. A *town planner* is unlikely to be able to fill this role well, but of course the opposite is true, pioneers may not be the best at building stable resilient long lasting infrastructure.

Settlers, steal from the pioneers, build products, listen to customers to increase features & respond to feedback. They use ecosystems. They constantly improve what exists.

Town Planners are good at applying known solutions to problems. They thrive when taking a methodical 'waterfall-like' approach to a well-defined problem with low variability and risk. As a result, the tools they use tend to be plan based, requirement based and have a high degree of process, formality and governance. They should be familiar with techniques such a six-sigma and drive operational efficiency from high volume operations.

Pioneers will provide useful challenges to *Town Planners*, especially in periods of disruption, as they offer new ways of forming towns as a response to dealing with disruption.

The purpose of both of these ways of categorising jobs (Pioneers to Town Planners and Thinkers to Producers) is that understanding the full nature of a job can help us ensure the right people are put into the job. It can help us put the right people into a new team. It can help us put the right balance of people and teams into a new business unit. Putting the wrong people in causes problems for the individual, the organisation and the culture.

Do you have the right mix of these kinds of roles in the right parts of your organisation?

Specific Measurable Goals

To be effective we need to link people's objectives to the business strategy. We need to flow down strategic goals through to individual goals to get everyone pulling in the same direction. Of course, some areas are already doing this.

When we look at career assessment we should do so through the lens of recruitment, looking at making objectives specific and measurable so we can get a genuine handle on performance-based job descriptions.

Instead of looking at very generic objectives we should look at the kind of things we really want people to do in a job, and assess those, perhaps in line with these job types (from Producers to Thinkers):

Type	Generic	Specific
Producer	Must have experience in financial reporting	Deliver completed financial reports for all of your projects by the 3rd week of each month
Improver	Must have experience in process modelling	Conduct a comprehensive process review of deployment processes to determine what it would take to improve end-to-end delivery time to operations by 20%
Builder	Must have experience in software engineering and delivery	Lead and deliver the implementation of the new order fulfilment system within 6 months
Thinker	Must have engineering background with a knack for creative solutions	Develop a totally new approach for exploiting a novel opportunity for new business value within 3 months

If you are helping someone craft their objectives, then make them specific and aligned to their job in delivering the business strategy. Work out which job type you're talking about and what challenges you're trying to solve when giving objectives.

How would you create specific measurable objectives for the following challenges that face our organisation?

Are your objectives specific and aligned to strategy?

Changes over time

Over time the mix of jobs that is required by an organisation will change. As we enter periods of change caused by disruptions to our market or technology the split of work will need to change, and the distribution of job types in organisational areas will need to change. We will need to free up Thinkers/Pioneers to think, moving what used to be innovative into more mainstream areas. Who are our thinkers and pioneers?

As ideas turn to new realities the balance of work flows from the Thinkers and Builders to the Improvers and Producers. There is a risk that we keep the ideas in the areas, or with the people, who created them instead of pulling them through to the people best suited to industrialise them. Leaving these engineering problems with the Thinkers can demotivate them, causing them to leave for pastures new where they can think about the hard problems and create new solutions

rather than support the ones they had a couple of years ago. Maintaining the balance across the four work types is a constant but necessary struggle for us to adapt and survive.

Facebook famously lived by the motto:

"Move fast and break things"

Mark Zuckerberg, Facebook CEO

Now 10 years old, serving over 500 billion API calls per day Mark Zuckerberg, Facebook CEO, has changed the motto at the F8 Conference in San Francisco last week to:

"Move fast on stable infrastructure"

Mark Zuckerberg, Facebook CEO

Even he admits it's not quite as catchy as the old posters are being pulled off the walls in FBHQ but Facebook has finished pioneering and is now settling having disrupted the market (Facebook were not the first social network, but are the most successful). Facebook has less need for Thinkers right now and more need for Producers. That is, until someone significantly disrupts the social media market.

There is significant value in having Pioneers, Settlers and Town-Planners in an organisation, indeed most organisations will not survive with a population of only Pioneers constantly pushing at the boundaries, chasing the next shiny problem and pioneering into new spaces. Equally organisations will not survive without them for very long, especially when disruption comes along. The trick is intentionally focussing the right people on the right type of work at the right time.

In the rush to act there is a risk of an emergent workforce which has lost sight of the bigger picture and end up doing the wrong type of work with the wrong people, creating inertia rather than adapting quickly.

As an organisation we need to focus our producers and town-planners into providing the commoditised services necessary to support our pioneering exploration. Not just in operational engineering areas but in all parts of the business from HR to Policy.

We need to focus jobs in every area on delivering the strategy by aligning specific objectives to strategic goals. We need:

- Pioneers/Thinkers finding new solutions, providing future value
- Settlers/Builders growing those solutions, leveraging from new and old
- Town-Planners/Producers industrialising existing solutions and providing resilient stable infrastructure

...and we need them organised the right way.

What do you think the right mix of jobs is?

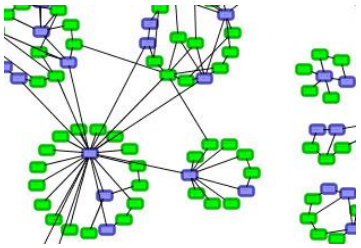
3. BLOG: I CAN PREDICT THE FUTURE OF YOUR SOFTWARE PROJECT

For several years I have reflected on how the organisation's communication structure impacts the systems and software it produces.

