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Hybrid Project Management Approach for Software Modernization

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Abstract

Software modernization or legacy modernization, refers to the conversion, rewriting or porting of a legacy system to a modern computer programming language, software libraries, protocols, or hardware platform. Legacy transformation aims to retain and extend the value of the legacy investment through migration to new platforms [1]. Currently, I am working as a Senior Business Analyst with Blue Cross Blue Shield, one of the largest insurance provider in the United States across the health sector. I am deployed to work on their initiative towards software modernization along the healthcare industry through their software-as-a-service (SaaS) platform – "The Healthcare Online Resources (THOR)". This service is available to numerous providers in the healthcare vertical to leverage their current operations and comprises of multiple modules including but not limited to claim adjustments, preauthorization and group coverage status. With the ongoing centralization of resources and increased competition, most of the companies are focusing on software modernization by leveraging their current technologies and hardware platforms, to remain the trendsetters and viable in the marketplace. To enhance my efficacy and understanding of the business requirements, I would like to conduct my thesis research towards the topic of "Software Modernization". I would be able to leverage my experience as Senior Business Analyst to understand and bridge the gap between business requirements and the supporting technology backup. Being working in a multinational company, with multiple cross-functional teams, I plan to include different research results through self-surfing and interaction with these team members. Additionally, I had like to conduct surveys across these cross-functional teams mainly business and technical teams to understand and document their challenges and experience. Therefore, I strongly feel that I would be able to justify the thesis and the corresponding research.

Keywords: Software modernization. Legacy Modernization, Digital Transformation, Blue Cross Blue Shield, Legacy Systems, Insurance Provider, Business Analyst

Abbreviation

HU – Harrisburg University

BCBS – Blue Cross Blue Shield

PMO- Project Management Office

PM- Project Management

SDLC – Software Development Life Cycle

Hybrid – Agile/waterfall Software Development Life Cycle

Figures and Tables

Table of Contents

Hybrid Project Management Approach for Software Modernization

Legacy System:

A legacy system is an old method, technology, computer system, or application program, "of, relating to, or being a previous or outdated computer system." Often a pejorative term, referencing a system as "legacy" often implies that the system is out of date or in need of replacement. [2]

Legacy system runs on out dated technologies and hardware, maintenance costs are very high for this antique technologies. In current market most companies have to improve their systems to keep them competitive. Most of the time these technologies and hardware are roadblocks to include any new enhancements. New hardware or operating systems stop supporting old technologies versions which force companies to replace legacy systems. Also sometime maintenance costs of systems overweight replacing them. New staff have lack of understanding of technologies used in development and most of the times there are no documentations available of development of these systems which makes it even worst to implement any new enhancement.

Problem Posed by Legacy Systems [3]

- **To Remain Agile to Change**: In current business environment and improvements in technologies, Companies have to quickly adapt these changes to remain competitive. In most of the cases; legacy systems are inflexible to support these new changes. Organization requires these flexibility to adapt changing new business requirements and rapidly evolving future technologies.

- **High Maintenance Cost**: Most of the articles and case studies mentioned legacy systems are stable systems but those are very high maintenance. In most cases maintenance of these systems exceed the costs of replacing with new systems. In most

cases these high maintenance cost of legacy systems is one of the major drivers behind legacy system modernization.

- **Lack of Knowledge**: Legacy systems are confronting the lack of resources. They have very limited number of suppliers/vendors. Also legacy systems are using outdated technologies and subject matter experts are limited in the industry. New people faces many challenges to understand them. These systems have lack of documentation. Most documents are not even properly documented or have missing parts. These reasons make IT departments to force management to introduce new projects for software modernization.

- **Prone to Failures**: Legacy systems are deeply involved in business but the legacy systems might fail due to lack of experts and suppliers/vendors. Legacy systems are business critical and companies cannot afford their legacy systems to fail; so they need enough precautions and risk mitigation plans to avoid failure.

