Introducing Lean Principles with Agile Practices at a Fortune 500 Company

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Abstract

Why does the introduction of Agile software practices within a large corporation pose a difficult and challenging prospect? How can Lean principles mitigate development challenges and enhance your success? What does an approach born in manufacturing have to offer to software development? This experience report sets out to answer these questions and offer insights into achieving a smoother transition to Agile through the application of Lean tools and principles.

1. Introduction

Capital One is a large financial services company generating revenue of $12 billion, net income of $1.8 billion and is currently ranked No. 187 on the Fortune 500 list [1]. Like many companies today, Capital One faces the challenges of decreasing operating costs while maintaining the competitive edge to be first in delivering innovative product offerings to customers. In response to market challenges, Capital One executives outlined a speed to market goal calling for a significant decrease in product and project development timeframes. As a result, in 2004 within business units supporting software development, Agile pilot projects sprung up across the company through both traditional channels of Executive sponsorship and independent grassroots efforts. By 2005, almost 20% of the portfolio held projects leveraging Lean and Agile practices that enabled software delivery 30% to 50% faster than projects of similar size and complexity [2].

This report shares the insights gained from one of the pilot efforts initiated in 2004 within the acquisition division of Capital One. The pilot gained distinction by making a deliberate decision to apply Lean principles in conjunction with the adaptation of Agile techniques.

While this information does not advocate that Lean, or Agile methodologies, provide a “silver bullet” to solve all software development issues, it does propose that pausing and evaluating current delivery processes under the lens of Lean prior to initiating an Agile pilot will increase the likelihood of a successful pilot with tangible business metrics. The results generated by this pilot effort provided the leverage to transition from a Waterfall delivery method to a composite Lean and Agile delivery method for the division’s entire portfolio of projects.

2. Speed to Market Challenges

Increasing the pace of software delivery came into focus in response to the competitive environment demanding the need for increasingly shorter project delivery timeframes. Projects were becoming larger in size in an effort to push their way up prioritization channels by claiming the largest return on investment. Large program efforts of 12 to 18 months became commonplace, with three to five projects structured within the program to provide more oversight and control. Project performers were allocated to three or four active projects at one time. Resource optimization processes began to require as much coordination to manage as the actual work to deliver a project.

Functional areas supporting project delivery across the company began to implement improvement initiatives to support time to market objectives. The efforts did generate mild success for their departments’ metrics, but these silo efforts failed to reduce aggregate timeframes. This type of result driven by functional optimization is described in Eli Goldratt’s work on the Theory of Constraints [3].

3. Starting with Lean
Lean principles have proven their value beyond the manufacturing environment – as expanded upon by the works of Jim Womack [4] and Michael George [5]. Lean approaches had also been successfully applied to internal production operations resulting in speed and efficiency gains at Capital One. Lean was recognized as a proven method that not only showed improvement in speed also generated stronger quality outputs while lowering costs. However, it was not until Mary and Tom Poppendieck’s revolutionary ideas on Lean Software Development that a connection between Lean and Agile could be conceptualized and realized [6].

Experience led to an understanding that software development is a complex effort with high levels of variability. In response to the unpredictable nature of software development, reliability is sought and not repeatable -- as is the desired outcome in manufacturing. The uncertainty principle is an oft-cited reference when describing the inconsistent behavior of the development process [7]. But in making the connection between Lean principles and Agile practices, a new series of thoughts, hypotheses, and insights on applying Lean tools to evaluate software delivery practices ignited.

To address the delivery dilemma, a broad level of expertise from each department supporting project delivery was needed and efforts set forth to recruit a team of people, who are referred to in this paper as the Core team. The Core team was chartered to delve into and solve the following problem statement, “Why do new capability infrastructure projects take so long?”.

It became evident that in response to rapid growth and the evolving maturation path of the company, there had been an accumulation of idiosyncratic project delivery methods, artifacts, and governance. Lean offered a framework to return to a focus on value delivered to the client. A Lean exercise such as, Voice of the Customer (VOC) ensures that you have captured the clients needs from the perspective of the client and enables a focus of attention on the most critical needs [5]. A preliminary VOC exercise validated that the internal clients of the process considered speed to market as their top priority.

Before you change your process, you need to know your process. The core team estimated spending 12 weeks following the DMAIC framework (Define, Measure, Analyze, Improve and Control) espoused in the process improvement method Six Sigma [8]. The team negotiated a trial period of four weeks to pursue the application of Lean principles. At the end of the four week period, the team was able to provide a wealth of both quantitative and qualitative insights into root causes of duration and secured buy-in to complete the remaining body of analysis planned in the original 12 week requests.

