Approaches to Adaptive Iteration: a comparative review

(Discussion draft)

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1 Abstract

Creating successful change in situations that are partially structured, emergent and partially predictable requires an iterative approach that enables learning and action to co-evolve. Eight variants for such an iterative approach have been identified. A comparative review of those approaches has identified considerable similarity but also several subtle but significant variations, most of which are due to the context for which they were first developed. Drawing on this comparative review, a draft set of principles for a general approach (called Adaptive Iteration) is proposed. An outline formulation for a general approach is presented.

2 Introduction

Many situations, although complicated, are well structured and predictable. In such cases, experts and specialists determine the most appropriate action plans based on analysis and judgment derived from their expertise and experience. However, such expert based approaches are insufficient for situations that are partially structured, emergent and partially predictable. In these cases, iterative experiential learning should inform and supplement the expertise and experience of specialists. The response is an adaptive one in which learning and action co-evolve. Action changes the situation which, in turn, creates on opportunity for further learning (for the situation to 'talk back') which, in turn, may suggest modified action, and so on. I will call this co-evolution of action and learning, 'Adaptive Iteration'.

This paper explores the nature of Adaptive Iteration with particular reference to a range of variant approaches that have been proposed over the past 20 years or so. A comparative assessment of these approaches highlights the salient and subtle aspects of Adaptive Iteration in various contexts. The paper also introduces an additional variant that the author believes better addresses situations that have high levels of emergence and require novel solutions.

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3 Variants of the Adaptive Iteration approach

Adaptive Iteration is an iterative approach involving four core phases (Figure 1). Variants of Adaptive Iteration have been developed over the years to explain and guide experiential learning and adaptive action. In this section, eight of these variants (Table 1) are summarized with a view to exploring their similarities and differences.

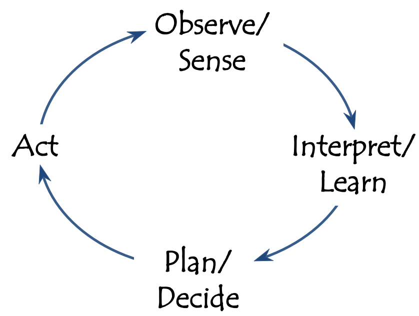

Figure1. Underlying Adaptive Iteration approach

Developer	**Title**	**Phase of Iteration**			
		Observe/Sense	**Interpret/Learn**	**Plan/Decide**	**Act**
Kolb	Experiential Learning	Reflective Observation	Abstract Conceptualization	Active Experimentation	Concrete Experience
Boyd	OODA Cycle	Observe	Orient	Decide (Hypothesize)	Act (Test)
Deming/ Shewhart	PDCA/PDSA Cycle	Check/Study (Observe)	Act (Learn)	Plan	Do (Test)
Haeckel	Adaptive Loop	Sense	Interpret	Decide	Act
Dixon	Organizational Learning Cycle	Integrate	Interpret	Act	Generate
Snowden	Cynefin: Complex Domain	Sense		Respond	Probe
Ries	Lean Startup	Measure	Learn	Build	
Eoyang	Adaptive Action	What?	So What?		Now What?
Fietz	Adaptive Iteration	Observe	Interpret	Design	Experiment

Table 1. Variants of the Adaptive Iteration approach

3.1 EXPERIENTIAL LEARNING

Kolb's Experiential Learning model (Kolb, 1984) emphasizes concrete experience (action) as the source of learning. This is particularly relevant in partially structured, emergent and partially predictable contexts, where expertise and experience must be supplemented by real-time (experiential) learning to discern the most appropriate action. Such action stimulates further experiential learning which, in turn, may trigger revised action, and so on. Although Kolb's Experiential Learning model is usually presented from a learning perspective, it could quite legitimately be framed from an action perspective and presented as a general model for adaptive change.

Kolb highlights that Experiential Learning requires that the learner have four kinds of abilities:

> "They must be able to involve themselves fully, openly, and without bias in new experiences (Concrete Experience). They must be able to reflect on and observe their experiences from many perspectives (Reflective Observation). They must be able to create concepts that integrate their observations into logically sound theories (Abstract Conceptualization), and they must be able to use these theories to make decisions and solve problems (Active Experimentation).