Software modernization:

Software modernization refers to the conversion, rewriting or porting of a legacy system to a modern computer programming language, software libraries, protocols, or hardware platforms. Legacy transformation aims to retain and extend the value of the legacy investment through migration to new platforms. [1]

Legacy systems are frequently large and difficult to modify, and scrapping or replacing them often means re-engineering an organization's business processes as well. Also, applications which are developed with modern language like JAVA are also becoming legacy where industry still have systems running on legacy languages like COBOL or VB and these systems might be reliable but they are facing challenges of lack of knowledge and prone to failures. These systems

are the first to address with software modernization projects.

Migration to new technologies can help to reduce maintenance costs and also open window for business team to work on enhancement. Migration allows to take advantage of new services like web services, cloud services or integrating them to available enterprise software. Transformation will allow applications to align more closely with future business requirements to enhance functionality. Reduce cost of maintenance will help to put more budget to emerging technology department.

The goal of software transformation is to maintain the value of the legacy system with the new technologies. This modernization can take several forms. For example, it might involve translation of the source code, or some level of re-use of existing code plus a Web-to-host capability to provide the customer access required by the business. If a rewrite is necessary, then the existing business rules can be extracted to form part of the statement of requirements for a rewrite.

Type of Software Modernization [4]

There are many types of software modernization possible and companies have to identify what is required from them to assure continuous improvements at the predictable industrialized cost.

- **Sustain**: Keep the application with minimum maintenance and budget.

- **Re-platform:** Move the current application to a more modern hardware/operating system.
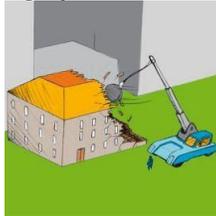
- **Decommission**: Retire the legacy system with controlled manner and preserve essential data.
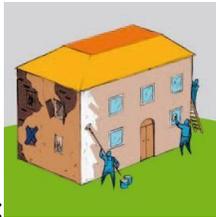
- **Remediate**: Improve the core structure of the application to improve integration and flexibility.

- **Consolidate**: Merge different platforms to reduce duplication and overheads to achieve efficiency.

- **Extend/Enhance**: Enhance functionality or services to provide improved integration and flexibility.
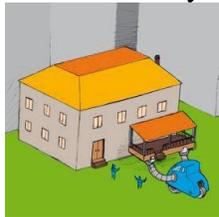
- **Migrate:** Migrating to a new language or reuse the code in modern environment.
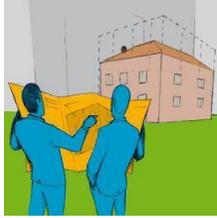
- **Replace:** Use the essential rules of legacy system and recreate system in a modern language or package.

Waterfall Project Management Approach:

Waterfall is a traditional project management approach to software development. In this methodology, we follow different phases in sequence as mentioned below:

- Gather and document requirements

- Design

- Code and unit test

- Perform system testing

- Perform user acceptance testing (UAT)

- Fix any issues

- Deliver the finished product

In traditional project management approach, each phase works on distinct procedure of software development, and each phase generally finishes before the next one can begin. This approach is possible when business requirements are clear and milestones are easily identifiable in the development process and achievable.
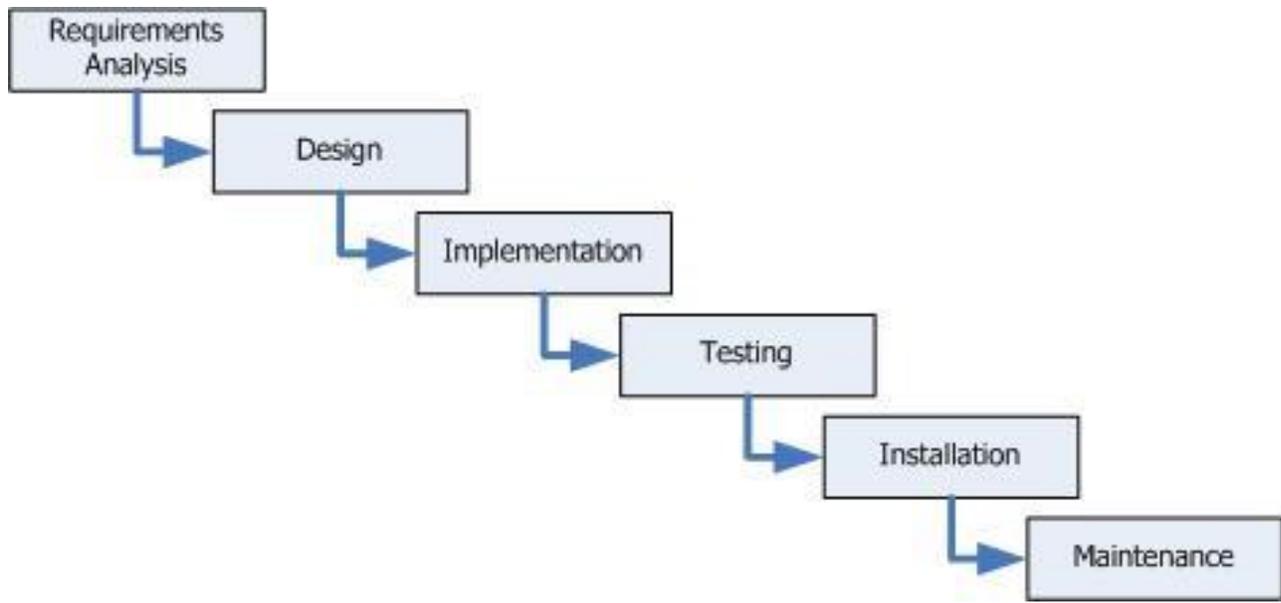
Figure 1Waterfall Project Management Approach

