Impediments in Transitioning to Agile

Time-boxing Testing Efforts

Taniya Dasgupta

Harrisburg University
GRAD 699-PMGT

Project Supervisor: Dr. Thomas Sheives

Abstract

In agile framework, the system is developed in sprints. Some value-based products for the customers are created with completion of work in a sprint. There are firm dates of commencement and end in sprints, and duration of each sprint is normally equal. During a sprint, any change in scope or resources cannot be made. But sometimes it becomes difficult to follow this rule on account of the business needs. This time-boxing approach is seen responsible to cause more hindrance than propel organizations towards time-efficient development of products. This type of project demands a much more flexible time-line as compared to standard agile project management practices of 'Sprint' used for creating cost-effective products within time. Similar problems are faced by the organizations transitioning from traditional method to agile practices. From different sources of research it is found the transition could not be smooth in all cases and sometimes was unable to achieve the expected business growth due to various factors. A number of options and approaches are discussed for helping an organization transitioning from traditional to agile methodology but any unique and full-proof approach cannot be arrived at. Ultimately it becomes a question: can we overcome difficulty in time-boxing approach with discrepancies in testing efforts and get a systematic and tabulated solution of the problem in transitioning to agile? Through this research having limitations the answer in all respect cannot be reached. The question is left with ample scope for further research by future researchers as well.

Keywords: Agile, project management, traditional, testing efforts, transition, methodology

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Preface

This thesis is submitted out of my strong feelings that the impediments in transitioning to agile and the difficulties in respect to time-boxing testing efforts should have solution in providing the industries their much-desired relief. It is a present day need to the business world in view of successful shifting to remain in competition with other industries.

It's a matter of excitement to me that through the progress of this thesis I have learned a lot to apply in my practical field of work. It naturally makes me grateful to people in the encouraging role behind me.

First of all, I would like to express my sincerest thanks to my supervisor Dr. Thomas Sheives, who has continuously guided me towards my goal. He has been extremely patient all along my research work and become a motivating factor to me with his expert opinion, valuable feedback and whole-hearted support. This is the opportune moment to me to extend my profound regards and gratitude to him.

I extend my sincere and heartfelt thanks to all the people who have participated in the survey conducted to complete this thesis and provided their valuable feedback. Without their cooperation it might not be possible for me to conduct the survey and to make it meaningful.

Finally, I want to thank my family for unconditionally supporting me and for their faith in me. It's the strength to me that all of them are always with me with their good wishes.

Introduction

The phrase "Survival of the fittest" is applicable to everyone but has special impact on industries as well. Industries adopting new methodologies usually try to achieve some type of performance gains or other benefits. As a result, industries are running amidst a stiff competition for the sake of survival and to achieve business growth to the fullest strength. In this domain, almost all the organizations cannot remain in their traditional system taking stakes to participate in an unequal business fight. They usually struggle their best to step up on account of survival, adequate business and even with intention of taking the lead in the market.

At the same time, it's an accepted fact that adopting best practices of agile project management should lead to increasing the productivity and efficiency of developing a software product. This expectation is driven by Sprints in the agile framework which are time-boxed with fixed start and end dates and generally of the same duration. But it is often witnessed as per several research studies that it is not leading to a fruitful and expected result. This finding generates the source of a problem with transitioning from conventional waterfall methodology towards agile practices of project management in organizations.

There is an evident impact of this problem in the requirements gathering, development and testing steps of an SDLC (Software Development Life Cycle) transforming from waterfall methodology to agile methodologies. The time-boxing approach of agile methodology is seen to cause more hindrance than propel organizations towards time-efficient development of products. There are sufficient gaps and bottlenecks witnessed in the end to end testing phase which includes Dev to Dev testing, Integration testing, UAT (User Acceptance Testing) and Unit testing of software products.

The reason behind this problem is because requirements tend to get finalized or changed frequently which might result in the change in scope. It becomes especially challenging for teams working on data warehouse projects operating as a data hub trying to implement time-boxed sprints. As a data hub team, it is part of a Program Integration function and needs to interact with several upstream and downstream interfaces. This creates intricate dependencies and caveat for the further requirement or scope alterations majorly failing the stringent 'time-boxed' concept of sprint iterations. It would naturally ask for a remedial measure.

It poses a huge challenge across teams working as part of a Program Integration function to implement change request in requirements, development and testing efforts, resulting in overlap between various types of testing and the end result being a major fail in QA (quality analysis), numerous production issues and bugs in end products. This type of project demands a much more flexible timeline as compared to standard agile project management practices of 'Sprint' used for creating cost-effective products within time.

It has also been found that the transition could not be smooth in all cases and sometimes has been unable to make the expected business growth due to various factors. One of the main reasons behind such failure is a failure in creating an agile-friendly environment while transitioning from traditional Waterfall methodology. The developers and others engaged in this field are all involved in it and face it as problematic and challenging in view of its involvement in respect of changes in all the characteristics of an organization, as cited by Gandomani, Zulzalil, Azim, and Ghani (2014).

According to Conboy, Coyale, and Wang (2010), a number of researchers have identified challenges related to communication while transitioning to agile method. It has also been corroborated by Gandomani, Zulzalil, Ghani, Sultan, and Nafchi (2013). In fact, the resulting

transition largely depends on the barriers created by organizational culture in terms of work ethics, communication patterns and existing structural hierarchies. According to Cohn & Ford (2003), one vital issue is the agility in the organization and this is a challenge which takes part in changing the culture of the organization and interrelations entirely.

In agile scrum framework, work is performed in iterations called sprints. The work completed in each sprint should create something of tangible value to the customer or user. Sprints are time-boxed with fixed start and end dates, and generally they are of same duration. As a rule, goal-altering changes in scope or personnel are not permitted during a sprint; however, business needs sometimes makes adherence to this rule almost impossible. The time-boxing approach of agile methodology is seen to cause more hindrance than propel organizations towards time-efficient development of products. There are sufficient gaps and bottlenecks witnessed in end to end testing phase which includes Dev to Dev testing, Integration testing, UAT and Unit testing of software products.