Kolb notes that these four kinds of abilities require that the learner have diametrically opposed abilities on two primary dimensions:

> The first dimension represents the concrete experiencing of events at one end and abstract conceptualization at the other. The other dimension has active experimentation at one extreme and reflective observation at the other. Thus, in the process of learning, one moves in varying degrees from actor to observer, and from specific involvement to general analytic detachment.

Thus, the effectiveness of Experiential Learning depends on the extent to which the learner can apply and integrate all four abilities to an experience. Kolb believes that the ability to resolve and integrate the inherent conflicts between the adaptive modes (abilities) is a "hallmark of true creativity and growth". Kolb provides some insight about how this resolution and integration of adaptive modes occurs:

> Development in one mode precipitates development in the others. Increases in symbolic complexity, for example, refine and sharpen both perceptual and behavioral possibilities.

So, although there is inherent tension and conflict among the adaptive abilities, Kolb suggests that there is a reinforcing feedback loop, not just for Experiential Learning itself but also for the development of the four adaptive abilities that are required for Experiential Learning. This is significant as it suggests that the ability to learn experientially may be a difficult at first, but can develop quickly (and naturally) once there is momentum in the reinforcing development loop.

3.2 OODA

The OODA (Observe-Orient-Decide-Act) loop was developed by John Boyd, a fighter pilot in the US Air Force during the Korean war and subsequently a military strategist and 'thinker'. William S Angerman provides the following context for Boyd's development of the OODA Loop (Angerman, 2004):

> It is said that the ideas behind the OODA Loop were set in motion during air-to-air combat exercises at Nellis Air Force Base in 1974 (Lind, 1985). During this time, Boyd was tasked to evaluate why U.S. pilots flying F-86s fared so well in air-to-air combat against enemy MiGs during the Korean War. During his investigation, Boyd discovered that the U.S. planes were actually inferior to the North Korean MiG-15s in almost all measures of performance. However, two features of the F-86 allowed U.S. pilots to gain an advantage. First, thanks to a bubble-shaped canopy, U.S. pilots had better visibility enabling them to better attune themselves to their air environment.
>
> Second, the F-86s had powered hydraulic controls that allowed faster maneuver transitions. U.S. pilots used their superior situational awareness and ability to make rapid changes to force enemy MiGs into a series of maneuvers from which they could not escape. The shock that set in when the enemy realized that they were in trouble only hastened the deadly outcome. Boyd recognized that the ability to cycle through observing, orienting, deciding, and acting faster than an opponent led to a considerable competitive advantage.
>
> ….. It is within Patterns of Conflict (Boyd, 1986) where the OODA Loop is first mentioned, drawing from Fast Transient theory:
>
> > Idea of fast transients suggest that, in order to win, we should operate at a faster tempo or rhythm than our adversaries—or, better yet, get inside adversary's Observation-Orientation-Decision-Action time cycle or loop (Boyd, 1986, p.5)

Although Boyd did not attempt to establish academic credibility for concept of the OODA Loop he attempted to generalize it and develop an intellectual context for it. This work was presented in various papers and presentations in the US Department of Defense (Angerman, 2004; Osinga, 2006). The relevance and powerful simplicity of the OODA Loop has led to it having considerable influence on Department of Defense doctrine and to it finding its way into such areas as cognitive engineering, complex adaptive systems, intelligent agents, entity modeling, and data fusion (Angerman, 2004).

The simplicity of the OODA Loop model led to some criticism of its suitability for more general use (outside combat situations) and this led Boyd to propose a more elaborate version of the model (Boyd, 1996). In particular, the elaborated version included more feedback paths and provided contextual considerations, especially for the Orient step. From the context of this review paper, Boyd also started to modify the language around the Decide and Act steps, which he parenthesized as 'Hypothesise' and 'Test' respectively in the elaborated model. It is the author's view that Boyd's modified language for these steps is more suitable for the use of the model in partially structured and emergent situations.

3.3 PDSA/PDCA Cycle

The PDSA/PDCA (Plan-Do-Study-Act/Plan-Do-Check-Act) Cycle was developed in an early form by Walter Shewhart and refined and enhanced by W. Edwards Deming. It was developed primarily as a participative approach to the continuous monitoring and improvement of manufacturing (production) processes. It is one of the core methods of the Total Quality / Continuous Improvement approaches developed and refined in Japan through the 1950s, 1960s and 1970s and subsequently adopted widely by manufacturers in western countries.