Agile Project Management Approach:

Agile methodology is an alternative to traditional project management for software development. This approach is focus on development piece-by-piece rather than whole software. Agile methodology provide better platform for communication between development team, business team and end users. This project management is best practices when business requirements are unpredictability and unclear. Planning and changes in design occur throughout the project based on lessons that are learned along the way.
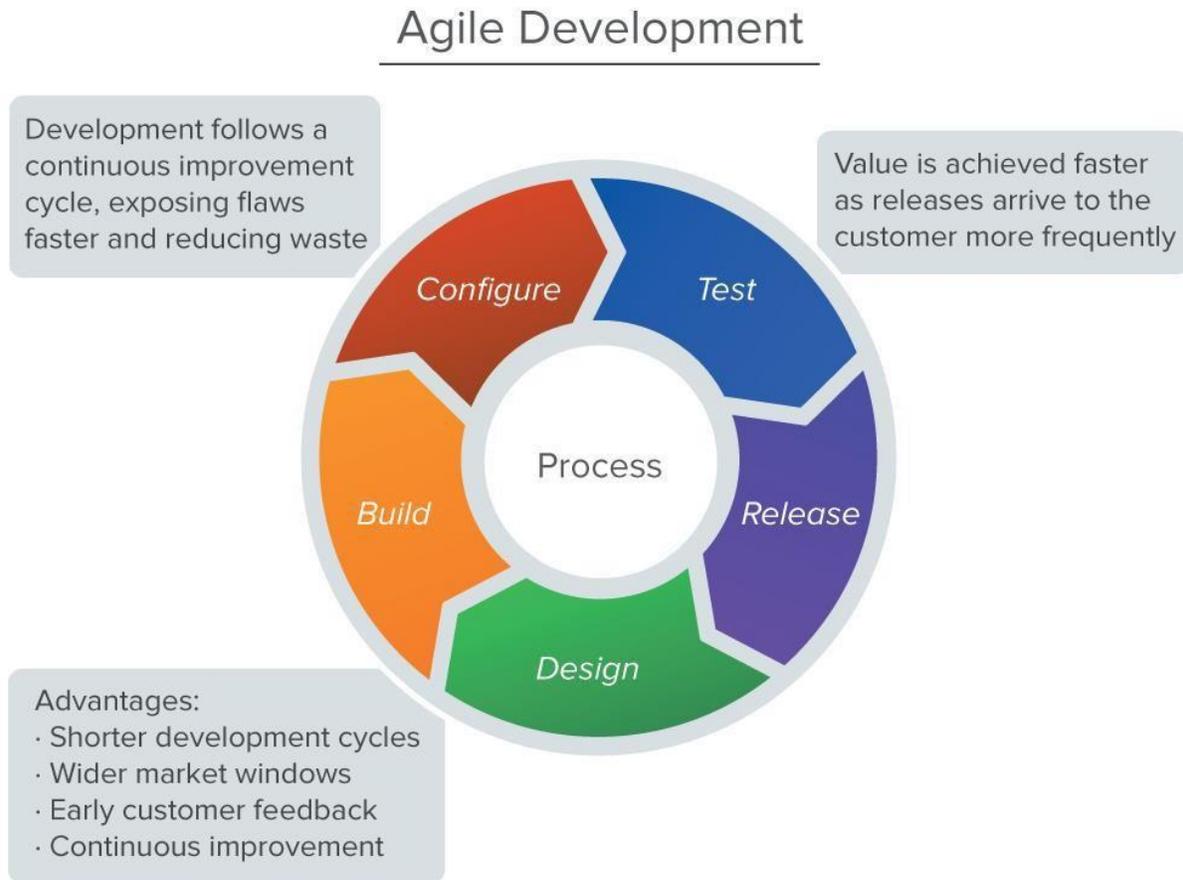
Figure 2 Agile Project Management Approach

