

Software Based Disruptive Change Initiatives Require a Culture of Quality

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Abstract

The meaning of quality – whether in the software product we develop or the organization that develops it – needs to evolve over time to adapt to changes in business requirements and environmental factors. The authors observe that not all software-based Change Initiatives are created equal. Some occur within an enterprise with stable enterprise architecture, while others require a significant paradigm shift to transform an enterprise and disruptively shift business or operating models. We believe managing complexity, promoting active organizational learning, and treating change as a common Enterprise Language are key understandings that project leaders and participants must acquire in order to successfully lead transformative change initiatives. These understandings are important to transformative Change Initiatives and are the foundation of a quality culture necessary for a modern enterprise to continually learn, sustain, and renew itself. This paper will outline key success factors in “crossing the chasm” to implement disruptive Change Initiatives in large enterprises.

Biography

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1. Introduction

Changes in the modern enterprise are increasingly managed as projects that are enabled or supported by enterprise software or IT systems (henceforth “Change Initiatives”). Some Change Initiatives deliver relatively simple improvements to existing business practices, such as digitizing paper workflows. In contrast, some Change Initiatives are transformative in nature and impact major business processes or basic operating models or paradigms, such as mergers of previously independent or autonomous organizations.

Transformative Change Initiatives are prone to failure. Although failure is often associated with failed software implementation, technology and software development are seldom the root cause. A common root cause may be a lack of collaboration among business units or disconnect between IT and business management. Closer collaboration between IT and business staff can be achieved through the use of certain software development life cycle (SDLC) methods – e.g. Agile, the Unified Process, and Joint Application Development (JAD). If used correctly, these SDLC methods can contribute positively to overall quality, typically by avoiding defects in requirement gathering or by enabling early detection and correction of defects [Jones 2012].

We believe iterative SDLCs, including Agile that implement changes incrementally with frequent course corrections, are important to manage quality in Change Initiatives. However, we also believe that SDLC is one aspect of overall quality; with other considerations being an organization’s ability to articulate the desired change accurately, to work with contractors effectively, and to manage change in the context of complex organizational dynamics [Kwong 2018]. In this context, Enterprise Architecture methods are often used by large enterprises to align business goals and objectives with IT systems design [Ross 2006]. There appears to be no shortage of management methods, techniques, and philosophies, but Change Initiatives remain highly risky.

We observe that some transformative Change Initiatives are doomed to fail when leaders and participants are not aware of the magnitude of the change needed and the dynamics at play during enterprise change. This may be so even when IT and business management are willing and able to work closely. In this paper, we will characterize different types of Change Initiatives in the modern enterprise. A descriptive model of organizational change and relevant dynamics will be presented. Leveraging this understanding, we present possible approaches for assuring quality and mitigating risk in transformative Change Initiatives. This paper expands on Section 7 Organizational Dynamics in our PNSQC 2018 paper [Kwong 2018].

2. Change Initiatives and Enterprise Architecture

Projects in an enterprise’s portfolio can be categorized into projects required to run or grow an enterprise and projects required to transform an enterprise [Maizlish 2005], as depicted in Figure 1.