W. Edwards Deming introduced an early form of the PDCA cycle (then known as the Deming Wheel) in a lecture in Japan in 1950. The approach was picked up by the Japanese where it was subsequently formalized as the PDCA Cycle. When the PDCA Cycle was introduced to western countries, Deming was concerned that the 'Check' label would be open to misinterpretation and renamed it 'Study', giving rise to the PDSA Cycle.

In comparison to other approaches in this review, the PDCA cycle primarily focuses on the improvement of well-structured and relatively predictable processes. This, in turn, gives rise to several distinctive features of the PDCA Cycle:

- It places considerable emphasis on statistical measurement and analysis to target the improvement activities and to test (Check) if they have made tangible improvement to sustained process performance.
- It places explicit emphasis (the Act step) on the actions necessary (training, procedures, equipment design) to embed the learning from successful improvements. The equivalent step in most of the comparison approaches in this review focuses on reflection and interpretation to create learning that informs improvements to the plan or design.

Deming continued to refine and adapt the 'Shewhart Cycle', as he called it, and the terminology in the version published in 1986 is more applicable to less structured and predictable processes: 'Observe' replaces 'Check/Study', 'Learn' replaces 'Act', and 'Test' replaces 'Do'

In any case, as can be seen in Table 1, the structure of the PDCA Cycle is similar to the underlying structure of the other adaptive approaches.

From the evolution of the PDCA/PDSA cycle summarized above and described in more detail by Ronald Moen and Clifford Norman, it is evident that Deming was struggling with how to formulate it to address situations that are unpredictable, uncertain and emergent. It is likely the effectiveness and subsequent popularity of the PDCA version to improve relatively predictable manufacturing processes became a significant barrier to the development and promotion of a more widely applicable version.

3.4 Adaptive Loop

Stephan Haeckel incorporates another interpretation of Adaptive Iteration in his design for Sense-and-Respond organizations (Haeckel, 1999). Haeckel's Sense-and-Respond organizations are those that deliberately pursue the ability to dynamically sense market needs and rapidly organize to fulfil them. This is in contrast with the more conventional Predict-and-Plan organizations which, because they are not structured for rapid response to market changes, place greater emphasis on predicting the market and then using those predictions as the basis for future plans.

In the Adaptive Loop, Haeckel summarizes four key competencies required for a Sense-and-Response organization:

1. Sense changes in the external and internal situation. Successful proactive, adaptive systems must register (sense) implicit and tacit signals as well as explicit ones.

2. Interpret these changes in the context of capabilities, aims and experience, separating information from noise in the system.

3. Decide what needs to be done. Transform knowledge into action by making decisions about the allocation of resources.

4. Act on those decisions by communicating decisions as a command, or suggestion, or blueprint that commissions activity by others.

Haeckel states that the effective execution of the Adaptive Loop is not sufficient to create a Sense-and-Respond organization. People in the organization must also have the authority and autonomy necessary to act quickly in response to market signals. This requires that the organization has a clear and agreed sense of purpose and set of governing principles. It must also reduce emphasis on a formal organizational hierarchy and increase emphasis on clearly defining roles and accountabilities throughout the organization. The effective application of the Adaptive Loop enables these roles to self-organize in response to changing market signals.

The focus of Haeckel's adaptive loop is the rapid reconfiguration of organizational capabilities in response to signals from the external context, in particular the market. In the main, the case examples in Haeckel's book involve established organizations serving reasonably well established markets. The Adaptive Loop is used to rapidly and efficiently tune an organizations capabilities to changes in market expectations. The target adaptations are rapid but relatively incremental.

The Act phase of Haeckel's Adaptive Loop describes 'implementation', not 'experimentation'. As such, the Adaptive Loop does not lend itself to the pursuit of novel or innovative approaches to satisfying market needs or to the discovery new market opportunities for existing products or capabilities. It does not emphasize genuine feedback from the Act phase to the Sense phase. The Adaptive Loop is not really a loop, but rather it is the repeated application of a linear Sense-Interpret-Decide-Act approach. It is distinguished by the precision and short cycle time of the end to end process.

3.5 Organizational Learning

Nancy Dixon uses an Adaptive Iteration model, called the Organizational Learning Cycle, to describe the requirements for organizational learning (Dixon, 1999; Holgaard et al, 2007). Dixon proposes the following four phase iterative process:

> Generate: Widespread generation of information, which encompasses both the collection of external data and the internal development of new ideas.
>
> Integrate: Integration of new/local information into the organizational context. The key processes are diffusion of information and the questioning of established collective meaning structures.
>
> Interpret: Collective interpretation of information, whereas new collective meaning structures are created by a collective participation and negotiation, but not necessarily consensus.
>
> Act: Having authority and the necessary information to take responsible action based on the interpreted meaning.