Hybrid (Agile-Waterfall) Project Management Approach:

Implementing Agile-Waterfall Hybrid project management allows software teams to work agile project management approach, while hardware development teams and product managers can keep using a traditional project management approach.

Tight, continuous integration between waterfall and Agile software development processes from each phases. Collaboration is key, and the Agile-Waterfall Hybrid method enables teams to define requirements and adapt to changing requirements and provide feedback. While agile project management approach can be practiced for any development project and will often

deliver powerful benefits, while in some situations where waterfall are the smarter way to go. The Hybrid model is best suited for reusing software code and future technologies must also be part of development.

Research Question

The central question to which I am seeking answer is:

Why hybrid (Agile-Waterfall) project management approach should be practiced by companies for software modernization of their legacy systems and digital transformation?

Literature Review

Introduction

For the purpose of this research the existing literature is explored from following perspective.

1. How hybrid project management beneficial for software modernization?

2. What challenges companies are facing for software modernization?

3. What are the drawbacks of practicing agile or traditional approach for software modernization?

Blue Cross Blue Shield, North Dakota – THOR

BCBSND is a member-owned company, the largest provider of health insurance coverage in the state. As a business leader and employer company believe every North Dakotan should have access to quality health care. Company has deployed to work on their initiative towards software modernization along the healthcare industry through their software-as-a-service (SaaS) platform – "The Healthcare Online Resources (THOR)". This service is available to numerous providers in the healthcare vertical to leverage their current operations and comprises of multiple modules including but not limited to claim adjustments, preauthorization and group coverage status. As mentioned above THOR is collection of many modules which address different business processes. Providers are given access to different modules based on their business needs. THOR was initially developed in early 2000 as a desktop application which was converted to web application as per business needs. Company haven't gathered any new business requirements to make any changes to any of business process while converting to web application. BCBS has used visual basic as programming language. Business team wants to introduce enhancement or improve current business process but none of their requests are accepted from IT department as visual basics is out dated and is not so supportive for enhancement. THOR runs only on internet explorer while there

are plenty browsers are used by end users. Soon out dated technologies supporting THOR will not available in market which will increase the risk of THOR failure. THOR is required to migrate to latest technologies which can support enhancement to current business processes. Company has contracted implementation partner to run migration software modernization project to convert THOR from visual basic to latest version of .NET. Company wanted to practice agile methodology for their project as other running projects are already practicing it. Nature of agile approach requires high amount of communication between business team and development team which is waste of resources for business team. Business team can easily provide clearly defined business requirements as enhancements were not part. So after providing business requirements, they are required to be part of user acceptance testing. So Waterfall approach would have work better. On the other hand in THOR all the modules are individual so here development cycle can be independent for each module where agile approach would have more suitable. So eventually looking at the progress of development and possibility of code reuse BCBS has decided to follow hybrid model. [5] [6]

Challenges of Legacy System Modernization [3]

- **Time Constraints to finish modernization**: As discussed in introduction about challenges of legacy systems like lack of resources and documentations. It is hard to estimate risk from these issues. Most time project manager don't even consider them risk and doesn't include them in risk mitigation plan. Usually software modernization is long duration projects, many earlier plans regarding the modernization change and this further delays the projects.