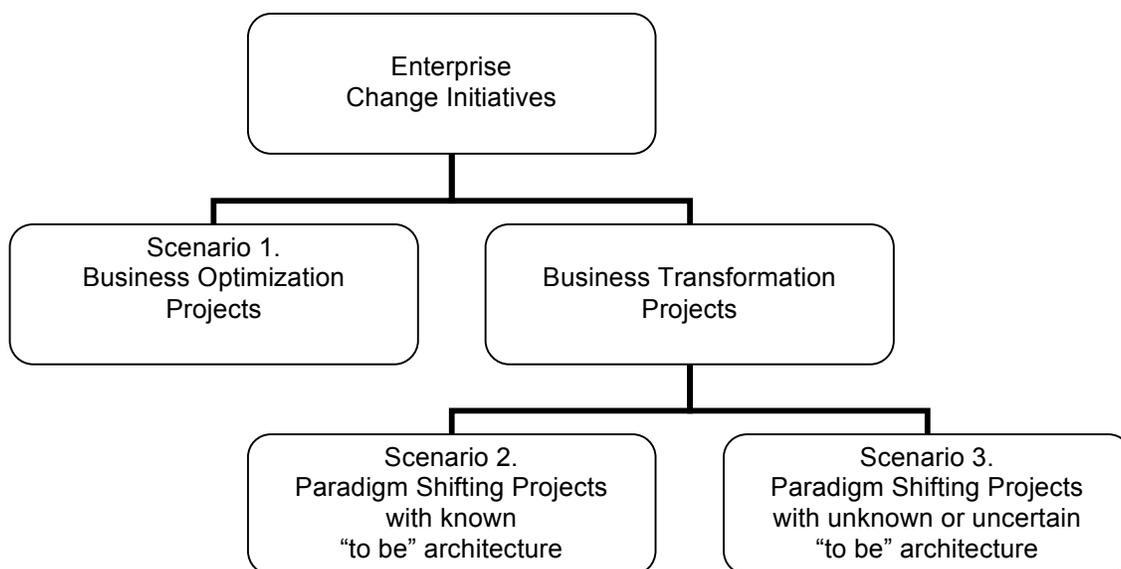


Figure 1. Enterprise Change Initiatives can be broadly classified into two categories: projects that optimize business operations or support growth based on the current operating paradigm (Scenario 1) and projects that transform an enterprise. Among these projects, there are projects with known “to be” architecture (Scenario 2) and those that have unknown or uncertain “to be” architecture (Scenario 3).

Projects required to run or to grow an enterprise may not require significant changes to business models or business processes and may focus on optimizing existing workflows or user experience. Typical goals for this category of projects may include: improve process efficiency, improve customer satisfaction, and reduce operational costs [Jones 2012]. These types of projects likely do not require significant changes to the organization's Enterprise Architecture (EA), whether formal EA is in use or not.

Projects required to transform a business usually involve major business process or technological changes. Historically, IT executives may associate projects required to transform an enterprise with the following: implementing an ERP system, building a data warehouse to support cross-functional needs, or implementing middleware to integrate heterogeneous systems [Ross 2002]. These types of initiatives are likely major undertakings of an enterprise, which require large IT investments whose outcome can significantly affect the future performance of an enterprise.

Transformative Change Initiatives of qualitatively greater scope and complexity are increasingly common in large enterprises. According to the Federation of Enterprise Architecture Professional Organizations (FEAPO), transformative changes typically include large mergers or acquisitions, rapid adoption of new business models, the shift from one overarching operating model to another. These kinds of Change Initiatives require "transformational enterprise architecture" in order to realize the desired business benefits [Architecture & Governance 2013]. Furthermore, new solution approaches that drive or enable new business models must be delivered in increasingly compressed time frames. According to Adrian Cockcroft, former Chief Architect of Netflix, "enterprises have hit a turning point" with respect to cloud technologies, software-as-a-service (SaaS), and DevOps [Bloomberg 2014].

In summary, the magnitude, complexity, and velocity of cross-functional change needed often conspire to create great challenges to stakeholders of Change Initiatives. These initiatives may not be "normal" enhancements or optimization of existing paradigms; they may be "paradigm shifting" [Kuhn 1970] in the sense that the enterprise's Enterprise Architecture is to be disruptively transformed, as categorized in Figure 1.

3. Enterprise Change as Complex System Dynamics

A modern enterprise can be modeled as a complex value network of many functions and participants. Therefore, enterprise change over time can be viewed and analyzed as complex systems dynamics. The business literature contains many examples of the application of complexity theory to the analysis of business ecosystems, emphasizing the importance of the interdependence between participating parts.