Dixon also outlines four categories of 'infrastructure' necessary to support the organizational learning cycle:

- Measure results to capture lessons learned
- Configure systems to move information across organizational boundaries
- Build infrastructure to support systems-level dialogue
- Organize work to disseminate decision making for speed and flexibility.

Dixon highlights the parallels with Kolb's Experiential Learning Cycle, but emphasizes that Organizational Learning involves collective behavior and is a collective responsibility of the people in the organization. Although Dixon represents organizational learning as an iterative process, her description of the 'Generate' phase is focused on the widespread generation of information through internal and external environmental scanning rather than through any particular organizational action or experiment authorized or planned during the 'Act' phase. As such, Dixon's Organizational Learning model depends on learning generated from 'natural' experiments and does not give significant emphasis to feedback, an element critical to learning in dynamic and evolving contexts. Interestingly, Chaparral Steel, a company Dixon uses as a case study, considers itself a 'Learning Lab' and has "challenging the status quo" as one of its three competitive principles. It is clear that Chaparral Steel generates much of its learning and improvement (adaptation) through experimentation rather than through environmental scanning.

Not surprisingly given Dixon's focus on learning rather than action, her emphasis tends be on people-related structures and processes. The emphasis is on creating shared and contextually relevant meaning through widespread collection, sharing and interpretation of information.

3.6 Cynefin Framework: Probe-Sense-Respond

In their Cynefin sensemaking framework, David Snowden and Mary Boone propose a Probe-Sense-Respond approach as one of a suite of leadership actions in the Complex domain (Snowden and Boone, 2007). The Cynefin Complex domain corresponds with the domain of interest in this review, that is, domains that are partially structured, emergent and partially predictable. Although Probe-Sense-Respond is a three phase process, the Sense phase is essentially a combination of the 'observe' and 'interpret/learn' phases in the four phase Adaptive Iteration model prevalent in this review. While the Probe-Sense-Respond approach is not explicitly represented as an iterative process, it is implicit in the work of Snowden.

Snowden emphasizes that the Probe phase consists primarily of safe-to-fail experiments that both test a hypothesis about potential improvements and generate additional learning about the nature of the Complex System. He also allows the possibility of multiple parallel experiments to increase the scope and depth of the learning.

Because Complex Systems are emergent and their future behavior cannot be predicted with confidence, Snowden also advocates the use oblique or indirect approaches to identifying improvements. He also encourages the introduction of diverse perspectives by incorporating related-but-different expertise into the Probe-Sense-Respond activities.

In addition to Probe-Sense-Respond, Snowden and Boone also mention the following as components of the suite of actions in the Complex domain:

- Create environments and experiments that allow patterns to emerge
- Increase levels of interaction and communication

- Use methods that can help generate ideas: Open up discussion (as through large group methods); set barriers; stimulate attractors; encourage dissent and diversity; and manage starting conditions and monitor for emergence.

3.7 Lean Startup

According to Wikipedia: *"Lean Startup" is an approach for launching businesses and products, that relies on validated learning, scientific experimentation, and iterative product releases to shorten product development cycles, measure progress, and gain valuable customer feedback. In this way, companies, especially startups, can design their products or services to meet the demands of their customer base without requiring large amounts of initial funding or expensive product launches*.

The Lean Startup approach (Ries, 2011; The Lean Startup, 2013) began as a methodology for (software based) entrepreneurial startup activities. However, it is increasingly being applied within large companies to address situations with that have significant levels of uncertainty (http://www.fastcompany.com/3004572/eric-ries-how-make-any-company-move-lean-startup) – a defining characteristic of the Lean Startup approach.

At its core is the establishment of a 'minimum viable product' followed by the implementation of the Build-Measure-Learn feedback loop "to begin the process of learning as quickly as possible". As stated on the theleanstartup.com/principles website:

> The Lean Startup methodology has as a premise that every startup is a grand experiment that attempts to answer a question. The question is not "Can this product be built?" Instead, the questions are "Should this product be built?" and "Can we build a sustainable business around this set of products and services?" This experiment is more than just theoretical inquiry; it is a first product. If it is successful, it allows a manager to get started with his or her campaign: enlisting early adopters, adding employees to each further experiment or iteration, and eventually starting to build a product. By the time that product is ready to be distributed widely, it will already have established customers. It will have solved real problems and offer detailed specifications for what needs to be built.