- **Data Migration**: It is difficult to migrate data from old database to new system. There is many possibility of losing data from legacy systems. Also it is hard to follow same data

structure from legacy systems. According to this article 59.6% of the respondents agreed that data migration is one of the challenge of legacy system modernization.

- **Complex System Architecture**: New people who are involved in modernization of legacy system, has difficulties in understanding complex legacy system architecture. Most of the cases developers find legacy system structure were poorly constructed and hard to adopt in new systems.

- **Lack of knowledge**: As discussed lack of documentation makes legacy system business requirements gathering process time consuming.

The Need for Hybrid Approaches

The reason behind failure of projects is because of not correct selection of a software methodology. Each project or organization has its own methodology that may have characteristics suitable to pertaining project or organization. An organization that uses software methodology does follow ideas from various other methodologies or may also combine standard methodologies with agile approaches. The purpose of doing this is to tailor a development strategy for the organization or project.

Thus, for the past decade or so practitioners and researchers have found that in order to improve software development process, software development methodologies have to be combined. Also, they have realized that a better software development process can only be achieved by going through the advantages and disadvantages of each methodology and thereafter combining the strengths and eradicating the weakness of two or more approach.

Highlights of the hybrid waterfall/agile project development approach [7]

A hybrid agile/waterfall development approach is suited for outsourced distributed software development. For project, before development complete the documentation related to business

requirement and during the development process keeps doing minute course corrections as one goes along.

The key components of a hybrid waterfall/agile process.

Every project requires a detailed project plan

This tip does not consist of project plan process diagram because sometimes this has to be done even before one bids for a project; also it can be part of deliverables. There are many work management tools available but I have used Microsoft Project for this process.

Create a question list for clients at each stage of development

The development team must make sure to generate a list of questions for client to answer right from the RFP document to a requirements document. It is always a nice idea to gather answers related to issues which the client is not clear about or have very less knowledge about it. It is always a great practice to get rid of these questions way early rather than making any assumptions about anything.

Some documentation is optional

There are many documents which are considered to be optional and need to be selected on case by case basis viz. technical specifications, functional specifications and technical architecture documents. One may waste lot of time if they keep collecting all this information and lend up working on short term project like designing a part of website. The process shows a superset of all documents one may require or client may require to generate before starting to code anything.

A high-level design document is always needed

For each project once one passes the specifications phase, the development team needs to create a high level design draft even if it's just few pages. This will make interface designs clear to

understand etc. This will make clear every customer aspect by the development team and always have a chance to ask questions and make things clear before going towards the coding part.

Weekly, every-10-day or periodic build release deadlines must be achieved

In hybrid waterfall/agile model, the development and testing part is divided into weekly span in the project plan depending on the time. It may vary from every 10 day or maximum of every two week build release cycle and finally on this date without fail release has to be done.

The development team can arrange a meeting without clients and decide what can go through this build, some flexibility is allowed in deciding what goes through this build; but the release date is never changed for any reasons. The point behind practicing this is to always follow a build and release discipline. Each build has to be tested locally and then only it is allowed to be released. This process makes sure that software is tested number of times than in a purely waterfall model and thereby increasing the quality of software indirectly.

Determine if a requested change requires a change order

When one obtains feedback from clients and create tickets or defects related to it, first make sure if it requires a change order. What is difference between a defect that doesn't require a change order to fix and that requires a change order? The reason is simple things like color; font or some calculation error can also be flagged as defects. Change order can be considered if work to be done requires more than 4 hours. This is a thumb rule and can change on a project by project basis and needs to be taken into account.