It was Melvin Conway who stated:

> *"Any organization that designs a system (defined more broadly here than just information systems) will inevitably produce a design whose structure is a copy of the organization's communication structure."*

Melvin Conway, 1968



We can see examples of Conway's Law at multiple levels within an organisation. At the lowest level, it is often stated as "If you have three developers writing a UI you will get three ways of doing everything (mouse click, menu item, short-cut key)".

CONWAY'S LAW IN ACTION

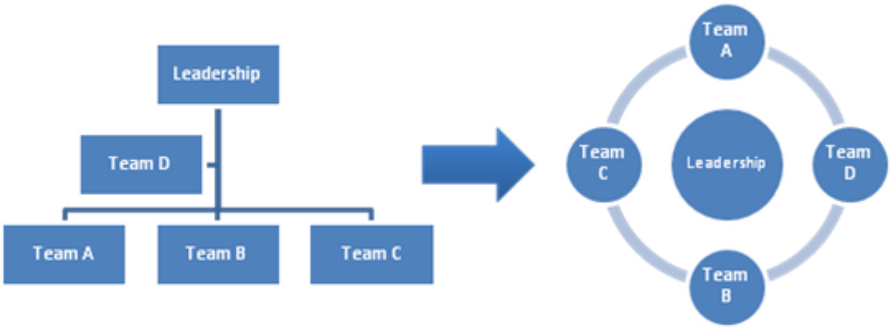
At a slightly higher level we organise around functional areas (e.g. processing, storage and presentation) then if we require a new product how likely are we to get a solution comprised of a data processing component, a storage component and a presentation layer? Is it possible to get anything else from an organisation structured in this way? Could such an organisation create a single component that fused these concerns or a solution separated in some other architectural pattern?

This design will be applied whether it is the best or not. Indeed, the system might not even need a relational database or a graphical interface - a flat file or in memory data store might have been quite adequate for data and a command line interface perfectly acceptable.

It's like building a house, if I bring in a team of carpenters, PVC window fitter and a thatch roof expert, I'm probably going to end up with a wooden house, with PVC windows and a thatch roof. This is analogous to a software team, and this can lead to poor (or the wrong) architecture, over complicated designs and competing modules.

FORMING TEAMS

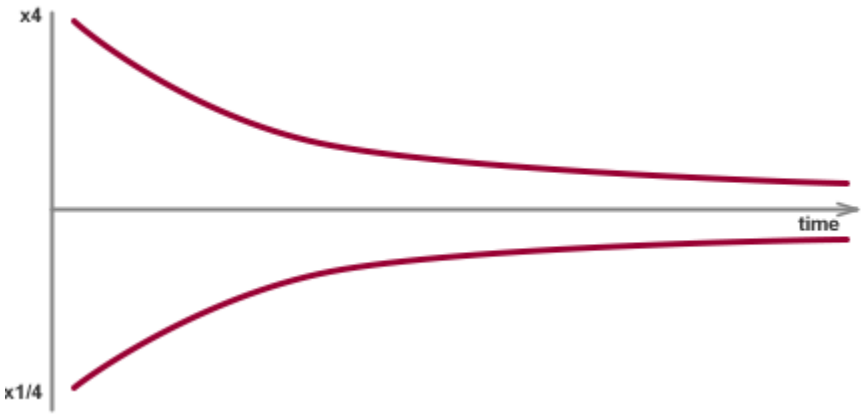
When we are forming teams to tackle a new project, architectural decisions are being made at the point of team selection - even without architectural analysis, understanding risks and requirements – before even a single diagram has been produced. Selecting a team with four software engineers rather than three will influence the architecture because work now needs to be found for the fourth team member. Work will be divided into four parts.



Simply by forming teams and creating lines of communication we are making decisions that will influence the architecture of the system before a line of code has been written. Creating a team of 15 people for a project during its conceptualisation has an impact not only on the style and structure of the system but also the team's ability to be effective in the creative exploratory stages of a project when close collaboration is most necessary.

When new work is just starting, these decisions are made at the time when least information is known. I've seen plenty of examples when people who will not actually be involved in the development effort making decisions which can compound the issue.

The "Cone of Uncertainty" (developed for software by Barry Boehm in 1981) is often used to express this problem which shows that at the beginning of a piece of work the risks and unknowns are so high that estimates are typically a factor of four out. Only by doing some of the work, de-risking and elaborating, can we increase predictability. At this early point when we know the very least about a project is when we're making inadvertent architectural decisions, contractual decisions and planning decisions. Incubation and iteration are designed to rapidly reduce the cone of uncertainty as quickly as possible, however risk reduction should include the social structures and practices not just the technical issues.



RECOMMENDATIONS

There isn't a "silver bullet", but we should attempt to avoid these problems by:

Start with the smallest team possible

- Try to avoid making architectural decisions in staffing the team by understaffing it.
- Keeping the team hungry will reduce the possibility of building more than is needed or over architecting it.
- Try not to spend money on things that don't matter to customers. Frugality breeds resourcefulness, self-sufficiency and invention. There are no extra points for headcount, budget size or fixed expense.