Kwong & Harmon analyzed the dynamics of value networks based on non-equilibrium dynamics [Kwong 2007]. When this analytical approach is applied to complex enterprises, there are three distinct scenarios:

- Scenario 1: Business Optimization Projects¹ – This type of Change Initiative occurs within a stable operating environment with stable operating paradigms. In this scenario, the magnitude of change at the enterprise level is small, and the basic operating paradigm of the enterprise and EA are not changed appreciably. Change initiatives here are business optimization in nature, and normal project management methodologies work well.
- Scenario 2: Paradigm Shifting Projects with known "to be" architecture² – This type of Change Initiative transforms an enterprise from its current operating paradigm to a stable new one. Here, the magnitude of enterprise change is large and entails significant changes to operating models and EA. This type of Change Initiative can usually be guided by industry or domain-specific designs ("dominant designs" [Utterback 1996]) or an accepted maturity model.³ As a result, strategies and roadmaps toward the "to be" state of the enterprise can be developed, at least in principle. However, a poorly understood or executed Change Initiative may deliver a "to be" state of the enterprise that is less optimal than planned or, even worse, less optimal than before the Change Initiative. Houchin and MacLean observe that in many organizations, especially in the public sector, enterprise change gravitates toward a new stable

1 The game theoretical parallel of Scenario 1 is single-person games; e.g. individual small firms seeking to optimize performance in the presence of overall market forces that it cannot affect appreciably.

2 The game theoretical parallel of Scenario 2 is multi-person games; e.g. non-cooperative games in which players make decisions independently and cooperation is self-enforcing. Given perfect information flow, non-cooperative games have global optimal strategies called the Nash equilibrium.

3 For example: the Capability Maturity Model Integration (CMMI), Medicaid Information Technology Architecture (MITA), or the Environmental Protection Agency's Cross-Media Electronic Reporting Rule (CROMERR).

equilibrium [Houchin 2005]. They argue that complex organizations strive to maintain stability through the establishment of organizational structure and culture; much like living species, social groups, and nations. As an example, a Change Initiative usually requires personnel roles & responsibilities to be adjusted. In a large enterprise, it may be impractical to change the position descriptions of all staff and their reporting relationships in a short timeframe. As a result, certain practices may be retained and may well “live on” through a Change Initiative, constraining the pace of change. One challenge of a Change Initiative in a mature organization is to balance beneficial change with necessary stability.

- Scenario 3: Paradigm Shifting Projects with unknown or uncertain “to be” architecture⁴ – This type of Change Initiative also transforms the enterprise from its current operating paradigm to a new one. Unlike Scenario 2, the “to be” state of the enterprise for Scenario 3 cannot (or cannot yet) be fully elaborated or understood, owing to the rapid changes in business requirements or overall business environment. This type of Change Initiative does not have the benefit of dominant designs or accepted maturity models.⁵ In this Scenario, clear strategies and roadmaps are not possible, or roadmaps are valid only for a limited time and must be updated frequently. Anderson observes that enterprise changes do not necessarily result in a long-term equilibrium [Anderson 1999]. When changes in business environment are more significant and rapid than an organization's ability to bring about beneficial change, a previously successful enterprise may fail [Christensen 2003].

Change Initiative	Nature of Change	Magnitude of Enterprise Change	Gap between “as is” and “to be” states	Strategies and plans age or become obsolete quickly?
Scenario 1	Business Optimization Projects	Small	Small	No
Scenario 2	Paradigm Shifting Projects, with known “to be” architecture	Large	Large and with guidance of applicable dominant design or maturity model	No
Scenario 3	Paradigm Shifting Projects, with unknown or uncertain “to be” architecture	Large	Large and without guidance of applicable dominant design or maturity model	Yes

Figure 2. Change Initiatives as analyzed using the analytical approach of Kwong and Harmon [Kwong 2007].