Using Hybrid Scrum to Meet Waterfall Process Deliverables [9]

In the given case study the most archetypal elements for the success of this project were: *1. defining* and *2. Implementation* of a hybrid Scrum methodology. In the very early phase of the project itself it had become *evident* that despite of having a working SDLC in the organization, the project was

in jeopardy and could be cancelled unless quick successes were achieved by the project team. No one else but the company's own policies were to be blamed for this difficult scenario. Even if the waterfall approach would have been taken for this project, it would have not generated the success early enough to protect it from the chopping block. As they say "Necessity is the mother of Invention", hybrid Scrum methodology was indeed a prodigy of necessity. As an example of its usefulness, the project though being quite far from completion, continues to track successfully from release to release. As the features continue to be added to the hybrid scrum methodology, the customers who use the CG-LIMS in their everyday activities are greatly appreciating the attention that is being spent in customer interaction. This can only be deemed as a benefit of the agile system. In a very similar fashion the other side of the coin – Product owners/Sponsors/Stakeholders are very much excited and appreciative of the fact that they have the visibility as well as a participatory role in the Scrum and Hybrid Scrum activities. Additionally they are also happy about the fact that standard to which the project is ultimately held which is the SDLC Process, is being satisfied. In the meantime the deliverables of the model are also being realized which include: *1. Increased and more frequent customer interaction, 2. important releases being delivered every six months and 3. Potentially shippable product being delivered every two weeks.* Owing to the increased transparency brought forward by the scrum team the deficiencies are being discovered and addressed early on, due to which surprises have minimized and have ultimately contributed to increasing the morale of the Scrum Team. This has led to an increment in the tempo of operations and at a sustainable pace. The very important element to success of this hybrid scrum model is that the deliverables from the waterfall process have to be clearly defined. After which a clear strategy has to be formulated regarding how the team will accomplish and deliver its objectives. Discipline is of utmost importance for the success of this project because forgoing the inefficiencies of the

past and adopting agile methodologies require a great deal of dedication and commitment from the management and team members alike. While implementing the hybrid scrum model for use in CG-LIMS and for meeting the specifications of USCG SDLC, six specific method/artifacts were added or modified. Similarly when the hybrid scrum would be required to be applied to an organization in need of similar results, certain other methods or artifacts could be modified to cater to the needs of the specific organization. Another benefit achieved by implementing the hybrid scrum model is the knowledge gained that apart from providing the means for co-existence of "Scrum and Waterfall" in an organization, but it also provides an alternative approach to an organization for transitioning from waterfall process to Scrum that too in an incremental approach. It is a very viable course since it is not always possible for an organization to transition from waterfall approach to a more agile scrum system overnight. This could be owing to budgetary restrictions, political reasons, training or organizational logistics. As we all know that nothing can be achieved without pain and perseverance, similarly a successful implementation of this system would need an initiator, and a champion who will be vigilant and willing to take minor setbacks for the greater good. From the personal experience acquired while implementing hybrid scrum with CG LIMS project, it is easier to envision the forbearers in other organizations using the hybrid scrum for transitioning their organizations from waterfall to Scrum 32. The limited scope of the study is the only major shortcoming of this study. At this point of time it can be safely said that as more thorough studies will be conducted in the future, more value would be added to the hybrid scrum model. Finally to the conclusion of this thesis it can be said that it is possible to combine the two approaches, namely – Waterfall and Scrum. Success can be achieved with both the processes.

Success Criteria for Project Management Methodology

As we all know that there is no universal methodology or "the best method" as they say which can work evenly for all business types, of varying sizes or even industries. However there are indeed ways to determine which methodology to use and apply effectively to a particular business. While evaluating methodologies the following few factors could be taken into consideration:

- Key business drivers

- Constraints

- Risks

- Core organizational values and strategic goals

- Complexity

- Stakeholders

- Project cost & Size

The organizational project management Maturity model (OPM3) was developed by the Project Management Institute (PMI), in order to assist in this regard. It has now become a globally recognized standard and it enables organizations to improve project management capabilities, help solidify successful project outcomes, standardize processes and strengthen the connection between execution and strategic planning. The main focus of the OPM3 model is to focus on the overall organizational effectiveness based on which it provides guidance on incorporating project, program and portfolio management. OPM3 has been revised from time to time, once in 2008 and then in 2013. It has been adopted as an American National Standard and recognized by American National Standards Institute.