A possible cause of this problem is because requirements tend to get finalized or changed frequently which might result in change in scope. It becomes especially challenging for teams working on Data Warehouse Projects operating as a data hub trying to implement time-boxed sprints. As a data hub team it is part of a Program Integration function and needs to interact with several upstream and downstream interfaces, this creates intricate dependencies and caveat for further requirement or scope alterations majorly failing the stringent 'time-boxed' concept of sprint iterations. It poses a huge challenge across teams working as part of a Program Integration function to implement change request in requirements, development and testing efforts, resulting in overlap   between various types of testing and end result being major fail in QA (quality analysis), numerous production issues and bugs in end products. This type of project demands a

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much more flexible time-line as compared to standard agile project management practices of 'Sprints' in order to develop products in both time and cost-efficient manner. This naturally demands rigorous research of this gray area in order to get rid of this bottleneck. An in-depth and thorough fact-finding analysis is expected to lead us to a solution.

Problem Statement and Justification

There seems to be a problem in the implementation of time-boxed sprints, in the face of ever-changing requirements and scope for a data warehouse project which is part of a Program integration function (a data hub at center interacting with several upstream and downstream interfaces). This brings in a time crunch for development and especially testing efforts, resulting in low-quality QA and bug-ridden products at the end of a development cycle.

Adopting best practices of agile project management is expected to increase the productivity and efficiency of developing software products. It is often witnessed as per several research studies that it is not leading to a fruitful and expected result. In agile framework, the work completed in each sprint should create something of tangible value to the customer or user. Sprints are time-boxed with fixed start and end dates with fixed durations. The completion of the previous sprint is immediately followed by a new sprint. As a rule, goal-altering changes in scope or personnel is not permitted during a sprint; however, business needs sometimes makes adherence to this rule almost impossible.

This problem has negatively impacted the requirements gathering, development and testing phases of a SDLC transforming from traditional waterfall methodology to agile methodologies. The time-boxing approach of agile methodology is seen to cause more hindrance than propel organizations towards time-efficient development of products. There are sufficient gaps and bottlenecks witnessed in end to end testing phase which includes Dev to Dev testing, Integration testing, UAT and Unit testing of software products.

A possible cause of this problem is because requirements tend to get finalized or changed frequently which might result in change in scope. It becomes especially challenging for teams working on Data Warehouse Projects operating as a data hub trying to implement time-boxed

sprints. The data hub team, as a part of the program integration function, needs to interact with several upstream and downstream interfaces. This creates intricate dependencies and caveat for further requirement or scope alterations majorly failing the stringent 'time-boxed' concept of sprint iterations. It poses a huge challenge across teams working as part of a program integration function to implement change request in requirements, and development and testing efforts. The challenge results into overlap between various types of testing and end result being major fail in QA (quality analysis), numerous production issues and bugs in end products. This type of project demands a much more flexible time-line as compared to standard agile project management practices of – 'Sprints' in order to develop products in both time and cost-efficient manner.

In case of enterprise level projects where epics are drilled down from portfolio level into value stream and then further broken down into user stories and action items at project level for each team, it is imperative that every team or interface as part of the PI function is in sync. The crucial effort to ensure producing error free software development at the end of each iteration is to chalk out an end-to-end bullet proof integration testing plan – this is a joint effort from all teams/ interfaces that are interacting as part of the PI function. But in agile framework, often it so happens that there exists gaps or bubbles in requirements and business ask, human error and interpretation, perception or analysis by each interface adds to the confusion and lack of clarity, especially if there are last moment ad hoc changes being pushed for release in an iteration and time-boxing of sprints becomes a major setback. This flows in or translates into gaps or discrepancies in testing efforts for respective interfaces. It almost results in each interface or team creating or delivering their piece of enhancement of the deliverable software without much clarity of what other interfaces are bringing to the plate, resulting in complete chaos and failure of the final shippable product built.

If we don't deep dive into these issues now, then this will eventually impact the productivity and efficiency of the organization in the long run. These experiences naturally lead to the following questions justifying an in-depth research towards adopting best practices for the organizations to efficiently increase productivity, produce less error prone software while not stretching budget and time constraints while in transitioning phase:

- What is /are best practice(s) of project management that can ensure a cost and time-efficient development of products in this scenario?

- Is there any solution of impact on the time-boxing of development of potentially shippable increments while introducing Scrum under project management with the agile methodology?

- How can time-boxing for end to end Integration Testing be efficiently implemented when multiple teams as part of a program integration function are working on shippable enhancements?

- Analysis whether there is any necessity of less procedural or conventional types of project management in case of larger, traditional organizations with complex cross-team structures and communications?

- Waterfall methodology employed heavy straight project designs and very limited scopes changes or feedbacks during and between the development life cycles and stages of deployment. On the other hand agile promotes feedbacks and incorporations of changes. How far is this practically achievable within two weeks sprints as a team part of PI function?

- Should the transition from waterfall to agile vary according to the structure and background of the company concerned?

- Whether it is and how it is possible to amalgamate/ have the agile methodology and traditional project management approaches as one project management methodology?

This research will find new innovative ways to adopt best practices of agile framework with methodologies along with reviewing existing business processes to effectively address the redundancies and bottlenecks discussed above.

Literature Review – Analysis of Related Work

In an agile framework, according to PMI (2008), work is performed in iterations called sprints. Some value-based products for the customers are created with the completion of work in a sprint. There are firm dates of commencement and end in sprints, and duration of each sprint is normally equal. The completion of the previous sprint is immediately followed by the next sprint. As a rule, during a sprint, any change in scope or resources cannot be made. But sometimes it becomes difficult to follow this rule on account of the business needs.

The research paper of Kautz, Johansen, and Uldhal (2014) primarily contributes to the body of knowledge in Information systems development (ISD) by demonstrating the positive impact of agile development and project management methods on software development productivity. It acknowledges the fact that innovative agile information system in software development has received much attention from researchers and practitioners. Agile methodology as touted by researchers is the 'ideal' approach for dealing with change and unpredictable elements of ISD, especially in a dynamic environment. The method of research is focused on an empirical investigation in form of a case study and aims to answer two primary questions: What impact has the introduction of agile development and project management method Scrum on information systems and software development? What is the impact of any deviations from the guidelines of Scrum? The paper suggests seven indicators or measures of productivity which is applied to assess the company's performance as per increment in productivity by exploiting the potential of the scrum and its best practices. The research results are then discussed in detail with regard to the conventional practices of the scrum as well as to complex adaptive systems (CAS) that evolves based on each organization's culture and organizational structure.