4. Navigating the Process of Transformative Change

Transformative change is, by nature, a cross functional undertaking. In our experience, the following aspects are especially important in navigating the process of transformative change: managing complexity, organizational learning, adopting an enterprise language for change, and working toward a culture of quality for change.

a. Managing Complexity

Transformative Change Initiatives are inherently complex undertakings because stakeholders in large enterprises have certain collective characteristics that do not lend themselves to simplification [Page 2009]:

- diversity – the great number of participants and their differences in background, training, and values;
- connection – the participants’ perspectives are affected by each other’s perspectives;
- interdependence – the participants’ actions are affected by each other’s actions;
- adaptation – participants can change or adapt their perspectives and actions.

Curlee & Gordon observe that traditional project management methodologies have weaknesses with respect to managing complexity. There are aspects of the work of project managers⁶ that “are either not fully explained or are treated as solely linear concepts” in the PMBOK [Curlee 2011]. Indeed, recent editions of the PMBOK

⁴ There is no game theoretical parallel of this scenario, because the “rules of the game” change too rapidly to enable stable strategies.

⁵ For example, the current state of distributed ledger / blockchain technology used for smart contracts in finance and trading applications [Hong Kong Monetary Authority 2016].

⁶ These aspects include harnessing complexity, stakeholder communications, virtual teams, and leadership.

provide substantially more guidance on stakeholders' management and on the use of iterative / Agile methods to help manage real-world complexity.

In the authors' experience, the following considerations are important in managing complexity in Transformative Change Initiatives:

- Review goals and objectives in a business case frequently to assure that they are up to date.
- Review the project plan frequently to assure that it aligns with the current business case. This includes scope (inclusive of functional, non-functional, security and other requirements), schedule, budget, resources, and other aspect of the project plan that may need to be adjusted when the business case is updated.
- Incorporate slacks in project schedule and budget. Project schedules and budgets should not be so "lean" as to eliminate the possibility of flexible response to unanticipated issues or problems. Slack may be locally non-optimal but enables overall project robustness, especially in enabling response to the unexpected that inevitably arises.
- Encourage diverse perspectives among stakeholders; especially ideas that may not initially appear to align with an organization's "dominant logic" which often leads to "group think." However, this must be balanced with decision-making processes that are timely, enable greater weight be given to the perspectives of stakeholders with the deepest topical expertise, and avoid analysis-paralysis.
- Encourage synergistic links between stakeholders that exploit the diverse knowledge, experiences, and background of the stakeholders. Leverage positive interdependences between stakeholders' thinking that lead to cooperation, organizational learning, synergy, and win-win scenarios.
- Attend to small issues and conflicts between stakeholders early on, in order to avoid the sort of "self organized criticality" associated with irreversible loss of mutual confidence, trust, and the ability to work together effectively. Consensus is helpful, but there needs to be a way for the team to move forward when complete consensus is not possible or cannot be achieved quickly.

b. Organizational Learning

While "out-of-the-box" thinking may be welcomed by some, it is well known that social and cultural considerations may impede the diffusion of innovation [Rogers 1995] and the widespread adoption of new technology [Moore 1991]. Transformative Change Initiative requires the adoption of new enterprise paradigm, business processes, and technology by an enterprise. This entails the mass adoption of a new "worldview" within the enterprise, with requisite change in mindset made possible by organizational learning.

To support organizational learning, a variety of tools and methods have been found useful. Many mature organizations have adopted Enterprise Architecture (EA), which is the "fundamental organization of a system embodied in its components, their relationship to each other and to the environment and the principles guiding its design and evolution" [Zachman 1997]. Zachman considers EA to be an ontology for a modern enterprise or an Enterprise Language to support change. The Enterprise Language of EA enables formal description of the "as is" state and possible "to be" states of an enterprise. So, different enterprise designs can be framed conceptually, detailed, reviewed, and approved -- typically in cross-functional work groups or review boards.