Only doing just enough architecture

- Be aware of those who are quick to point out the risk of under architecting a system, not looking to the future and not building a system that can change and grow, and resist the temptation to buckle.
- The risks of over architecting are if anything worse. Too much architecture can equally prevent a system changing and growing, and too much architecture leads to more time consuming and expensive code to cut. Then there is the risk of not shipping at all, too long spent producing the "right" design may result in a system too late to be viable

Aim for cross-functional, generalising specialists

- Create teams with people that each have a range of skills, preferably in addition to one or more specialism and experience of the whole-lifecycle rather than specialist, people who have deep knowledge of one subject. Yes, have a Java or a C++ software engineer on the team but have one who knows a bit of SQL or a NoSQL approach and isn't scared of a little UI work. In time you might need to add database and UI specialists but delay this until it is clear they are needed.

Consider a "Whole Team" approach

- The team needs to include its key stakeholders so that part of the solution isn't missed out by having it being "not our job"
- Also incorporating less experienced people who can broaden their skills and experience taking a longer term view.

As an organisation we need to *incentivise* this approach, in Conway's own words:

> *"Ways must be found to reward design managers for keeping their organizations lean and flexible. There is need for a philosophy of system design management which is not based on the assumption that adding manpower simply adds to productivity."*

Melvin Conway

The purpose of Leadership is not to amass followers but to grow more leaders.

How we choose to staff a team significantly affects what that team will produce. We can therefore make predictions on the output of teams based on how they are resourced. In my next blog I'll describe reversing Conway's Law to help us shape solutions by making careful resourcing choices.

4. BLOG: LEGACY ENFORCES ORGANISATIONAL STRUCTURE

In my last blog I discussed Conway's Law:

> "Any organization that designs a system (defined more broadly here than just information systems) will inevitably produce a design whose structure is a copy of the organization's communication structure."

Melvin Conway, 1968

Conway's Law also applies in reverse - we see this when considering our legacy systems. These systems can impose predefined structure on the teams who maintain these systems and even on the wider organisation.

In a previous blog I gave an example of a 3-tier system: database, business, GUI system. Imagine this system has now been operational for several years. The original developers have left the organisation and new people have been recruited. The system contains lots of complexity in all three tiers such that each tier requires a specialist. The database is so rich in stored PL/SQL procedures, triggers and constraints that only a SQL expert can understand it. The GUI is crammed full of JavaScript, CSS and not HTML 5 compliant so that only someone dedicated to interfaces can keep it all working. And the middle tier is using a lot of EJB 2.0 concepts requiring significant experience.

Given this situation the company has no option but to staff the team with three experts. Conway's Law is now working in reverse: the system is imposing structure on the organisation. We can see examples of this effect in our own organisation.

Again this happens not just at the micro-level but at the macro-level. Entire companies are constrained by the systems they have. Economists might call this path-dependency: you are where you are because of how you got here not because of any current, rational, forces. Many organisations end up evolving a large legacy architecture of inter-connected systems. Often "architectural archaeology" is necessary to uncover exactly what exists and how it's all connected. The design of these legacy architectures was constrained by organisation structure, it is now very difficult to reorganise without changing the legacy architecture and systems to support the new desired structures.

Underlying both Conway's Law and Reverse Conway's Law is "Homomorphism" or "The Homomorphic Force".

THE HOMOMORPHIC FORCE

This force acts to preserve the structure of system even as the system itself moves from one technology to another, from one platform to another. Both forms of Conway's Law and the Homomorphic Force pose a dilemma for any organisation. Should they work with the force or try to break it?

This is a complex problem and very context sensitive. However, I tend towards saying: Work with Conway's Law, not against it - like woodworking, work with the grain not across it. Be aware of Conway's Law and learn to play it to your advantage. Simply fighting it or ignoring it is unlikely to work.

Conway's Law does contain a get-out-clause: the system that will be created will be a copy of an existing organisation, if you can create a new organisation, one not pre-loaded with assumptions and well-trodden communication paths then maybe you can create a new system with a better design. By creating something new to do something new you avoid the Homomorphic force.

WHAT'S THIS GOT TO DO WITH US?

If we want new things we need new organisations to create them, where we consider the impacts of Conway's law and consider the roles and the people we need. This doesn't just apply at a system level, but at the macro organisational level – the topic of my next blog.

5. BLOG: I CAN PREDICT THE FUTURE OF YOUR ORGANISATION

In my last two blogs from Conway Week ("I can predict the future of your software project" and "Legacy Enforces Organisational Structure") I discussed how organisational structures affect the structure of the systems they build and how existing systems can constrain the structural choices that an organisation may implement. In this blog I will explore the outcomes, both intended and unintended of commonly used organisational models in the context of Conway's Law.

Every boundary, both inside teams and between teams, causes a structural separation and Conway's Law is invoked. Additionally, hand-offs between individual specialists and teams cause delays in workflow as work is buffered at the boundaries. Often I see various controlling mechanisms, such as team inboxes, backlogs, front-door processes and other forms of work queue which, frequently, add unnecessarily to the total Lead Time for work. It is time to revisit the original intent of these mechanisms and consider ways we can achieve the purpose without adding unnecessary lag and buffer to delivering value to our customers.

Structure increases the impedance in the organisation to doing a piece of work. The less structure we have, the ***faster*** we'll be to deliver value.

Structure also decreases the flexibility and adaptability in an organisation for responding to strategic change. The less structure we have, the ***faster*** we'll be to adapt.