Some high-level process for tailoring Project Management methodologies have been discussed in PMI's guide named "Implementing Organizational Project Management Practice Guide". For an

organization to maximize its strategic benefits, it must carefully evaluate the methodologies based

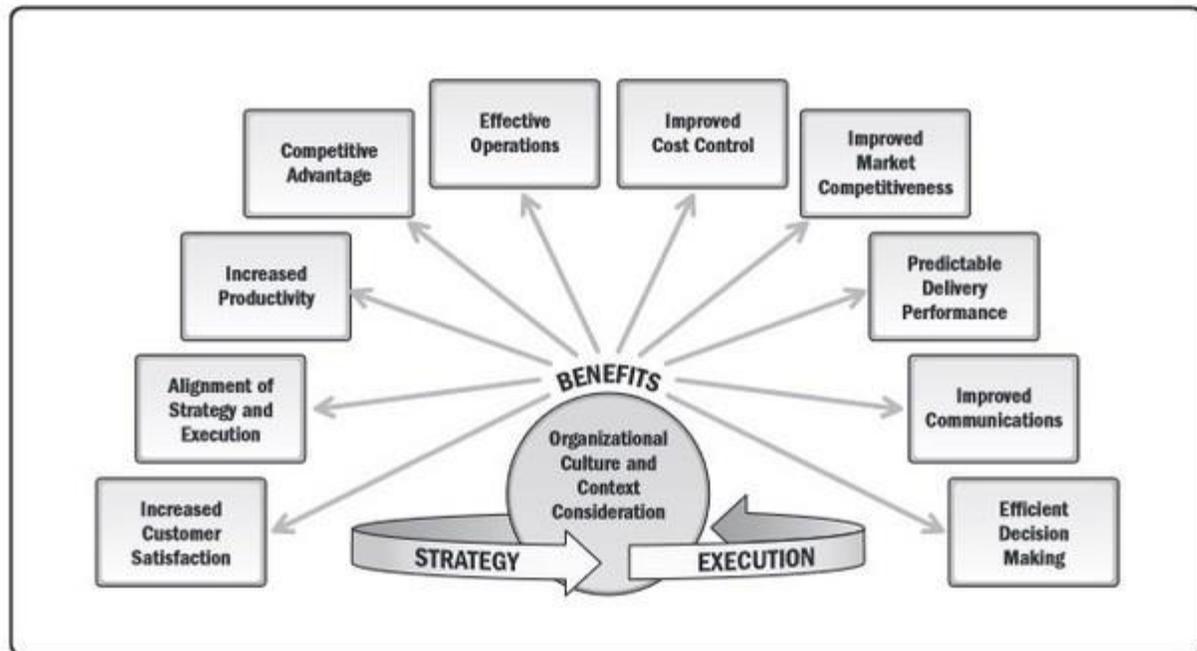on the factor in the PMI Methodology Tailoring Process and choose the best suited method

Figure 3Implementing Organizational Project Management Practice Guide.

Benefits of Organizational Project Management (OPM) [11]

Since successful strategic alignment is the main goal of OPM3 model, it would be highly beneficial

for young business to adopt OPM3 for their organizations, since successful project out come

primarily depend on such alignment. In order to ensure that the right methodologies are being

employed for specific projects in order to increase customer satisfaction, improve cost control,

increase productivity etc., it will have to incorporate Enterprise Program Management Offices in

their organizations. This will ultimately aide in expediting and improving decision making process

in addition to supporting alignment with companywide goals.

All project management methodologies are unique and have their own pros and cons. It would be

in the best interest of an organization to consider adopting multiple PM methodologies while

taking into account the type of projects along with other previously discussed factors.

Finding the most suited methodologies that would enable one's organization to efficiently and effectively reach its business objectives is the ultimate goal of Organizational Project Management .To achieve this goal it is highly important to figure out that how specific projects align with the overall organizational objectives and what factors impact the failure or success of these goals.

Research Methodology

Introduction

The main goal of this section is to talk about what kind of research methodology can participate for this thesis. Qualitative and quantitative are types of the research methodology can be used for this thesis data collection. Qualitative research takes approach of semi structured interview, online survey, results collected by different tools. Quantitative approach discusses the theoretical insights arising from the finding of case studies and research questions from which hypothetical conclusions are made.