The research methodology used for this paper chose a case study approach to research the impact of Scrum on information systems and software development processes and projects. The chosen case organization sole product is a case management system for municipal job centers, which gives administrators the opportunity to work across different platforms. For the development of the case management system, the department previously followed the traditional waterfall model and later launched the implementation of Scrum as the preferred development model.

The research paper states that case unit's handling of retrospective meetings only reflected the actual process and method, but not the developed product. This put the unit at the risk of missing out on any knowledge, which could contribute positively to the future iterations and development projects. There is scope for future research to further investigate the relationship between team learning and interaction of autonomous interconnected team members in retrospectives and how productivity supported through Scrum stems from learning.

According to Turner, Ledwith, and Kelly (2010), project management plays a significant role in facilitating the contribution of small to medium enterprises (SMEs) which in turn makes a key contribution to the economy in terms of employment, innovation, and growth. This research paper analyses whether SMEs require less bureaucratic or conventional forms of project management than those used by larger, traditional organizations. This research study aims to identify the nature of project management required by SMEs, and the results of the qualitative stage of such analysis are reported in the form of research results in this paper. The research methodology includes the interview of people from companies of the three sizes of SME, micro, small and medium, from a wide range of industries and from four countries. SMEs use project management both to manage operations, to deliver tailored or customized products to customers,

and manage innovation and growth. This research study finds similar project management approaches used for both purposes. The main differences are found to occur across the size of the company and country.

As per Mahadevan, Kettinger, and Meservv (2015), prior to the era of implementing "Agile" software development methods, organizations followed traditional "Waterfall" software development life cycles. Waterfall methodology employed heavy straight project designs and very limited scopes changes or feedbacks during and between the development life cycles and stages of deployment. Waterfall methods make heavy use of outcome controls primarily monitored by the information systems function (ISF). This research paper invests the control mechanisms used by the ISF and business function (BF). The background for the research is based during and after the introduction of a major agile project at a large U.S. company which was originally following and implementing the traditional waterfall methodology. This research paper focuses on outcome control, the predominant control mechanism used in the case study of the company, gave way to a hybrid-like control that possessed mechanisms of emergent control while maintaining vestiges of some waterfall-like outcome control. It was observed that, prior to the introduction of agile, the software development process was firmly in the hands of the ISF. The paper then summarizes the lessons learned from the case study to point to the complexity of designing control mechanisms during a transition from the waterfall method to an agile approach and that this transition might vary according to the structure and background of the company concerned. The results of the case study imply that agile development is suitable when there is a high degree of uncertainty and risk in a project that arises from frequently changing requirements.

According to Spundak (2014), with the growing trend of usage of agile project management on different projects, it is evident that contradicting sides exist – traditional and agile project management approach, and that there exists a need to combine both approaches. The paper covers a thorough literature review and starts with the definition of the project management approach and of the project management methodology. It provides an overview of different project management approaches. The literature review shows what is considered as part of project management methodology in a wider or even narrower sense, and what the main characteristics of a methodology are. This research paper focuses on the need for combining project management approaches on the case of a software development project. Contrary to the traditional approach, impact of the human factor and especially communication between project team members is accentuated to the point that it is recommended that project team members should be very good; if not the best one could get. Due to the significant differences in project work organization compared to the traditional approach, organizational environment significantly impacts implementation of the agile project management approach, and organization should be prepared to embrace changes imposed by the agile approach.

The paper provides the background for further research on the application of different project management approaches and methodologies. Further research can be built on the ingenious concept of creating a unique methodology for a project, based on different project management approaches. In that way, it is possible to create project management methodologies that have a high possibility of customization to project structures and to project environments.

Kautz et al. (2014) demonstrated the practical effect of agile methods and project management on software productivity events and contributed the same in Information Systems

Development (ISD). The fact that innovative agile information system in software development

has been given due importance by the researchers and practitioners, has been acknowledged.

According to Moe & Dingsøyr (2008), in agile literature, the development team productivity

is indicated as productivity. Agile methodology as touted by researchers is ideal for tackling the

change and unpredictable elements of ISD, especially in a dynamic environment. The method of

research is focused on as a case study with factual analysis and aims to answer two primary

issues: "Is there any solution of impact on the development of software and information

processes, if occurred while introducing Scrum under project management with agile

methodology?" and   "Can the impact of variation, if any, of the general principles of Scrum, be

managed?" This research paper suggests seven indicators or measures of productivity which is

applied to assess the company's performance as per increment in productivity by exploiting the

best practices of Scrum.

Schwaber & Beedle (2002) found the introduction of the process of sprint development with

iterations had a pivotal position when Scrum was used. Results are then considered in details in

connection with conventional practices of scrum and Complex Adaptive Systems (CAS) that

evolves based on each organization's culture and organizational structure.

To undertake the research in connection with this paper an attempt was initiated with an

approach of studying the case of solution affected by Scrum, if any, on the procedures and

projects in respect of information systems and software development. An organization dealing

with a system of case management in municipal job centers was selected. Under the system, the

administrators had the scope to work in various programs following the traditional waterfall

model and later Scrum approach was implemented with an introduction of the iterative sprint development process as the preferred development model.

Kautz et al. (2014) found that only the particular process and method were emerged out from retrospective meetings of each case without any reflection of the product developed. These findings clearly established the risk that the knowledge towards any effective contribution in future iterations and other projects would be missed out by the organization.

According to Kautz et al. (2014), it gives birth to the scope for further analysis and future research so far as the team learning and its relation with the influence of inter-linked team members in retrospectives were concerned and about the support of Scrum to productivity originated in learning.