Conway's Law (1968) states that:

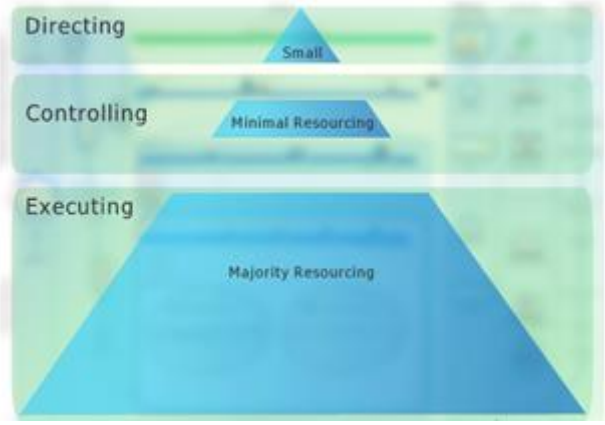
> *"Any organization that designs a system ... are constrained to produce a design whose structure is a copy of the organization's communication structure."*
>
> *Melvin Conway, 1968*

VERTICAL CONWAY'S LAW

"Programmes are a collection of closely related projects that together deliver business value."

Where planning processes impose a structure of Programmes, Projects and multiple teams (even when a Programme only has one project – which is pointless) at each layer we see duplicated sets of planning, requirements, architecture, testing effort and artifacts. When groups of people are structured into a vertical stack of layers that perform activities on the same piece of work they will create translational layers of work with transactional boundaries between them typically leading to large amounts of waste and confusion.

This model *can* work for big organisations like ourselves that need to co-ordinate well understood strongly related systems-of-systems development efforts however it is an inefficient model to apply to poorly understood (high risk) changing work as the structure is slow and cumbersome to change and due to Conway's Law makes architectural choices which may be less than ideal. Especially as our understanding of the various problems improves.



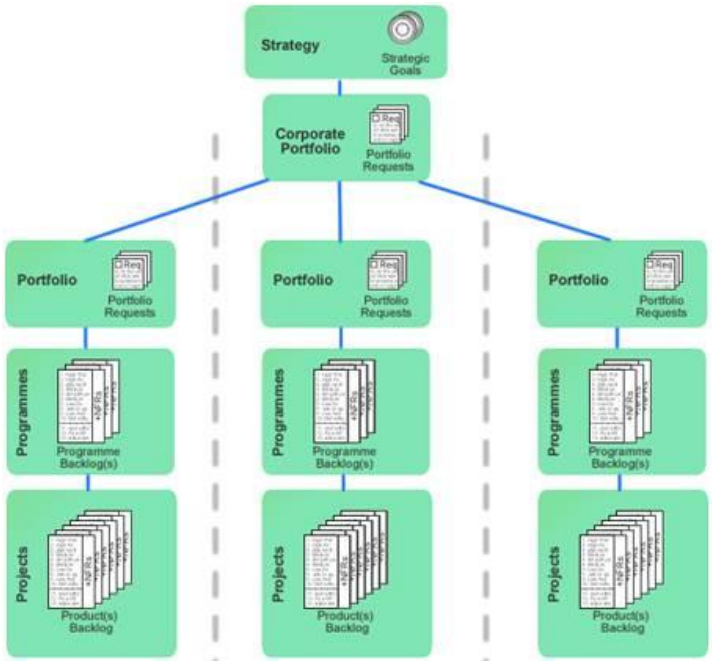
Lean thinking tells us to minimize the "Directing" layer and the "Controlling" layer of Programmes and themes. The majority of our resources should be focused on "Executing" our plans – building products, doing research and solving difficult challenges.

Projects can, and should, exist as stand-alone projects within the Portfolio. We need programmes to coordinate multiple projects that must work together. Where this coordination isn't necessary the programme isn't necessary.

HORIZONTAL CONWAY'S LAW

As well as vertical structure we can consider horizontal structure in two ways:

1. Structure teams aligned to functional characteristics (requirements, delivery, metrics, operations, etc.) - This is a **terrible idea** that leads to stove-piped empire building specialisms with transactional hand-offs between them removing a "whole team" mentality to product delivery, quality and delivery of business value.
2. Structuring segments of the business into parallel delivery organisations such as departments, groups, business lines, domains etc. This is a very common model which has a number of variants. This model can lead to a duplication of development effort and so is often augmented with a common base layer as dictated by Enterprise Architecture or Operations/ITServices concerns.



Naturally this model has numerous variants based on multiplicity: structured portfolios can sometimes have programme structures, or a mix of programmes and stand-alone projects or no programme structure at all. Some complex/large organisations may have multiple strategies and so further multiply this kind of structure. Any increase in multiplicity will increase the complexity and risks that need careful care:

- Duplication of development effort in separate teams
- Duplication of support and improvement effort in silos
- Division of culture into sets of sub-cultures
- Possible fragmentation of business value (and Enterprise Architecture) to the point that delivery teams can't understand how they contribute business value
- A fragmented business that struggles to create cross-organisation value streams.
- Fragmented inertia against corporate level decision making and change (leading to an inability to innovate and react to disruption)

Conway's Law in other areas

As well as thinking about structure and team dynamics Conway's Law has a significant effect on culture, as each structurally separated group will develop a separated sub-culture. Similarly, it has an effect on architecture as mentioned in my previous blog; if an organisation is structured into major departments then all must be coordinated to deliver a corporate response to a new challenge. This tends to lead to a number of components or products reflecting the organisation structure that may not necessarily be the best architectural response to a problem.