4. Applying Lean Tools

The core team began by mapping the activities of new capability delivery across the process flow (value stream) of the Acquisitions division. A value stream (VS) is defined by a product or service type and includes external and internal processes and extends into the customer’s realm [5]. Within the acquisition value stream, for example, project delivery is considered the service type. A value stream map provides a visual swim lane depiction of the all process steps involved in creating a product or service and includes critical process metrics such as: cycle time, touch time, and queue time. When the Core team concluded the VS exercise, the Acquisition value chain map depicted 122 high level tasks, each with 10 to 12 subtasks requiring navigation across multiple departmental organizations.

Duration and time are important measures in the application of Lean tools. After the process tasks are mapped, the cycle time and touch time of each task is captured and labeled on the value stream map. Instead of walking the production floor with a stop watch, as one might be doing in a manufacturing environment, the team walked a virtual path by interviewing performers across the value stream capturing, along with other duration data points: best case, most likely, and worst case cycle/touch times.

After adding the touch and cycle times to the value stream map, the team classified each of the 122 high level tasks from the value stream map as one of three categories. Customer Value-Add (CVA) is assessed for tasks that add form, feature, or functionality to a capability. Business Value Add (BVA) are tasks that provide for financial, regulatory, and legal requirements. Non-Value Add (NVA) are any tasks that fell into neither the CVA or BVA category.

These categories are structured to support continuous improvement and designed to challenge conventional thought by presenting any process in a new light broadening the doorway of opportunity. When applying these monikers to most processes, the result will often show that over 90% of tasks in any given process are NVA. (Note: this is non value in the
eyes of the customer.) A world class Lean organization operates with about 50% of tasks classified as NVA in their processes [8]. Applying this type of classification to the tasks presented an alternate view and widened the possibilities of improvement.

After classifying the tasks, the team then moved to calculating the Process Cycle Efficiency or PCE of the project delivery process. PCE is a key Lean formula or tool that measures the amount of value add time in a process divided by the total time it takes to complete and deliver the product of your process [5]. For the pilot, PCE was calculated to be 14%. Using this information, the team took steps to increase the PCE by eliminating NVA tasks where possible. When elimination was not feasible, attempts were made to minimize the duration of these events through balancing the tasks across the process to maximize flexibility - such as introducing parallel paths.

5. Employing Lean Principles

Starting with the principle of “Eliminate Waste”, the team further classified the NVA tasks by the type of waste the task introduced into the process [6]. It found that of the seven types of waste classifications Transportation, Inventory, Motion, Waiting, Over-processing, Over-producing, and Defects (Re-work), Motion was the most prevalent type of waste. This was followed by Over-processing and Over-producing.

Root-cause analysis focused on the challenge statement (How do we reduce the duration of new capability infrastructure projects?) produced a multitude of insights into the process. These insights fell into seven categories:

- Resource Management and Optimization
- Complexity
- Artifacts
- Multiple gates
- Organizational alignment
- Level of project/process expertise
- Accountability

After exploring thoughts on what contributed to the waste within the process, the team made deliberate decisions about where to focus attention and gather more data to confirm the actual impact. Applying techniques like the “5 Whys” to the output of the root cause analysis led to the identification of process improvement solutions to address waste opportunities.

The team identified 41 high-level factors of root causes that contributed to the problem of duration. Then the list was prioritized by quantifying the impact and the effort anticipated to resolve the issue. The exercise produced a list of 19 contributing factors that would be addressed in the improvement effort. The key factors included:

- Optimization of resource time with allocation to three or more projects at one time
- Manual execution of test cases without the benefit of automation
- Frequent stops for official signoff delaying efforts for days or weeks
- Performers working within the process having little visibility into tasks upstream or downstream
- Redundant and overlapping roles across departments
- Unclear expectations for customer’s role
- Low level of customer interaction with development team members
- Assigning the most knowledgeable and skilled technical resources to coordinate the work instead of contributing to it

The analysis of the process provided qualitative and quantitative data suggesting numerous opportunities to apply other Lean principles to reap additional benefits. Two such areas were: increasing the release frequency of value-add code; and actively supporting team empowerment concepts in the culture [6]. The analysis focused on waste identification also suggested that the examples of waste were not unique to a single department, but rather, applicable to organizations across the company. Many of the insights gained by the effort could be considered reusable by other groups and the findings were shared broadly across the company.