The 'Lean' part of Lean Startup is derived from the waste minimization approach in 'lean manufacturing'. The analogy is that a startup enterprise should develop and build only those product features necessary to test whether the 'value' and 'growth' hypotheses are valid. Building a high quality, feature rich product is irrelevant if it is not valued by customers and will not drive sustainable growth.

It is clear that lean startup is based around the general Adaptive Iteration approach. Although it is stated as a three phase approach, a design phase is implicitly incorporated in the Build phase. In the first iteration, the design is outside the loop and produces the design for the 'minimum viable product'. In subsequent iterations, the design phase is implicit in the 'Build' phase as modifications to product and/or business model are made based on insights gained during the 'Learn' phase.

Although the development of the 'minimum viable product' is outside the Build-Measure-Learn adaptive loop, a similar iterative approach is used. Product and business model ideas are tested experimentally with prospective users. A key feature of Lean Startup is the development of innovative and low cost ways to rapidly get real feedback from target customers about the viability of the proposed product and business model.

3.8 Adaptive Action

Glenda Eoyang and Royce Holladay of the Human Systems Design Institute use a three phase iterative 'Adaptive Action' approach to address uncertain and unpredictable situations. The approach draws heavily on the concepts and perspectives of Complexity Science, particularly those relating to the self-organizing behaviour of Complex Adaptive Systems. In their Adaptive Action Guide (HSD Institute, 2013), Eoyang and Holladay describe Adaptive Action as:

> Adaptive Action is a process that enables people to respond to their environments in coherent and productive ways. Adaptive Action assumes that, although human systems may seem hopelessly complex and unpredictable, in fact, patterns emerge from the dynamics of these systems. By "pattern" we mean "the similarities, differences, and connections that have meaning across space and time." Adaptive Action provides a systematic approach to identifying these patterns and responding appropriately. In other words, people can learn from their experiences and work together to influence systems toward more coherence and greater sustainability.
>
> We define Adaptive Action as an intentional reflective process based on these three questions: What? So What? Now What? These three questions are deceptively simple. Each one can lead into a deep exploration of the patterns emerging in human systems.

The Human Systems Dynamics Institute web site (HSD Institute, 2013) describes the three questions as follows:

1. **What?** – We gather pertinent data from across the environment to develop a picture of the underlying dynamics of our current status. What are the patterns we see and what do we know about their impact on the system?
2. **So What?** – We examine data to make sense of it. We come to understand what the "picture" of our current status means and begin to explore and plan next steps. We explore the impact of the system patterns on the whole, part, and greater whole; the conditions (CDE) that generated those patterns; and options for action that can shift the patterns to make the system more adaptable, more sustainable, more fit.
3. **Now What?** – We take action and then pause for a second check to measure our impact. By following up and asking where we are now and what is to be done next, we start the next cycle in the iterative process.

Central to the Adaptive Action approach is the Containers, Differences and Exchanges (CDE) construct. In the book *Adaptive Action: Leveraging Uncertainty in Your Organization* (Eoyang and Holladay, 2013), Eoyang introduces this construct as follows:

> I examined conditions for self-organization in a variety of contexts and classified all of them into three categories that were based on function. I called these categories meta-variables and named them *container*, *difference* and *exchange*. For me, the conditions – container, difference and exchange – both described the emergent patterns and explained the dynamics of the self-

> organizing processes that generated them. As an explanation, the CDE Model could form the foundation for a theory of action.
>
> Adaptive Action emerges from this theory of action, in which change is driven by accumulation and resolution of tension within the system. Tension emerges wherever variation of any kind (difference) exists within a bounded space (container). Change occurs when some means of interaction (exchange) releases the tension, and the boundaries and variations shift.

The three Adaptive Action phases - What? So What? Now What? – cover the scope of the four Adaptive Iteration phases as outlined in Table 1. However, the boundaries of the Adaptive Action phases to do not map neatly to those of Adaptive Iteration. For example, measurement and data gathering are included both at the beginning of the 'What?' phase and at the end of the 'Now What?' phase. As such, the three Adaptive Action phases cover a little more than a full cycle of an iteration.