This management and architectural inertia is one of the reasons that small new organisations can out-innovate established businesses in a market.

Using Conway's Law to our advantage

Organise teams in a structure that resonates with the solutions you are trying to create. If we want a very modular system/culture with high resilience, then we should create many small teams. If we want people to focus on processing as a separate concern from analytics and visualisation, then we should structure them into separate domains.

If we are trying to merge two teams, then leaving them physically separated with different names and identities will actually reinforce their separation (an example of the Homomorphic Force). I think we need to build holistic teams that can work on delivering business value across the various concerns involved in software engineering.

There is no point in a team developing quickly if it is building the wrong thing. There is no point in directing the right things if the development teams can't deliver due to poor organisational structure. Simply, we need to join up the all people involved to the common strategy and let them get on with it.

Does adding more managers to a piece of work make us better, faster, cheaper or happier?

How we organise structurally drastically affects the cultures, architectures, productivity and the very products that we can and will produce. We are in a period of disruption where we must organise for change and not build structures based on our current limited understanding of the future. Where we currently have structure, due to past stability, we should revisit the need for its existence. The less structure we have the more agile the business will be as it reconfigures to face the coming challenges. Once we've established our way forward and the business characteristics become more stable we may want more structure again (just as Facebook have done) but for now structure will only slow us down.

In my next blog I'm going to look at a number of different structural models that organisations use, in the context of Conway's Law.

6. BLOG: FUNCTION FOLLOWS FORM

In my previous blog I described how Conway's Law has an impact on Organisational Structures, in this blog I'm going to talk about a couple of standard organisational models and their consequences. First though whenever we talk about organisational structure inevitably we have to talk about hierarchy.

> *"Hierarchy is a system in which members of an organisation or society are ranked according to relative status or authority."*
>
> *Wikipedia*

Generally, hierarchy is instantiated in structural relationships within an organisation where people report and are managed by a layer above, and those people to a smaller layer above and so on in a rough triangle shape.

"Hierarchy" is often thought of as negative because a number of dysfunctions have their roots in hierarchy:

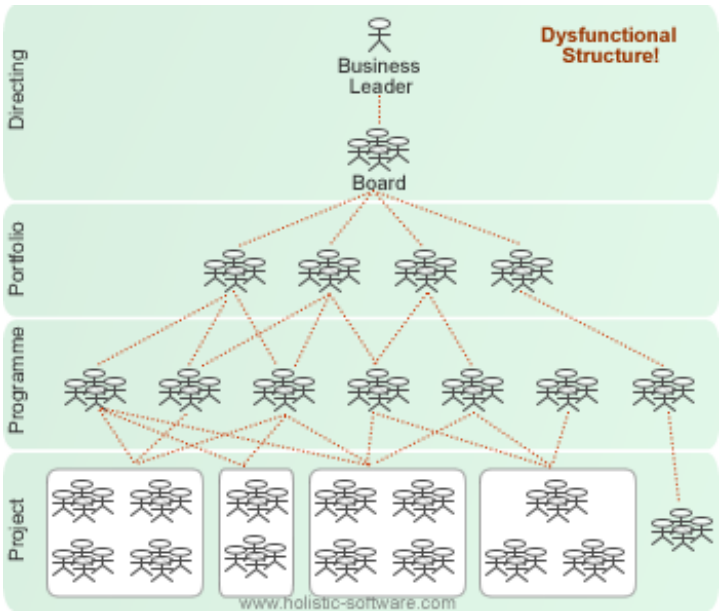
- **Excessive layers** - hierarchy can lead to many intermediary layers between Delivery Teams and Business Leaders obscuring communication and causing transactional and transformational behaviour between layers (Vertical Conway's Law)
- **Top-Heavy delivery** - even minimal layers of hierarchy can introduce management around a delivery team, looking at the people involved as a whole we sometimes see a high ratio of "managers" to "doers" sometimes we have seen more "managers" than "doers". A Delivery Team of 5 may need no managers and yet sometimes we see small teams surrounded by 10 or more "managers" adding inertia and causing confusion. This form of organisational bloat is wasteful.
- **Value fragmentation** - Because hierarchy encourages decomposition it can lead to functional decomposition through team structures (Horizontal Conway's Law)

However, not all hierarchy is inherently bad. Indeed, some form of hierarchy always exists in human social structures - even when they try to suppress it (e.g. holocratic groups, communal ownership groups, co-operatives). In these groups implicit hierarchy is always created as they are

funded and supported by Leaders. Even the flattest, most transparent, companies have an implicit hierarchy - unless every employee is a shareholding director with voting rights earning dividends.

Excessive hierarchy causes negative behaviours, but some level of hierarchy is practically unavoidable, especially when more than one team is involved and/or people are working for other people. However, where possible we should minimize layers and structure joining our senior leadership with customers and delivery teams. Every team must be able to express their value proposition to the business, and not in terms of handing over a product from one team to another to another...