6. Exploring Agile

A seemingly obvious concept is that one of the most important value-add tasks in a software development project is…coding. But the analysis showed the act of coding as the 76th task of the 122 high-level tasks in the current state map. Designing and developing code accounted for only 10% of the duration of delivering a software development project to production.

The analysis provided new insights on how various factors lead to introducing non value waste into the process, outside of how code was being developed.
The team discovered a redundancy in documentation efforts at multiple points in the life cycle. While functional areas understood their own process steps, the steps were not understood across the entire value stream, resulting in over-delivery of descriptions in documentation and unnecessary delays caused by not knowing who to contact. In many cases there were linear handoff steps that were not required to support the quality of code.

The team moved quickly to determine how to eliminate NVA tasks, duplicate actions and linear handoffs, combine tasks when feasible and create new tasks when necessary to facilitate the elimination of a series of tasks. Key principles of waste removal, collocation, resource dedication, iterative development cycles, and application of Agile techniques for project delivery were considered and then applied. At the conclusion of the 12-week effort, the team had designed a leaner project delivery process that reduced the number of tasks in the process by 50%. Returning to the goal statement and original hypothesis, the team directed attention to iterative development and how Agile practices could further reduce duration.

How could it be that a software development process only spent 10% of time in an average IT project working on the code? Code development had taken a back seat in the organization and was overshadowed by an increasing number of project management tools and cost reduction initiatives. Recognizing the limits of Waterfall delivery and the potential of iterative development, the focus was turned toward a quest to learn about Agile methods. In order to start a pilot project, we needed to determine which Agile practices best suited the environment. The Core team initiated the evaluation process by considering Agile practices from several perspectives:

- Suitability of the development environment to iterative cycle and daily builds
- Organizational hurdles and level of Executive support
- Associate knowledge level and technical skill expertise
- Cost of implementing new techniques

In evaluating the strengths and limitations of the development and testing environments, it was discovered that the current configuration would not support daily builds and that the code release process was structured to support a phased delivery approach. Resource optimization constraints where people were allocated to support work in four to five projects at one time was an additional complication. Over time the technical and domain expertise of the performers had decreased not only from normal attrition but also the heavy reliance on contractors in the organization. Extreme Programming (XP) had been attempted several years ago, but was abandoned in the face of these constraints [9]. Even with these challenges, however, Executive support for a pilot start was strong. There was considerable demand to generate data to prove the concept and begin to develop a deeper understanding of the benefits that Agile development techniques could produce, in order to significantly improve the delivery of value for clients.

Research into the various types of Agile development techniques and consideration of the organization’s constraints led us to believe that Scrum would be the most effective start into Agile development. The Scrum methodology as articulated by Ken Schwaber [10] provided a road map to deliver iterative development in a complex and highly variable environment. Scrum adapted well to the individual needs and priorities, was not reliant on external consultants or companies, and had no inordinate licensing or software purchasing requirements. Most importantly, implementing Scrum was not dependent on making upfront enhancements to infrastructure configuration and appeared to complement the desire to test the hypothesis around iterative development.

7. Selecting a Pilot

Now that the team had re-designed the process and determined to adopt Scrum for its initial Agile approach, it was time to select a pilot. In discussions with Executive stakeholders, it was understood that to drive change momentum, the pilot project needed to be reflective of a typical project delivered on the platform in terms of size and complexity.

This is an important attribute in selecting a pilot, because when attempting a new method, one could take several different approaches depending on the level of risk and demand for quantitative results. The core team considered options including introducing the concepts of Lean and Scrum to the entire portfolio of active projects or limiting the focus to only small projects in the portfolio such as enhancements. The prevailing thought was that either the broad approach as well as the less risky approach of small efforts would fail to produce the convincing and tangible results needed to overcome the organizational
constraints that could lead to a roll out scenario. The Core team made the following decisions on the selection of the pilot: 1) The Project would need to be similar in size and complexity of other projects delivered on the platform. 2) The team members allocated to the project would need to be a representative mix of knowledge and skill levels present on the platform. Leveraging the consensus on this approach, the team moved forward into defining how to select the right project to pilot.

The team then worked to identify the categories that would provide the pertinent data for determining the selection and fashioned the approach to support proof of concept. The selection categories that resulted were size, complexity, budget allocated, and non-start status. Applying these filters to the project portfolio, The Core team identified a selection of potential pilot candidates. Pros and cons of each project were considered, with each team member acting as an advocate for each of the pilot options. After consideration, each dimension was ranked relative to the others and was assigned a relative weight. Next, the projects were evaluated for each identified criterion and then scored to populate a summary matrix. This approach provided stakeholders with objectivity into selection and avoided extended circular conversations delaying a start.