Turner et al. (2010) in their research paper found project management had an important role facilitating its contribution from SMEs which in turn played a significant role in the economy so far as the matter of employment, innovation, and production was concerned. The target was to explore the actual type of project management beneficial to SMEs, and the findings from the outcome of such analysis are outlined in the form of research results in this paper. The research methodology includes the interview of persons in different sized SME organizations, namely, micro-sized, small sized and medium sized organizations, out of a considerable number of industries located in four countries, namely, Austria, Romania, Ireland, and Sweden. SMEs managed their projects and delivered to the customers befitting and customized values. They also managed to be innovative in production with an increase in business. This research study finds that in both occasions similar types of project management approaches were used. The mentionable contrasts were only the sizes of the organizations and styles of management in

different countries. For example, more laissez-faire (unconventional/ free) management styles were preferred by Ireland and Sweden, but the people in the remaining two countries liked the adoption of autocrat systems. Unlike the people in Ireland, in Sweden people wanted a more structural system.

Also based on this study, Turner et al. (2010) found, the appropriate management in micro and small enterprises was of laissez-faire styles in comparison to the management with more democratic or autocratic styles which were perceived to work well for medium-sized enterprises. It becomes evident that the organizations of all three sizes under SMEs desired the less procedural type of project management approach compared to that of the traditional type. On the contrary, in the case of medium-sized enterprises which usually engage specialists with specific assignments, tasks, and responsibilities, the tendency was to aim for heavily structured arrangements compared to that in small and micro-organizations. In their research paper, Turner et al. (2010) study found that through the researches it was clearly established that it was essential to provide the SMEs a project management having a "lite" (light) design. But to accommodate the specialists in medium-sized enterprises in view of their roles it was necessary to have adhered to traditional forms. This adherence would be less required in case of small-sized and micro-sized enterprises which would rather be benefitted with project management having a "micro-lite" (micro-light) design facilitating the work of team members there and preferably was of laissez-faire styles.

It also indicates future research has the scope of delving deeper into conducting a thorough analysis. Turner et al. (2010) found that the succeeding step was carrying out a quantitative examination to obtain a clearer picture and to create a project management designed lightly for

medium-sized enterprises with a project management of micro-light style for small and micro

enterprises. (p.756).

Mahadevan et al. (2015) observed that, before the period of starting with agile software

methodologies, the organizations had deep involvement with traditional software development

processes and used to take the help of a huge quantity of project design in each phase of project

work but there were almost no scope of changes and feedback in those processes. (p.77). The

traditional methodology employed substantial straight project designs and very limited scopes

changes or feedbacks during and between the development life cycles and stages of deployment.

The outcome controls which were normally tracked by the information systems function (ISF)

were used by waterfall methodology in a profound manner. Mahadevan et al. (2015) found that

the information systems function was commonly made responsible in the waterfall processes.

They had also cultured how the ISF and business function (BF) used the control mechanisms.

Mahadevan et al. (2015) also observed, in the agile development method the role of coteries and

self-control became higher due to the impact of project control dynamics (p. 78). The research

was undertaken on the basis of situations observed when a big agile project was introduced at a

large company which was originally following and implementing the traditional waterfall

methodology, in the United States.

Fitzgerald, Hartnett, and Conboy (2006) found, researchers had explored the fitting of agile

processes in different domains. According to Mahadevan et al. (2015), "Outcome control, the

predominant control mechanism used in the case company, gave way to a hybrid-like control that

possessed mechanisms of emergent control while maintaining vestiges of some waterfall-like

outcome control." (p. 77). It has been found that the software-development process was

monitored by the ISF before the introduction of agile methodology. The paper then summarizes

the lessons learned from the case study indicating that the transition from the traditional method

to agile methodology faced complications in respect of designing control mechanisms and that

this transition might vary according to the structure and background of the company concerned.

The results of the case study imply that in case a project is occupied with the presence of an

excessive level of uncertainty and huge risk and if its origin is frequently changing requirements,

then agile development is befitting in that case. Mahadevan et al. (2015) found that a concept had

grown among the researchers about the way of co-existence of development techniques of agile

and waterfall methodologies in the same organization.

According to Mahadevan et al. (2015), "Many challenges existed when integrating Agile in

an environment where there were highly structured developmental processes." (p.98).This

research indicates large organizations which want to go for agile methods, can be benefitted

through the adoption of hybrid methodology. This paper has tried to address some of the

challenges but has not comprehensively addressed all factors which can be taken up as future

research scope. There is also a future scope of research to investigate how to harness the

dynamics of the relation of BF and ISF properly to provide avenues for better software systems.

According to Spundak (2014), "With the growing trend of usage of agile project

management on different projects, it was clear that two opposite sides existed – traditional

and agile project management approach, and that there existed a need to combine both

approaches." (p. 939). This research paper tries to answer the question of whether and how both

approaches can be combined in a single methodology of project management.

Vinekar, Slinkman, and Nerur (2006) found, most of the system development organizations made attempts to adopt both traditional methods and agile approaches. Their study tried to explore the reasons behind such move undertaken by the organizations for this apparently improbable contrast amalgamation and as well as to face the organizational challenges in terms of cultures existing therein. They declared in a clear tone that the systems development organizations trying to achieve benefits of both the methodologies at a time should go under this amalgamated way. (p. 31-42). But it is really a challenge to combine both the methodologies in an organization in a successful manner.

Spundak (2014) made a thorough literature review providing a description of different approaches to project management and delves deeper into the definitions of project management methodologies. It was found that to serve the purpose of attending the particular needs of a company and to run the projects, project management methodologies were accordingly adjusted. According to Spundak (2014), "The literature review showed what was considered as part of project management methodology in a wider or narrower sense, and what the main characteristics of a methodology were." (p 939).

Cockburn (2003) found that, in the process of delivering project values in a successful manner the principle that the project team relied on, could be recognized as project management methodology. This research paper focuses on the necessity to combine project management approaches in respect of projects for software development. Emphasis is given on impact of the human factor and their mindset in contrast to the traditional approach along with the communication capabilities of the team members in the project and a conception builds to have project team members of good quality if not the best. As a result, there would be a glaring

difference in the team with agile approach if compared to traditional approach and with the adoption of this agile approach in an organization, it would have to be ready to accept the changes.

Almeida (2017) observed four dimensions of challenges which were, people with their qualification, training, dedication in work, etc.; organization and its managing techniques to tackle changes to occur; the procedural challenges; and devices and tools in various forms during undertaking the transition to agile. (p. 47). There is no indication of getting rid of these challenges through a straightforward calculated process. According to Delcheva (2017) to make the agile transition a success, it is a big challenge to the managerial level to implement the change in the mindset of team members in terms of the cultural environment in the organization. (p. 14).