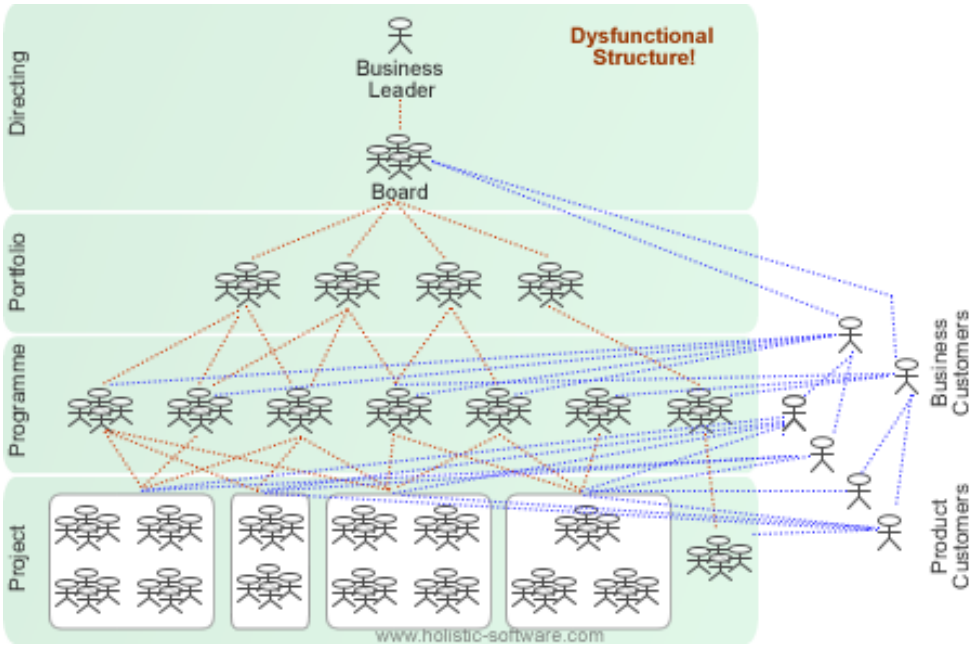
Hierarchical structures are often well intentioned and may even be well structured for stable work. However, as time passes portfolios are likely to overlap, as are programmes meaning that communication lines are multiplied across the hierarchy in a complex web. The following structure is a real team structure taken from a large software organisation (not here, a big financial institution):



Initially the organisation's business was split into 4 vertical business lines. However, over time these concerns converged onto common IT platforms as storage and processing became commodities. This led to overlapping requirements in programmes that were part of each portfolio.

As a result, Delivery Teams had requirements from multiple programmes which, of course, sometimes conflicted. Because many of the Products were large the organisation formed "Projects" containing multiple teams for some of these products.

Due to this **"Portfolio → Programme → Project"** structure being the standard approach to work in the organisation an isolated Product also had to fit into this structure (as shown on the far right of the diagram) which meant that there were 3 layers of management above the Product Team. You'll notice that "Customers" are nowhere to be seen on this diagram, in fact customers created an orthogonal management structure that caused more confusion:



This is more similar to a matrix organisation (described below) than a simple hierarchical organisation. Clearly this mess of communication lines causes problems, and is only exacerbated by introduction of more structure or more layers. The numbers of managers vs. doers in this model is far from ideal.

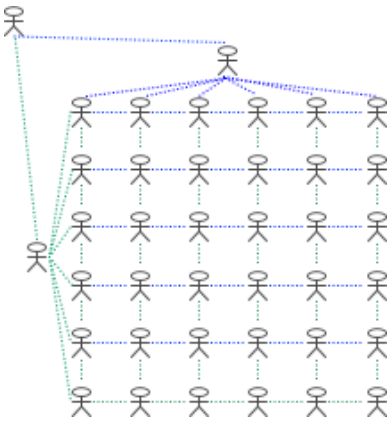
Organisational structures must be kept as simple and unstructured as possible so that people are free to collaborate in whatever forms are necessary to deliver as a holistic team.

"Separation into roles, layers, functional groups and other forms of ivory towers, even with the best intentions, causes significant problems in delivery."

There are a number of structural patterns organisations use to deal with scale of resources, each has its advantages and disadvantages.

Matrix

Matrix organisations have more than one reporting line, typically in software based organisations personal management (line management) is de-coupled from technical management.



Matrix structures imply flexibility by allowing technical groups to be re-organised without affecting line management structures. However, because of the fragmentation of concerns we often hear the complaint:

> *"My line manager doesn't know anything about my day job"*

The intended flexibility of such models is in practice difficult to achieve, and hindered by bureaucratic processes around career development that are introduced to recombine the de-coupled aspects of technical and line management. These structures tend to mean that everyone has at least two managers, which in itself can be a problem and cause conflicts if those two managers are not aligned.