8. Establishing a learning agenda

Anticipating the unknown, the pilot and test were structured with deliberate intent to incorporate learning outcomes throughout the experience. Acknowledging Capital One’s limited experience with Agile at the time, and Agile’s limited experience outside of pilot efforts in large financial companies, the pilot declared a continuous learning agenda to both performers and stakeholders.

A series of success measures were articulated such as: decrease duration, no increase in cost, decrease effort, and no degradation in quality for the test and pilot. In order to maintain executive buy-in, a declaration and subsequent analysis of several hypotheses around speed gains for iterative development were instituted. These hypotheses were tested and then measured over a 10-week timeframe on a portion of development work considered lower risk but whose timeline was critical.

The results from the test provided tangible evidence that an iterative development approach was faster than phased and did not introduce unacceptable levels of risk into the code base. This data not only further grounded assumptions but provided some quantitative validity that increased the comfort level of Executive stakeholders and project performers. The test results provided a 30% decrease in duration of the code development and testing and a 15% decrease in resource costs. Building on the testing success, the team then moved forward to the full start-to-finish pilot of a large and complex project typical for our environment through the proposed Lean and Agile delivery method.

9. Obstacles

The Core team encountered multiple obstacles in securing buy-in in order to start the pilot. As I believe is true in other organizations, the following hurdles were the most challenging:

- Obtaining facility space for collocation
- Gaining Executive support
- Influencing the change curve

Facilities issues were overcome by first researching the internal process steps in place that governed how the group operated. Insight into the process constraints and offerings was beneficial when we presented the Facilities team with our dilemma of creating collocated workspaces. This dialogue set the framework for the discovery of a shared goal around building workspaces that was conducive to collaboration and increased efficiency. The Facilities team was able to provide options for collocated work spaces that fit into current operating cost budgets.

Executive support was garnered through a very deliberate and thoughtful two-way communication, initiated in a stakeholder-chartered monthly communication which gradually experienced a metamorphosis from a report out into a series of interactive conversations focused on the learning agenda. Stakeholders began to view insights as more precious than project status. Understanding how performers were responding to change and the observed impacts on morale were more interesting than outlining the risk plan. The most effective method of driving this change was commencing a series of invites to stakeholders issued to visit the team workspace both during the DMAIC period and during the pilot phase. These one-on-one dialogues with the performers and the hands-on experience in the workspace set the stage for robust conversation as a collective.
There is a recognized change curve that each organization must experience when introducing Lean and Agile, or any new methodology into a process. The slope of the curve is dependent on the characteristics present in the culture of the organization [11]. Many considered both Lean and Agile to be a “flavor of the month” improvement effort and were leery of the methods’ longevity in the organization. To mitigate the pensiveness, open dialogues were encouraged as the teams experienced the change curve via informational workshops and an iterative training approach. Scrum and Lean principles were gradually introduced throughout the life span of the pilot. This approach prepared the performers for the continuous learning agenda and the expectation that at the end of each iteration new techniques and philosophies would be introduced and tested.

10. Pilot Results

The pilot project produced impressive results. The project’s duration decreased by 40% compared to the waterfall baseline estimate. The actual resource costs were 10% under the allocated budget. No degradation of quality in code was found. A targeted survey taken by the project performers before and after their pilot experience indicated an increase in morale. A subsequent unexpected measure of success was the steady flow of inquiries by performers on Waterfall projects requesting to be considered for the next Lean and Agile project.

The project customer’s feedback was the most influential piece of qualitative data to advocate a change in the delivery method. The customer was vocal in his excitement and freely offered, “The Lean and Agile methodology has allowed for the creation of a highly integrated and focused team which is exceeding expectations for both the project delivery timeline and scope. Having all the right players instantly available to discuss implications of new and/or changing requests has allowed an incredible amount of flexibility which is leading to a solution that meets the full business need. The project team has become a valued partner in achieving one of our most important business objectives.” This type of positive advertising was one of the more powerful aides in fueling the shift in the platform from Waterfall to a Lean and Agile delivery method for the entire portfolio.

Recognizing the opportunity to impact both the business and people metrics, senior leaders from across the business units in the value stream became open to the prospect of assigning their team members into virtual integrated delivery teams. Building collocated and dedicated teams was not the result of forcing organizational reporting changes but by presenting business results that were tied to the principles of collocation and collaboration. These teams were made up of people with the appropriate mix of skills and knowledge to deliver new capability work across all stages of the code development lifecycle. The decision to adopt the integrated delivery team model marked the start of the Acquisition value stream’s transition period from Waterfall.