The language and case examples in *Adaptive Action: Leveraging Uncertainty in Your Organization* focus primarily on organizational development, organizational behaviour and leadership. This is not surprizing given its origins in the Human Systems Design Institute. No doubt, the general approach has wider application (that, in part, is the premise of this paper) but it is unclear whether the current formulation and language of Adaptive Action will stimulate broad application outside the organizational/leadership context. That remains to be seen.

4 Discussion

From the preceding section we can conclude that there is significant advocacy for an iterative three/four phase approach to co-evolving action and learning in situations that are dynamic, uncertain and unpredictable. It is interesting to note that although the origins and initial application contexts for each of the approaches is quite varied, there is significant similarity and convergence. This section discusses the nature and significant of some the subtle variations across the approaches we have considered:

- Specific versus general application
- Linkage between plan/decide and act
- Intent/purpose as the central driver for Adaptive Iteration
- Achieving balance and integration across the four phases

4.1 Specific versus General application

All variants place emphasis on the nature and importance of observation, in the wider sense, as the key driver for learning. Deming/Shewhart and Ries use the more reactive and specific concepts of 'check' and 'measure' to convey the intent of their observation phase. Whereas, Haeckel, Dixon and Snowden use the broader concepts of 'sensing' and 'integration'. This reflects a significant point of variation in the various approaches to Adaptive Iteration – whether the adaptation is primarily in response to external influenced dynamics or whether it is primarily a response to the results of an internally conducted test or experiment.

Boyd's OODA cycle was originally formulated to explain the success of a situation over which the operator had significant influence and therefore was essentially an 'internally conducted test'. However, as the OODA Cycle started to be applied to wider strategic contexts, Boyd found the need to elaborate it to include the potential for more external inputs to the Observe and Orient steps. Similarly, Deming found it necessary to change the language for PDCA/PDSA as he attempted to encourage and support its application outside the relatively narrow process improvement context. This highlights the potential tension between a specific local application of Adaptive Iteration and a more general strategic application.

The tension between specific and general applications of Adaptive Iteration only exists if they are not explicitly recognized and understood as complementary. An externally focused approach to observing and interpreting is often necessary to identify performance gaps, significant misalignments or strategic opportunities that require Adaptive Iteration by the organization. An internally driven approach is then necessary to develop and test specific adaptive responses to close the performance gap or misalignment, or to take advantage of the strategic opportunity. The gap or opportunity identified in the wider adaptive loop becomes the objective or purpose that drives the local or specific adaptive loop. In this way, Adaptive Iteration applies at all levels in organizations – it is a fractal approach (Eoyang and Holladay make this point clearly). Therefore, it can be argued that it is a critical and core capability in organizations, especially those operating in complex environments.

4.2 Linkage between Plan/Decide and Act

An interesting point of variation across the Adaptive Iteration approaches is the nature and coupling of the Plan/Decide and Act phases of the cycle. In some instances, the plan/decision from Plan/Decide phase directly determines the actions in the Act phase. In other instances, the Act phase consists of experiments to test or validate the plans/decisions made in the Plan/Decide phase.

The actions in the Act phase can be either the direct implementation of the plans or decisions made in the Plan/Decide phase or experiments to test or validate those plans or decisions, or may be a combination of both. It is interesting to note that the Boyd and Deming/Shewhart versions originally had a direct coupling between the Plan/Decide phase and the Act phase. However, as they evolved, their approaches and language moved more towards the concept that the plan or decision is more like a hypothesis that needs to be validated through experiment.

There may be two reasons for this evolution of both the Boyd and Deming/Shewhart versions. First, the original versions were developed primarily for local application and as they were generalized to more complex situations it became evident that there was more uncertainty about the plan or decision and that the implementation costs and risks were significantly higher. Second, the original versions were developed in the 1950s and 1960s, a time when the 'machine bureaucracy' model dominated business and government. As such, there was limited networking and globalization, and consumers had limited choice and power. It was appropriate to have greater confidence that the success of any proposed changes could be predicted in advance.

It is the author's view that plans and decisions need to be more explicitly understood as hypotheses that need to be tested through well designed and implemented experiments. As such, managers and engineers need to be able to adopt the mindset and methods of researchers and designers, both of whom recognize that a scientific hypothesis or a design needs to be examined and tested through experiments or prototyping before being accepted as valid. The author believes that the term 'Design' is more appropriate than either ‘Plan’ or ‘Decide’ for this phase of Adaptive Iteration, and that ‘Experiment’ is a more appropriate term for the ‘Act’ phase.