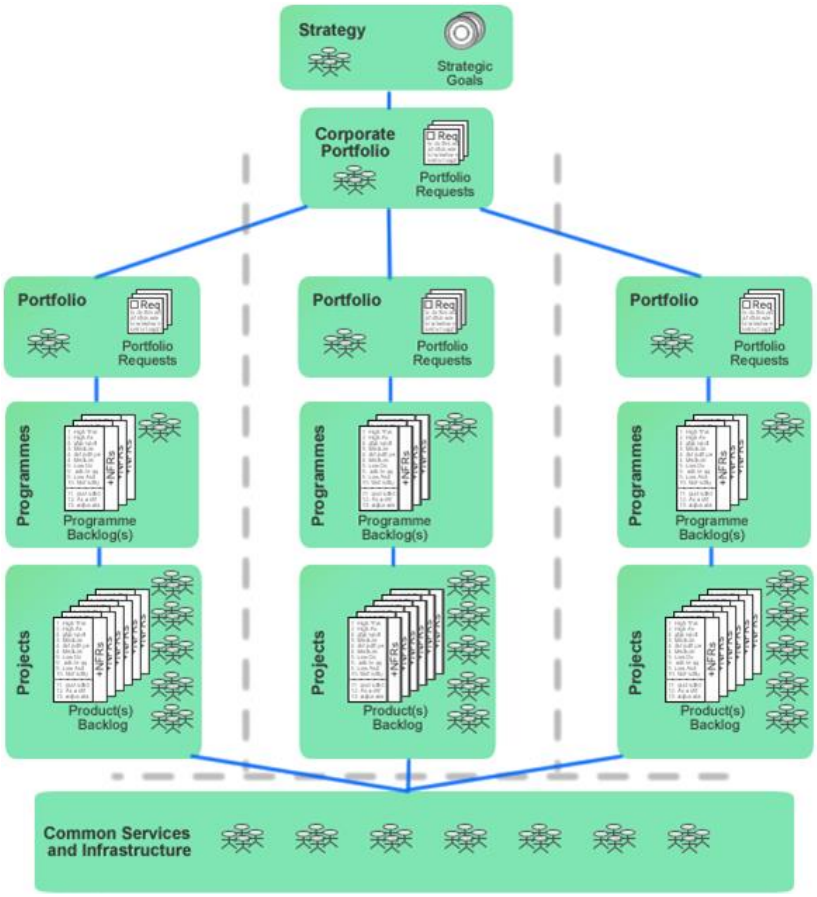
Some may ask, do professional skilled knowledge workers actually need a manager at all? Can't individuals take ownership of their own careers rather than abdicate responsibility to an appointed manager?

The diagram here is of course a simplistic version of matrix management, in real organisations like ours it tends to be more complicated. Matrix organisations tend to exhibit a lack of clarity on priorities between orthogonal structures and there are often power struggles between orthogonal parts of the split hierarchy.

Value Stream / Product Families / Vertical Business Lines

I consider organisation by Value Stream, Product Families and Vertical Business Lines to be essentially the same thing. They are examples of Conway's Law applied as a design principle as I mentioned in my previous blog.

Product Families, collections of products that work together to deliver business value are a Value Streams. Programmes (in their entirety) that represent these Value Streams are in fact Vertical Business Lines.



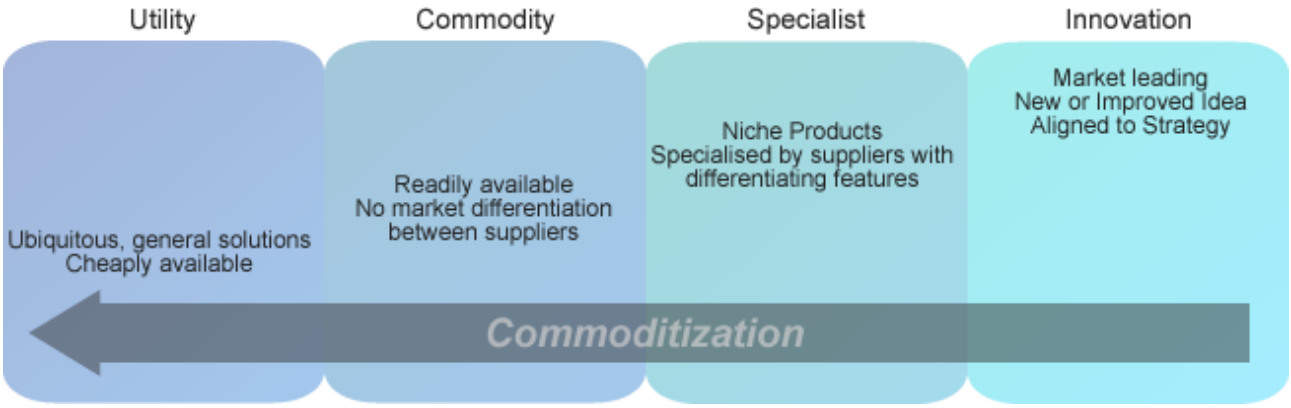
Although this is a tempting structure that looks quite clear it has some dangers. Typically, over time business value will move to cross the vertical lines as technologies converge and new opportunities arise. As a result, even when an organisation in a period of stability has well separated portfolios when periods of disruption occur they tend to turn into less well-structured hierarchies.

Common technologies (which are continuously created by the commoditization of technology) mean that separated portfolios will cross over where they meet common services. Note that the diagram above shows simplistic communication lines, if we increased the multiplicity to include every team it would look a lot messier, and as programmes start to overlap it quickly turns into the previously described dysfunctional hierarchical mess – especially when programmes aren't tightly aligned to delivery teams.

Product Maturity

Organisations can also structure their teams and work in terms of the characteristic of the work. The diagram below shows how the characteristics move from ***innovation***, where they are undefined, speculative and high risk, to more ***commodity/utility***, where they are well-defined, ubiquitous, less differentiation with lower risk. All work will move from the point of innovation to utility if there is enough supply and demand to drive it. (***note*** If you're interested in techniques and

approaches for driving things from the point of innovation through to commodity/utility, please ask),



If your organisation is focussed on building Specialist products then if we look at the far left of the commoditisation scale, it doesn't make sense to build utility or commodity components, systems or product you would just buy/rent them.

However, looking at the far right of the commoditisation scale, we are doing new inventing/innovating and specialist work; we will need completely different approaches, processes, working practices, teams and cultures which are appropriate for the different business contexts.