Semi-structured interviews in Blue Cross Blue Shield
Semi-structured interviews in Project Manager Group

This research method is focused on project management team and software development team for software modernization challenges and software development lifecycle. Semi structured interviews is chosen for qualitative research strategy. This interview will contain open-ended questions and better understanding of software modernization project. These interviews will conduct in person or on telephone. These interviews are going to be conducted keeping research question in mind. These questions are going to be little differentiating based on the managerial role and responsibilities.

Online survey

Online survey questionnaires are going to be based on project management lifecycles, waterfall SDLC, Agile SDLC and Agile-Waterfall SDLC. This online survey will target audience like Project management conferences, Project management offices. This survey will collect data, which will use for data analysis to support the research questions. This survey questions are going to be influenced by semi structured interviews review. Multiple-choice questions and one descriptive question are going to be part of survey. Length of the survey will be kept up to 2-3 minutes. Exploratory data analysis is going to be used in the initial stage by making charts and tables to understand the data.

Secondary Data Collection

Data Collection is essential for research. To accomplish the data collection, the following parts are identified: Data collection process, Data sources and Data analysis.

Data Collection Process:

Data collection process should be reliable and valid for the thesis research and practical purposes. Data is going to be collected from: Development JAD sessions, Meeting with PMO, Feedback from providers and other data produced during project schedule development and work break down structure.

Data Sources:

The data sources for this topic originally from the blue cross blue shield software modernization project team such as stakeholders, project manager, business analyst, provider and development team. Another data source came from documentation developed during project development cycles and project management tools. Use of these data sources validate the data collected and it will increase level of confidence of the research.

Data Analysis:

Cross-case analysis, business intelligence reports, reports generated from project management tools and conclusions are required phases for data analysis. For this research first we required to gather data from different tools and documentations. It is required validate these data from third person. For internet sources and published data examines the purposes of those studies.

Significance of the study

Apparently, it is proven that Waterfall and Agile model have its own downside, which makes us conclude that it is feasible and convincing to implement and adopt a Hybrid Model, to leverage the advantages of both the models.

The crucial part to selecting a Hybrid Model is to perform an in-depth analysis of the model the team plans to implement and adopt. When selecting a model, one has to always consider an extensive planning along multiple factors including but not limited to budget, timeline, effective utilization of resources, involved complexity of building the software system. Hybrid methodology aims to address each of the above listed factors in an efficient manner to achieve the maximum potential throughout the software development lifecycle.

Since, the Hybrid Model is still a new concept, it is in the emerging stage. The model is slowly and gradually adopted by more companies and will be the most cutting edge software building model in the near future.

The Agile methodology includes and revolves around asking questions such as:

- Collaborating with the customer during the contract negotiation and requirements phase

- Identifying the individuals included in the processes and the interactions among them

- Preparing a comprehensive requirements documentation for building the software

- Incorporating the changes as and when identified throughout the course of development

Hybrid Model does not follow the above listed manifesto in entirety, but it does throw importance on each of the above mentioned points. It is at the discretion of the customers and the development team to decide which of the above listed points have more value.

Limitation and key assumptions

The research has evaluated Hybrid Model and its approaches along the healthcare sector based on the professional experience and its advantages. The advantages includes achieving accuracy, better time management, scaling down the project resources and costs etc.

The model can be evaluated more along the lines of achieving operational efficiency over the long term, implementing scalable systems across the global locations for a firm, feasibility and scalability analysis of the approach to adapt to changes over a long term period and risk mitigation procedures.

The key assumptions includes Blue Cross Blue Shield (BCBS), providing support in terms of making resources available to effectively and profoundly perform research on the Hybrid Methodology based on their current software development process and their listed requirements.

Contribution to the knowledge

Hybrid Model methodology is currently in a very nascent stage of adaptation by companies across different verticals and not many have idea of implementing the approach. Hybrid Model is the future of the software development process and a large part of the companies are already in the early stage of analyzing and adapting the methodology.

The research has included multiple dimensions and significances of the Hybrid Model which when put to use might open up more scalable opportunities for companies in their daily operations helping them mitigate risk, reduce costs and improve time complexity.

An in-depth analysis of the methodology will make it easier for companies to move from

traditional waterfall and agile methods to Hybrid method to take advantages of the both the

methods and bring in an increased and joined efficiency.

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