4.3 Intent/purpose as the central driver for Adaptive Iteration

Adaptive Iteration does not occur in isolation. It is not an end in itself. The suitability of any given adaptation must assessed against the overall intent or purpose of the organization. Given the degrees of freedom throughout the Adaptive Iteration cycle, it is important that its intent or purpose is clearly and commonly understood by all involved. However, the intent or purpose should be stated at the highest possible level so as not to unduly constrain the scope of options explored during the adaptive iterations.

The centrality of intent or purpose to Adaptive Iteration is acknowledged by Haeckel who locates his Adaptive Loop within an overall ‘Sense and Respond’ process, the first step of which is to identify and agree the organization’s overall *raison d’etre*. He also embeds within the Decide and Phases of his Adaptive Loop explicit consideration of whether the organization’s *raison d’etre* needs to be modified.

However, many of the variants of Adaptive Iteration outlined in the preceding section do not give significant, if any, emphasis to the role of intent or purpose in ensuring the ongoing success of the organization’s adaptive responses. Intent is implicit and clear in the local versions of OODA and PDCA. In the OODA case, it is to win the air-to-air combat interaction. In the PDCA case, is to improve the nominated performance of a specific production process, although the target performance dimensions must be agreed beforehand.

The author believes that a clear and shared purpose is so critical to the success of Adaptive Iteration that it should be explicitly incorporated in the Adaptive Iteration approach. Adaptive Iteration is analogous with natural selection in the process of evolution – those variants (designs) that are successful survive selection pressures to pass on their genes. The ‘purpose’ in Adaptive Iteration is what generates the selection pressure that drives the Adaptive Iteration cycle.

4.4 Achieving balance and integration across the four phases

Because of the iterative nature of Adaptive Iteration, all four phases need to be balanced and integrated. Of the variants examined, only Kolb explicitly emphasizes and discusses this aspect. However, other variants incorporate elements that support integration of the four phases through the way data and information is presented and shared. Haeckel and Dixon emphasize the need to have mechanisms to share information through the Adaptive and Organizational Learning Cycles respectively and Haeckel proposes on-line technologies as such a mechanism. The approaches of Deming/Shewhart and Ries are embedded in overarching ‘Quality’ and ‘Lean’ frameworks, both of which incorporate visual and open data and information presentation as a core element.

The clear and shared understanding of intent and purpose noted above also provides integration across the four phases. Similarly, shared clarity around any core operating principles and constraints will also reduce the potential for conflict or confusion between the four phases.

There are also lessons to be learnt from designers, who are regularly required to balance practicality, creativity, evolving user requirements and commercial objectives. Progressive elaboration, extensive visualization (sketches, prototypes, storyboards), regular engagement with stakeholders, modularity and the use of metaphor are all relevant techniques designers use to ensure high quality outcomes.

As advocated by Ries, early rapid iterations around the adaptive loop are also a key to linking and integrating the four phases. Multiple explicit considerations of each phase during the early iterations ensures that narrow perspectives and inappropriate decisions are not locked-in before they have the opportunity to be considered and challenged from the perspective of each of the phases. Snowden suggests that on some occasions it may be desirable to have parallel iterations during the early stages of an adaptive response. This enables designers to explore a wider range of options and responses before thinking and perspectives become entrained.

5 General principles and an integrated approach for Adaptive Iteration

Based on the preceding review and analysis of a range of existing approaches, we can begin to develop a series of general principles for Adaptive Iteration. In addition, drawing on these principles and his experience as a management consultant and as a manager of a research and development organization, the author proposes a variant of Adaptive Iteration that he believes is better aligned with partially structured, emergent and partially predictable situations.

5.1 (Draft) General principles for Adaptive Iteration

The following draft set of general principles for Adaptive iteration is presented here to stimulate discussion and debate, and to provide a basis for further refinement and elaboration.

1. Adaptive Iteration applies to all non-random situations where behaviour and performance cannot be predicted with confidence in advance. In the main, this applies to situations that are partially structured and emergent. Because of dramatically increased connectivity generated by developments such as globalization and by technologies such as the internet, situations that require Adaptive Iteration are increasingly prevalent and of increasing significance.
2. Adaptive Iteration involves the co-evolution of learning and action in an iterative four phase approach:
   - Clear and unbiased observation of the situation, including contextual influences
   - Interpretation of the observed data to improve understanding of the trajectory of and the influences on the situation
   - Incorporation of the interpretation insights into a hypothesis for an improved design
   - Conduct of one or more experiments to assess the impact of the proposed improved design.
3. Adaptive Iteration is underpinned by a clear and shared understanding of the fundamental drivers for and constraints on the adaptive decisions. This provides coherence and alignment for all decisions and provides lower level scope for the adaptive process to explore novel and unconventional options. It also provides a clear driving force for adaptation and against the status quo.