Innovation work is typically riskier and speculative than more mainstream specialist products and so will be less tolerant of up front planning. "Failing fast" is particularly important in innovative/inventive work and this type of work is typically very unpredictable. As a result, building significant structure (in terms of project, programme and Solution Architecture) around innovation work is unlikely to be productive - this work should also be unconstrained by Enterprise Architecture (and indeed "standard" ways of working).

Innovative work is best treated as self-organised Product Delivery teams that are directly part of the Portfolio, with no programme structure.

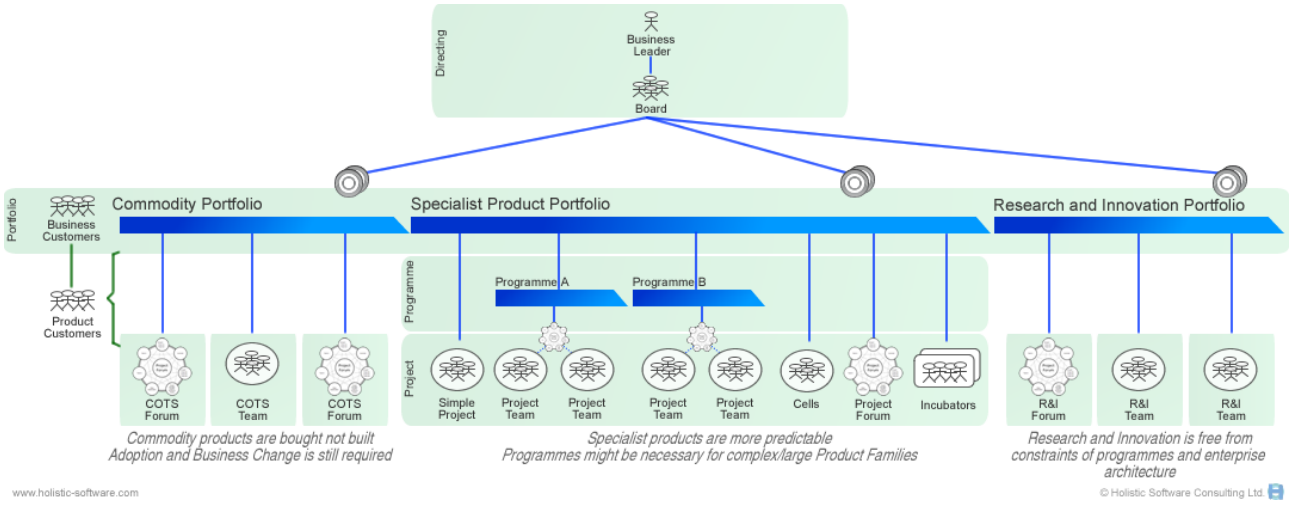
"There's nothing worse for innovation than an ideas process"

Products that are more "Specialist" may need a "bigger engineering" approach - depending on their scale or risk factors. Many large organisations will adopt more formal processes in this area as they seek to find economies of scale, especially around reuse. However, over time reusable platforms and architectures can become a hindrance rather than a help.

Hybrid Model

Forward thinking organisations with significant effort and coverage across the commoditisation scale above tend to gravitate towards a hybrid model. Structure is introduced only by exception to orchestrate effort across divergent teams and portfolio(s) when needed.

Structure is typically used in the part or the organisation building Specialist Product Portfolio(s) with much less structure in the Commodity Portfolio areas (because they are often understood, predictable, related to system integration and frequently COTS). There would also typically be a very flat structure in the Innovation areas (because they are so speculative, risky and constantly changing). I'd also expect different proportions of behaviours types, across the portfolio(s) as described in the "4 job types" blog.



We shouldn't be averse to all organisational structure - it temporarily crops up in many forms all the time. It's much better to allow project teams to form structure temporarily to suit the group's needs and people are more than capable of reaching out to teams they need to work with. Rather than having predefined structure we should create structure when, and only when, it is required. When we have no need for structure it should not exist.

Applying the same structures, architectures, processes and working practices across all of these work types can cause problems so a hybrid model is likely to be required for large/complex organisations like ours.

Conway's Law applies equally to people architectures and technical architectures – we need to work with it rather than against it.

V. CONTACT US

If you'd like to get in touch with us, please contact the GCHQ Press Office: +44 1242 221491 (ext. 33847)

VI. REFERENCES

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http://www.holistic-software.com
http://www.holistic-software.com/organization-structure
http://www.holistic-software.com/hybrid-dynamic-mode

Characteristics of Disruptive Change, Commoditisation Scale and Pioneer Culture references originally inspired by Simon Wardley, CSC Leading Edge Forum – used with permission.
http://blog.gardeviance.org/2013/01/the-next-generation.html
http://blog.gardeviance.org/2011/02/pioneers-town-planners-and-those.html

Complex vs. Complicated inspired by "Wicked Problems" – Keith Grint
https://www.dur.ac.uk/resources/public.health/northeast2012/masterclass2/Keith_Grint_Wicked_Problems_Clumsy_Solutions_presentation1.pdf

4 Job Types that Make innovation happen – Lou Adler
http://www.fastcompany.com/3009426/leadership-now/the-4-job-types-that-make-innovation-happen

Don't Come to the Dark Side – Lt. Col. Dan Ward (USAF)
http://www.dau.mil/pubscats/ATL%20Docs/Sep-Oct11/Ward.pdf