According to Papadopoulos (2014) the case study made by him has revealed that it is not an effortless matter to adopt the agile framework, rather the organizations intending to transition to agile need to frame the program taking all care and to keep away visible complications. (p. 462).

According to Kerzner (2001), a useful methodology should have provision of templates to be used, planning in a standard form, capabilities in managing time and controlling costs, standardized method to report, pliability so that it could be used in case of all projects, easy to get perceived by the user, acceptable and effective in the organization, using standardized project lifecycles, having guidelines on a solid platform of values and business ethics.

Views of Spundak (2014) in his research paper basically provide a very strong literature background on how traditional agile techniques can be reformed to include more customizable

techniques befitting to the specific project's, organization's and industry's needs and challenges faced.

According to Kaur and Boparai (2015) in spite of the fact that software products of top grade are delivered by adopting agile methodologies in speedy iterations with pliability and power of adjustability to changes and that it is not so easy in an organization having traditional approaches, the team in the development process in the organization should choose the best applicable procedure.

According to Jalote, Palit, Kurien, and Peethamber (2004), in place of taking a serial iterative development if a project is managed employing time-boxing it will clearly become more complex and when time-boxing is employed, a very proactive and tight project management is required as taking decisions may lead to adverse impact. Fern´andez et al. (2016) found, difference in process models gave birth to the time-boxing problem which apparently came up primarily in agile and in small enterprises and behind this issue there were reasons of poor assessments, fixing release dates and scope changes in an impractical manner and insufficiency of time was predominantly responsible for it. According to an interview taken by Delcheva (2017)," … it is hard to pin down a solid delivery date…" and" …that some items originally scheduled for delivery may not be complete in time.", being a vital concern to the customers in assessing the probable value of the product.

According to Abrahamsson, Salo, Ronkainen, and Warsta (2017), the project management team is compelled by time-boxed project management to create the unavoidable, highly compromised untimely decisions in the project. Further, according to them, in case a corrected bug is not appended in the test library and there is no customary system of running regression

tests, wastage of time and effort will happen to detect that bug and there will be delay in finding out any harmful result of change in code.

All these are indicative of the problem in time-boxing approach so far as agile framework is concerned and it is more applicable in case of an enterprise while transitioning from traditional method.

Petersen and Wohlin (2009) found, implementation problems were confronted also by agile in realizing continuous testing as much effort was needed in this process and it was also challenging in view of its use with different types of platforms and experimental conditions. According to Solinski and Petersen (2014), there are limitations which require a high level effort for continuous testing for agile with few RD practices and for mainly RD with few agile practices as it is tough to make an integrated test domain for variety of platforms and structural dependencies.

It further indicates the difficulty that whether time-boxing for end to end integration testing be efficiently implemented. It is also of particular concern when multiple teams as part of a program integration function are working on shippable enhancements.

Overall from these different sources of research and the papers on the same, it is found the transition could not be smooth in all cases and sometimes was unable to make the expected business growth due to various factors. It also adds the time-boxing problems and difficulties in testing efforts. One of the main reasons behind such failure is a failure in creating an agile-friendly environment while transitioning from traditional waterfall method. In addition, the impact of variation according to the structure and background of the concerned company may be responsible for this failure. Change in mindset is also difficult and requires a lot of time and effort. All above findings solidify the background for further research on the ingenious concept

of finding the best suitable and unique approaches for the project depending upon different

project management procedures or even any combination of such approaches that would fit the

project environments and can yield customized project structures.

Methodology

This section provides an overview of methodologies and approaches that will be used to research the problem and questions posed so far in this study. This methodology will be used to elaborate the overall methodology approach to probe into the problems or roadblocks stated in the previous section. This section will try to define and clearly explain the survey design and methods used for this study.

The current literature review generates a few questions in connection with impediments faced by the industries while transitioning from traditional waterfall method to agile methodology, especially related to time-boxing. Based on what has been discussed so far, it becomes imperative to study various kinds of people on each project (or interface) teams that are communicating and participating in requirements gathering, enunciation, documentation and developing shippable enhancements to software or application programming interfaces (APIs) at the end of each sprint.

Application of agile methodology in a large organization at the enterprise level predominantly demands detailed insights of the organizational culture, structure and hierarchy. Since the agile manifesto warrants communication over tools and end client satisfaction or communication of needs over business terms and SLA (Service Legal Agreement), mindset prevailing within and across respective teams and its members, prevailing notions and culture in an organization predominantly contributes towards how seamless the transitioning from conventional to agile methodology can take place.

 Overall Approach:

The overall approach will be to conduct a survey and a quantitative review. The survey is designed to gather various data about the way project teams are organized, the mindset of team

members and prevailing environment in the organization. Under this approach, face to face or one to one interviews as well as group discussions will be conducted to gather hands on knowledge and feedback of key stakeholders involved in the process of transition.

There will be two parts to the process.

– The first part will mostly focus on the qualitative aspect of the current distribution, organization and culture of teams as part of the PI function which will help build the "As-Is" analysis and process mapping that is currently followed. This will include details about the specific team and department the respondent belongs to, roles, responsibilities and contribution of the respondent towards PI function as a key stakeholder, role/position of the key stakeholder in the business process mapping. It will also cover a few other specifications of the project team, such as the existing project methodology, the team composition and size, geographical distribution of the project (onshore / offshore), type of agile framework team has selected to implement (Scrum/ SAFe), is there any scope of application and implementation of hybrid methodology.

The second part will relate to the quantitative analysis of the feedback of the stakeholders or team members on various roadblocks, show stoppers and issues faced while transitioning from conventional methodology into agile, especially focusing on how they well they have adapted to time-boxing and Sprint cycles of development. The purpose of the study is to find out the best practices and identify process improvements in the transition phase through face to face interviews of stakeholders in different roles, e.g. Developers, Scrum Master, Project Manager, Business Analysts.