In highly disruptive contexts, in which transformative change is expected to be relentless, traditional EA methods may be viewed as overly burdened by process and documentation and ineffective for just-in-time organizational learning. In reference to traditional EA methods, Cockcroft noted that "monolithic apps that need rigid architecture with rigid architecture review boards that maintain central control" may not work [Bloomberg 2014]. In order for new technologies to act as enablers of innovation and transformative change, "the goal of architecture was to create the right emergent behaviors." Managers need to "set up feedback loops and change the management style" in order to foster continuous enterprise learning.

c. Enterprise Language for Change

EA typically starts with natural language descriptions of knowledge in an enterprise. Zachman speculates that EA, as the Enterprise Language for organizational change, can be informed by the process of natural language change [Zachman 2014].

Important characteristics of natural language change include [Sole 2010]:

- different languages developed due to spatial (geographic) or cultural separations (e.g. power distance) – necessitating translation between groups that do not speak the same language or dialect;
- languages are subject to the forces of competition and "foreign invasion";

- languages may require expansion in order to address new things or new concepts;
- languages must evolve over time or risk decay (diminished use) or death [Zuckermann 2012].

By analogy with the four bullets above on natural language change, we infer the following characteristics of EA in the context of enterprise change:

- historical functional separations in an enterprise created different “languages” among professionals and managers – necessitating translation between groups by “multi-lingual” cross-functional specialists, architects, or managers;
- the different “languages” in use in an enterprise can beneficially “invade each other” – ideally converging on a single dominant language for the enterprise (a sort of “Enterprise Language” whether formal EA is used or not);
- different “languages” in use and the emergent Enterprise Language must incorporate new concepts from other paradigms, within but also outside the enterprise;
- the Enterprise Language must evolve over time to enable innovation and change or risk decay or extinction due to enterprise level decay or death.

Wittgenstein said, “If a lion could talk, we could not understand him.” The idea is that without common experiences and understanding, there cannot be communication with shared meaning. At the start of a transformative Change Initiative, different functions within an enterprise would likely understand the meaning of a proposed paradigm shift and associated changes differently. The organizational learning that follows, if done well, imparts common experience and shared meaning on the desired enterprise change among stakeholders. To accelerate this process of organizational learning, an effective Enterprise Language for organizational change can be helpful. From Section 2 and Section 3 of this paper, we believe our classification of the three types of Change Initiatives (Scenario 1, 2 or 3) and their associated dynamics provide a viable taxonomy -- an Enterprise Language -- for communicating the nature of enterprise change during Change Initiatives.

d. Toward a Culture of Quality for Change

There is no simple list for what constitutes a culture of quality for change. In addition to the focus areas covered above (managing complexity, organizational learning, and common enterprise language for change), we believe stakeholder training that emphasizes the following would be important in transformative Change Initiatives:

- Address enterprise-wide paradigm change early; especially with respect to major operating model change, business process change, staffing change, and other changes that are significantly different from prevailing organizational practices or culture.
- Adjust scope / quality requirements based on evolving changes in the business and external environment that take into account necessary or beneficial changes; not ignoring or resisting them on the ground of scope creep or change control.
- Develop project roadmaps that integrate relevant business functions and IT.
- Put in place project governance that integrates work teams and relevant business functions.
- Coordinate cross-team / cross-function dependencies methodically and carefully.
- Assure end-to-end functionality of work products across all business functions.

5. Agile in Transformative Change

Agile methods call for incremental delivery of change and frequent course corrections. As discussed in Section 4, these are good practices where transformative Change Initiatives are concerned. So, it is not surprising that Agile is gaining momentum in delivering Change Initiatives and, more generally, in enterprises seeking more “agile ways of working” [Aghina 2018].

Agile is used to handle uncertainty in requirements as new features are requested and their priorities shift in real time. Agile sprints produce frequent software releases based on direct input from the business. This tight coupling with the business supports early detection of defects in requirements and designs; as high level user stories / scenarios are elaborated to produce detail requirements that support design, development, and implementation.

In chasing agility, projects often ignore or can only poorly understand the uncertainties and associated risks introduced by the Backlog. With relentless sprints, it is easy to view completed sprints as a proxy for progress. The “risk trap” is poor understanding of the probability and impact of the actual project risks associated with implementing certain user stories incorrectly (scope / quality risks) and actual velocity falling short of the

expected (schedule / budget risks) [Nuottila 2016].