4. Adaptive Iteration may be a nested approach in which a lower level Adaptive Iteration cycle is used as the experimental phase for a proposal for a higher level design change. Because of its multi-level applicability, Adaptive Iteration should be a core capability throughout any organization.
5. Rapid iterations of Adaptive Iteration are important during the early stages of an adaptive transition. These iterations promote critical early learning and integration across the four phases. They also help shake-out any lack of shared clarity about the fundamental drivers and constraints.
6. Adaptive Iteration co-exists with analytical action. Where the impact of a design variable can be predicted efficiently and with confidence, Adaptive Iteration is not required and the design changes should be subject to 'analytical action'.

5.2 A GENERALIZED APPROACH FOR ADAPTIVE ITERATION

As indicated in the Introduction, the author has synthesized an approach to Adaptive Iteration that he believes is more generally applicable to partially structured, emergent and partially predictable situations. The proposed approach is a purpose-driven iterative cycle of observation, interpretation, design and experimentation. The approach (Discerning Action, 2013) is summarized as follows:

> A design is a hypothesis about the most appropriate response to a complex and unpredictable problem or opportunity. The design hypothesis could relate to a physical product, a service, a plan of action, a strategy, a business model, an organisational development initiative, etc. A design is a hypothesis because until it has been successfully tested in context through one or more experiments, its suitability as a response is not proven.
>
> Experiments can take various forms, including a thought experiment, a prototype, a simulation, a trial or a pilot. A unique natural occurrence in a business or organisational context could also be considered a form of unplanned or natural experiment. In such a case, the Adaptive Iteration cycle would start with the Experiment step.
>
> An experiment could be predominantly confirmatory or predominantly exploratory. In the latter case, the primary objective would be to stimulate information or insights (learning) on which the next iteration of design is based. I believe the expertise to formulate and execute various types of experiments is a critical aspect of Adaptive Iteration, and is not well developed in many organisations.
>
> An experiment is of little value unless it is supported by accurate observation. However, the observer's challenge is that in observation our brains are heavily influenced by what we expect to see. Our observations are significantly biased by our, often subconscious, experience and expectations. If the context for our observations is stable and predictable, this bias provides us with significant cognitive processing advantage by making it fast and efficient. But it is a major weakness if the context is complex and unpredictable. In such cases, the Observe step requires explicit consideration and the development of specific observational expertise. As Louis Pasteur once said, "in the field of observation, chance favours the prepared mind". When observing in complex and unpredictable contexts we need to "prepare our mind".

Experimental observations are useful only if they lead to relevant learning through interpretation. The learning may relate directly to the initial design hypothesis, or to unexpected observations that arose because they were made with an open mind and/or from multiple perspectives.

In complex and unpredictable contexts the types of things we seek to interpret from our observations include: critical decision points and options; weak signals that may indicate an emerging coherence; the early stages of a reinforcing feedback loop that may trigger rapid change; indicators of the underlying driving forces and motivators in the system; and the nature and impact of the constraints and boundaries of the system.

Based on the results of the experiment, the design will be further modified or refined. These changes are, in effect, another hypothesis to be tested and evaluated by further Adaptive Iteration.

At the centre of Adaptive Iteration is a clear and shared understanding of overall intent or purpose. This creates coherence for the myriad of decisions that must be made when undertaking Adaptive Iteration. A shared understanding of overall Purpose is especially important given the complex and unpredictable nature of the context. The Purpose should be at a reasonably high level otherwise it will constrain the nature and scope of the design hypotheses that are generated. If it is at too low a level, it will already have significant design decisions built in and will reduce adaptive scope.

6 Conclusion

A comparative review of eight approaches to creating adaptive change in organizations has identified considerable similarity but also several subtle but significant variations, most of which are due to the context for which they were first developed. Drawing on this comparative review, a draft set of principles for a general approach (called Adaptive Iteration) has been proposed. An outline formulation for that general approach has also been presented.

7 References and Further Reading

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