The set of questions will include qualitative questions and the questions are set up as follows:

1. Which team or interface of the Program Integration (PI) function are you part of?

2. In which role or capacity are you part of the team?

3. How long have you been part of the team?

4. Is your team co-located or members work remote?

5. How would you rate your experience as a team member with the current team size and structure? Please elaborate a little on your choice of scale – why do you think the scale you selected is applicable?

 [On a scale of 1-5 with 1- Extremely Poor; 2-Poor; 3-Scope of Improvement; 4-Good and 5 – Excellent]

6. How would you rate your experience as a team member with the current organization culture? Please elaborate a little on your choice of scale – why do you think the scale you selected is applicable?

 [On a scale of 1-5 with 1- Extremely Poor; 2-Poor; 3-Scope of Improvement; 4-Good and 5 – Excellent]

7. Please point out key areas where current organization culture might have scope of improvement?

8. How do you rate your experience (in terms of your role and responsibilities) while transitioning from conventional waterfall to adopting agile practices?

[On a scale of 1-5 with 1- Extremely Poor; 2-Poor; 3-Scope of Improvement; 4-Good and 5 – Excellent]

9. How do you rate the clarity of the current process flow of activities in the Program Integration function?

[On a scale of 1-5 with 1- Extremely Poor; 2-Poor; 3-Scope of Improvement; 4-Good and 5 – Excellent]

10. (a) What are your thoughts on the agile principles adapted by your team?

(b) Please rate your experience so far with agile?

[On a scale of 1-5 with 1- Extremely Poor; 2-Poor; 3-Scope of Improvement; 4-Good and 5 – Excellent]

(c) If you have chosen below "3" on your scale, please comment on areas or activities that you feel are mostly impacted?

11. How would you rate your team's performance so far from conception to roll out of shippable enhancements in each sprint? Briefly point out key suggestions for improvement if any.

[On a scale of 1-5 with 1- Extremely Poor; 2-Poor; 3-Scope of Improvement; 4-Good and 5 – Excellent]

12. Which in your experience is the most difficult or challenging effort to be time-boxed?

[a) Requirement gathering efforts b) Development efforts c) Unit Testing efforts or d) End to End Integration Testing efforts]

Please briefly explain the reason of your choice.

13. (a) How would you rate the cross-team (part of PI function) communication?

[On a scale of 1-5 with 1- Extremely Poor; 2-Poor; 3-Scope of Improvement; 4-Good and 5 – Excellent]

(b) Has it improved as teams are slowly in the adaption phase of agile practices?

[Yes / No]

14. What according to you are the current KPIs and ROIs that have scope of improvement in the organization?

The above questionnaire will be presented and response documented from employees currently serving roles across all hierarchies and teams from the Program Integration function in the organization. Both offshore team members (located remote or not in USA) and on-shore team members will be participating in this quantitative study. The interviews for on shore individuals will be conducted face to face while offshore members will be interviewed over skype / video calls. It is estimated that each team will consist of ten to fifteen team members and the Program Integration function comprises of six teams, leading to roughly a total head count of ninety stakeholders to be interviewed.

Since the very fundamental norm of agile methodology is "communication" and because time-boxing of sprints has a one to many relationship with various other "human" aspects of the organization, the initial questions are designed to get a sense of how the key stakeholders feel about the current organization, team structures and interpersonal relationships. The second part of the quantitative survey attempts to deep dive into understanding specific issues and roadblocks faced while transitioning into agile, especially in implementing time-boxed sprints.

Final results will be based on the analysis of the data gathered from this quantitative survey. The data collected will be stored in a .XLS file and exported to Tableau. The Tableau dashboard will be used to run calculations and present the data in the form of data visualization charts e.g. histogram, pie charts, line graphs, etc as is deemed fit for each section of the questionnaire.

Results and Findings

The results for the above mentioned quantitative survey are grouped into two different sections. The first section comprises of the analysis of responses shared by leadership or members of the team who hold roles such as e.g. Director, Program Manager, Value Stream Manager, Release Train Engineer, Senior End to End Business Analyst. This group is majorly responsible for driving the business ask as they are the ones who get to directly interact with the end clients. Once the ask is gathered or communicated to this group by the business, they chart out Program plans or POC (Proof of Concepts) of potential programs (a collection of inter-related projects) and attempts selling those to the end clients based on their needs. This group is also responsible of drilling down into the Program level plans and breaking these down into Projects. Basically, the leadership group is responsible to plan and decide on the future endeavors of the organization and also contribute to a large extent towards the company culture and organization. This group had the total strength of twenty five heads and almost ninety five percent of the participants from this group has been an employee of the organization for over ten years.

The second section comprises of the analysis of responses shared by team level members of the team who hold roles such as e.g. Developers, Scrum Master, Business Analysts, Database Analysts, Quality Analysts. This group operates at the team level unlike the former leadership group which operates at the value stream level. The members of this second group form the core of each scrum team and represent an interface or system operating upstream or downstream as part of the Program Integration function. There are three upstream interfaces or scrum teams namely TOMS, DQS and ESB and three downstream interfaces or scrum teams namely ODS,

ENSR and GPT. Each team has a strength of roughly eight to ten members. Hence, the total number of interviewees or participants from this team accounted towards an approximate number between forty eight to sixty. Almost ninety three percent of the members of this group has been employed by the organization as contractors and is associated with the organization ranging three to seven years.

Almost ninety two percent of the first group who are serving in the capacity of leadership roles are working or have been working remote and mostly interact with their team on skype or video calls. Occasionally when they visit the office head quarters they get to meet the team in person. Seventy percent of the participants from this group reported that so far, they have had positive experience with Agile. However, seventy two percent voted for "scope of improvement" when it came to current team size and organization structure. On requesting to elaborate why and which areas do they feel that has scope of improvement - most commented on the fact that there lacks visibility and often duties and tasks are not being clearly defined leading to over allocation or under allocation. Table 1 in the Appendix illustrates the above. These seventy two percent also commented on the lack of clarity of business process flows of inter-team and intra-team roles and responsibilities, deliverables, end to end integration testing and timelines. On requesting to provide more details, participants pointed out that this lack of clarity in business processes adds to confusion, miscommunication and discord amongst and across team members. Even if best practices of Agile principles, e.g. "communication over technologies" are implemented across organizations, lack of clarity in the business processes clouds understanding and interpretation of business ask and deliverables. This results in slack in productivity and efficiency. This seventy two percent voted "poor" in response to rating the clarity of current process flow of activities; "poor" in response to rating cross-team (part of PI function)

communication. This group provided mixed response (mix of positive and negative) in response to the question whether they feel the team will improve and adapt better to Agile principles as the team and its members matures.