11. Key Insights

Prior to initiating the pilot, the core team developed several hypotheses on how to mitigate some of the root causes identified during our Lean analysis. Theories on the value of knowledge and collocation generated several key learning points that were helpful in smoothing the path as the acquisition value stream transitioned to lean and agile delivery for the entire portfolio of projects.

Collocation of resources worked to solve many factors contributing to the duration of projects. Collocation also introduced new obstacles in developing a collaborative and productive work space. Finding available space to support the collocation of 10-12 people was a hurdle when room space was scarce. Although these may seem like a minor inconvenience, resolving issues like this play an important role towards influencing people to embrace and adapt to collocation. Incorporating feedback from the pilot and partnering with the facilities team, led to designing collocation in a different way. Instead of finding available conference rooms, the cubicle floor plan was leveraged to create open workspaces on the floor. These workspaces provided the desired wall structure to post visuals and more working area and all with the benefits of natural light. The openness of the space promoted a sense of accessibility and added the further benefit of providing increased awareness and recognition of the collocated team members’ efforts.

In a cost competitive environment, decisions are often made to pursue the use of contracted resources and/or outsourcing options. Developing tangible success measures upfront during the pilot and the successive roll-out phase produced a key quantitative
insight. As levels of technical and system domain knowledge decreased, a correlated increase was seen in project duration and costs. A team employing Lean and Agile, composed of resources with high levels of technical and system domain knowledge could deliver 50% faster “out of the gate” than a waterfall project of similar size and complexity. If speed, low costs and increasing productivity is an objective but knowledge levels become a constraint, then consider the following option. Be deliberate in establishing the number of teams staffed on the platform. The number of working Agile teams should equal the number of technical designer/developers that are assessed as having high levels of system domain knowledge present on the platform.

In Lean, this concept is known as setting a work-in-progress (WIP) cap [8]. Knowledge and speed will increase at a faster rate and less non-value add tasks will occur in the process as the ratio of experienced developers to teams increases. The faster the rate that knowledge builds drives the rate at which a platform can increase capacity, without increasing costs. When knowledge is recognized as a constraint, a smaller number of teams with productive developers will drive value faster and with lower costs than larger numbers of teams with less inexperienced developers.

12. Summary

The pilot results enabled a compelling business case for members of the executive team to rally behind and led to hearty conversations on initiating steps to deliver successive projects in a Lean and Agile manner. The customer endorsement provided further validation to move away from waterfall delivery and internal clients began to clamor for the alternate choice in delivery methods. In response, the departments that supported new capability development in the value chain chose to align resources into virtual dedicated teams and committed to moving to a collocated environment.

The quantified business case outlining the contribution of a collocated space to speedier delivery prompted the facilities department to engage and actively participate in driving value, as well. The business case value for building collocated spaces provided an effective mechanism for securing their department’s engagement and further appealed to the expertise innate within the group to develop creative options to convert traditional cubicle floor plans.

As dedicated teams and work spaces were being built, the core team moved to recruit potential Agile coaches from internal associate ranks and designed a path to build the coaching competency within the company. A list of characteristics was identified as critical in a potential internal coach apprentice and behavioral interview questions and case studies were structured to identify the strongest candidates. Each coach apprentice was then partnered with a certified Agile coach for a three month period while working with a dedicated team to enhance the learning experience.

Within the six months following the pilot results, the landscape had dramatically changed. Four dedicated collocated project teams with internal certified coaches had been formed and were producing value through the iterative development and testing of code. Three projects had delivered 40 – 50% faster than the waterfall baseline estimates and 10 – 17% under budget. There were no active waterfall delivery projects in the department’s portfolio, three new integrated teams were being created and three more apprentice coaches had been recruited.

The ruling hypotheses that was tested by starting with Lean tools, applying Lean principles, and then introducing Agile techniques is derived from a theory that the manner with which a company delivers a project should be considered as a process within a service. The service was considered to be composed of the integration of people, projects, software, and hardware that enables value for internal clients. The build of new capabilities should not be presented as a handoff but should flow into the broader value stream.

Prior to applying Lean software principles and Agile techniques, Lean tools should be utilized to remove waste. In cases where Agile pilots do not find success, a significant root cause may be produced by the waste inherent within the method with which a company provides for project delivery. You can increase the success of your agile pilot effort and thus a successive rollout if you first seek to eliminate the waste within the process that is obscuring and delaying client defined value.

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14. References