In traditional project management (waterfall SDLC), overall risk of remaining work in a project decreases as the project progresses (Figure 4.2). However, an unmanaged Backlog can result in increasing uncertainty with time and a higher likelihood of project failure (Figure 4.3). We have observed failed projects as a result of this type of poorly executed Agile or iterative SDLCs. The lesson learned is: over emphasis on sprint statistics without attendant efforts to manage the Backlog can compromise the health of a transformative Change Initiative.

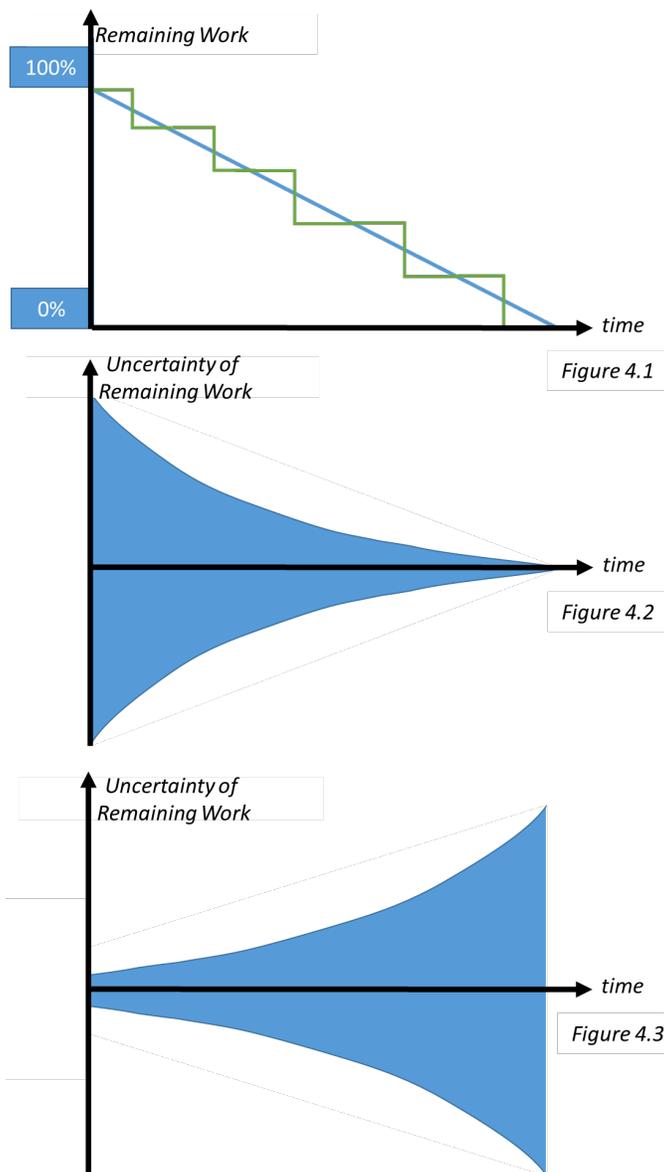


Figure 4. The “cone of uncertainty” expected in traditional project management (Figure 4.2) vs. the unmanaged Backlog in poorly executed Agile (Figure 4.3), as a Change Initiative proceeds by “burning down” work over time (Figure 4.1).

6. Conclusion

We have shown that Change Initiatives are not created equal. In a transformative Change Initiative, the business case and corresponding requirements may initially be high level and non-specific. This type of Change Initiative often has requirements that are ambiguous and need to be carefully elaborated. This elaboration requires cross-functional work teams that engage in managing organizational complexity, achieve organizational learning, and converge on a common Enterprise Language of change. Throughout the life of a transformative Change Initiative, complex organizational dynamics is always at play. For this process to be successful and repeatable, a culture of quality for change needs to emerge. These considerations are important even if an enterprise uses Agile or iterative SDLCs.

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