The remaining twenty eight percent were more optimistic and voted for "good" as far as team sizing and current organization structure is concerned. Their reason for choosing this option was that they felt that during the transition phase when an organization is transitioning from conventional methodology into Agile, team restructuring and reshuffling is expected and normal. During this phase, over allocation or under allocation of tasks is a practical phenomenon to take place as every team will go through the phase of "storming", "forming" and "norming" and the team takes time to get familiarized with the new methodology and hence during this phase, it is difficult to estimate LOE (level of effort) of individuals and of a team. This twenty eight percent however voted "scope of improvement" as response when it came to rating the clarity of current process flow of activities, stating that once the team crosses the stage of "norming" under Agile methodology, members are better equipped to apply the best practices and offer clarity in understanding business ask, process flows and improved communications across teams or interfaces. This section voted "scope of improvement" in response to rating cross-team (part of PI function) communication. This section similar to the other section (of seventy two percent) also provided mixed response (mix of positive and negative) in response to the question whether they feel the team will improve and adapt better to Agile principles as the team and its members matures. This is evident from Table 2 in the Appendix.

The second group comprises of the core members of the scrum team. This group is a fair mix of members who are working on shore and are based off shore. Approximately sixty three

percent is based onshore and the remaining thirty seventy percent are based offshore (India and Canada).

Thirty percent of the participants from this group reported that so far, they have had positive experience with Agile, when probed further this section of participants reported to have prior experience of working in Agile. Almost ninety two percent voted for "scope of improvement" when it came to current team size and organization culture. On requesting to elaborate why and which areas do they feel that demands scope of improvement – most replied on the same line as the previous group comprising of participants in leadership roles. These are demonstrated in Table 3 in the Appendix. The primary areas which demands improvement according to this group are lack of visibility, over allocation or under allocation of tasks. Concerns raised by developers were time-boxing of development effort, lack of clarity in estimation of Level of effort and last moment changes due to Agile methodology leads to development of buggy software and this causes delay and error in deployment as development teams runs out of contingency builds where additional changes and fixes can be deployed. Few of the participants also commented that since Agile methodology is a brand new practice in the team and that the team is still getting familiar with the best practices, principles and the application and following of scrum ceremonies – the positive changes will gradually show up. Business Analyst from most teams commented that for them the most challenging part was to get clarity on the business ask from Business partners, end users and key stakeholders and confirm changes regarding deliverables with development team in time. This again transitions into challenge in time-boxing of development efforts and estimating LOE for developers (as has been pointed out by the developers earlier). Although based on Scrum Masters response it can be concluded that they are trying their best to implement the scrum ceremonies to optimize team efficiency given time

constraint, it is imperative that team members give each other some time and continue putting in effort to collaborate with each other. Currently, sprint burndown charts and team velocity are not standardized and reflect a confusing picture because the team does not know its optimum productivity given the time-box imposed in each sprint. Once the team gets through the phase of familiarity and matures they will be able to estimate their efforts and velocity better and over-committing is expected to recede.

Table 4 in the Appendix is the illustration of this second group in respect of their response on lack of transparency, over allocation of tasks, time-boxing of testing effects and lack of clarity in current business process. Eighty two percent from this group also commented on the lack of clarity of business process flows of inter-team and intra-team roles and responsibilities, deliverables, end to end integration testing and timelines. On requesting to provide more details, participants pointed out that this lack of clarity in business processes adds to confusion, miscommunication and discord amongst and across team members. This section also voted "poor" in response to rating the clarity of current process flow of activities; "poor" in response to rating cross-team (part of PI function) communication. This group sounded rather pessimistic (barring only couple of participants) in response to the question whether they feel the team will improve and adapt better to Agile principles as the team and its members matures.

The eighty two percent voted "poor" as response when it came to rating the clarity of current process flow of activities. This section also voted "poor" in response to rating cross-team (part of PI function) communication. Many commented that this is a phase of confusion and dilemma as not only their respective team and its members are trying to best adapt to the changes, but also

other teams are going through similar phases. Since the Agile practices are adopted at enterprise

level, every team is going through similar phases of adjustment, reshuffling.

Discussion

   Based on responses and feedback from both the leadership and core scrum teams it was clear that there are mixed feelings about the results that might ensue once the transition of the conventional to agile principles completes. It was clearly witnessed that participants in leadership roles were more optimistic about changes which adaptation of best practices of agile is going to bring about. As compared to the former group, the core scrum teams of different upstream and downstream interfaces of PI function sounded more pessimistic in their response. This might be due to two primary reasons: One, the core scrum teams have a narrowed down view and experience of the current transitioning phase, although they are aware of the organization vision when it comes to actual implementation of the vision they are either resentful themselves or facing push backs from peers. This is however an expected phenomenon at the beginning of any new strategy, business process or methodology that an organization attempts to adopt at an enterprise level. On the contrary, the group of participants in leadership roles is more focused on the high-level goals and visions of the organization and they are the key people driving those transition goals. These members are however not deep diving into the actual day to day work and hence do not face the full-blown impact of pushbacks and miscommunication in this transitioning phase.

   The scrum teams were mostly apprehensive on number of times the requirements and business asks are circling back and of the fact that there is no clarity in the process on which team or interface should look into depending on the business unit and section the new requirements are catering too. It was clearly pointed out by many participants that the point of contention and roadblock is that when agile methodology is introduced in this ambiguous mess of business processes it is leading to development of faulty and error prone software

enhancements. Furthermore the time-boxing of software testing effort imposes critical restrictions on coordination across teams leading to multiple pushbacks, miscommunication and resentment. The final outcome is a software or enhancement delivered as product that has not been passed by Quality Analysts after thorough end to end integration testing efforts (both progression as well as regression changes and enhancements).

Upon digging in deeper and on more insights shared by leadership and scrum teams, it is firstly realized and in a way mutually agreed on that the grey areas and possible redundancies in business processes requires to be identified and then worked upon. Secondly agile methodology should then be strongly implemented; standardizing all scrum ceremonies across scrum teams can be one option. An agile coach might be the best person to facilitate all scrum teams to a standardized set of scrum rituals where each team will be introduced to same set of norms of daily scrum calls, sprint planning meetings where they will use standardized procedures in estimating user stories, maintaining sprint and product backlogs, sprint review sessions and finally sprint retrospective after each release is done. The scrum master of each interface or team must drive these meetings for each team respectively and interface calls or scrum of scrum meetings should be driven by a Senior Scrum Master or Release Train Engineer to ensure all the teams are working in tandem and are clear on their part of the list of deliverables for each time-boxed sprint.

Imposing such clarity, standardizing scrum ceremonies across all teams of the PI function and introducing roles who will drive all scrum ceremonies will help organize some of the current chaos happening during the transition period. But as stated earlier, this can only be followed after a clear process discovery of the As-Is business process is mapped, followed by identifying the

loopholes, redundancies and areas where scope of improvement is possible to produce the To-Be process.

From the above it is evident that (1) the scrum teams were apprehensive on number of times requirements and business asks are circling back; (2) Most scrum teams pointed out that when Agile methodology is introduced in this ambiguous mess of business processes it is leading to development of faulty and error prone software enhancements; (3) Time boxing of software testing effort imposes critical restrictions on coordination across teams and this is leading to multiple pushbacks, miscommunication and resentment across teams; and (4) Final outcome is a software or enhancement delivered as product that has not been passed by Quality Analysts after thorough end to end integration testing efforts.

Conclusions

The focus of this section is to draw up a conclusion of the study made so far. The transitioning from traditional waterfall methodology to agile approaches plays a crucial role in view of the cry for the existence of the organization and to face the competition in the business world. The issue involves the productivity and efficiency of the organization too. But the complexities are sometimes coming on the way of these organizations.

The issues of the challenges in this transitioning are the changed role of hierarchy, the waiver of the system of command and control, change of mindset of the team members, changing into self-empowered team, developing multi-skilled teams, improving quality of products satisfying the customers' needs, through a knowledge of understanding agile methods, and overcoming the impediments in time-boxing efforts towards time-efficient development of products.

The challenges in connection with time-boxing with testing efforts overviewed from the literatures are that agile develops the consequences of increased testing effort and very high continuous testing demands .The limitation results into continuous integration with testing where software is often made co-occurred with testing. Substantial effort is needed to recompense project testing deficiency on account of curtailment of test coverage following shortfall of independent testing in the projects. It also requires much attempt for continuous testing as it is tough to make an integrated test domain for variety of platforms and structural dependencies.

Further, in case of large organizations, the transitioning can be processed with an agile approach involving its methodologies. In practice, results of implementing best practices of any methodology would finally depend upon the people of the organization and the organization's

culture. Prior workshops to introduce a sense of how things might look in near future, implications, expectations might be organized to make employees and key stakeholders prepared and well informed about the organizational and to cultural changes that agile methodology is going to bring about.

In spite of these approaches some organizations with typical environment and productions might require some customized best practices that best suit their organization hierarchy, structure, culture and personality. In such scenarios, a hybrid approach with the combination of the traditional and agile methodologies can come across as a worthwhile option. But in case of a hybrid attempt for going through both the methodologies side by side, it is found that sometimes an organization faces difficulties. It comes on the way as an issue of challenging how to combine both the agile and traditional methodologies in an organization in a successful manner. It requires by an organization to overcome the strong gap in outlook, culture and technical application and to get both the approaches clubbed together to move with their hybrid outcome. It is also essential to consider the environmental impact, resources response, and sense of limitations while going for a hybrid venture. It has been tried for giving the approach a concrete shape but sometimes it fails miserably. The solution is not a single framework as it varies from organization to organization and this situation converts it into a difficult task. In fact, there is no uniform hybrid application or a new unique methodology found so far in case of transitioning to agile.

Further, sometimes the transition takes place taking care as required but there is no remarkable benefit derived by the organization. As a result it remains a matter to think how to overcome the problem when transition is looked for. There are mixed approaches too but in many cases failure is also an issue. The time-boxing testing efforts avoiding the impediments are

also vital challenges in this connection. The reason behind the failure or problem encountered is not much clear. It may so happen because the researchers or authors had viewed it from different angles and shared knowledge accordingly. And no conclusion can be arrived at regarding its completeness only in view of the fact that necessary identification of most of the cases were done. Hence, it becomes most important that the grey areas and possible redundancies in business processes require be identifying and then working upon and the agile methodology should then be strongly implemented. Another option is standardizing all scrum ceremonies across scrum teams and an agile coach may be appointed to facilitate all scrum teams to a standardized set of scrum rituals where each team will be introduced to same set of norms. But more research should be carried out to utilize this knowledge sharing.

It is felt that further scientific research should be conducted to find out the organizational changes needed to help the agile teams in order to achieve its benefit entirely and to strive for a useful solution of time-boxing testing efforts.

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Appendix

Group I Responses:

Table 1

Sl. No.	Resources	Roles	Remotely Located	Positive Experience with agile	Scope of Improvement
1.	Leadership	92	90	76	72
2.	Senior Manager	5	20	10	8
3.	Team Leads	3	5	3	2

Table 2

Sl. No.	Resources	Lack of Clarity in Current Business Process	Teams will adapt better as Teams mature
1.	Leadership	72	90
2.	Senior Manager	10	5
3.	Team Leads	5	5

Group II Responses:

Table 3

Sl. No.	Resources	Roles	Remotely Located	Positive Experience with agile	Scope of Improvement
1.	Developers	25	35	10	72
2.	Business Analyst	30	20	10	90

3.	Quality Analyst	30	5	7	45
4.	Scrum Masters	15	4	2	90

Table 4

Sl. No.	Resources	Lack of Transparency	Over allocation of Tasks	Time Boxing of Testing Efforts	Lack of Clarity in Current Business Process
1.	Developers	35	75	60	35
2.	Business Analyst	80	36	65	86
3.	Quality Analyst	30	69	95	57
4.	Scrum Masters	75	20	2	95