

A COMPARATIVE STUDY BETWEEN WATERFALL MODEL VS AGILE METHODOLOGIES IN THE IMPLEMENTATION OF IT (ERP) PROJECTS

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Abstract

Over the couple of decades IT Industry has changed exponentially with respect to the Project delivery models (Offshore model, Onshore model, Hybrid Model etc.), Technological advances (Software and Hardware changes), Infrastructure (On Premise Vs Cloud Services), revenue (Global revenue). Different project management methodologies have been evolved during this period. This publication is intended to provide a comparative study on Project Management Methodologies in which IT Projects are executed and how Agile Scrum Methodology has helped to cater the changes and successful execution of the projects. The two project management methodologies considered in this study are traditional Waterfall Model (which was considered successful) along with Agile Scrum Methodology, considered as a revolution in today's IT Industry (which is more flexible and divides the overall final deliverables into work packages delivered and sent for client review on periodic basis).

Introduction:

The IT world has transformed drastically over couple of decades. In early 90s IT was used only in large scale industries, Banks, Govt& Public Sectors and academic institutions. But in the today's world, mobile usage has become a necessity and with the advent of Android Technology almost every sector whether it is as large scale, medium scale or small scale is IT embedded. Almost everyone is using the IT enabled services in their daily life as well.

IT industry operates in the form of

1. Projects that are temporary endeavors which have a definite start and end.
2. Service Operations which cater to the day to day operations of the industry needs.

The Key components of IT projects are:

1. Technology
2. Skilled Resources
3. Infra Structure
4. Tools and Techniques

All the above factors are changing rapidly and a proper project management methodology along with a framework is required to accommodate these changes.

Technology is changing so rapidly, that the technology today is getting obsolete in immediate future. The best example to quote is Traditional Mobile Vs Android Mobile. The traditional mobiles are not compatible to install mobile apps, which can be done through Android phones. Hence an apt technology is to be planned which has a shelf life within the duration of project.

Data Chosen for the purpose of the study:

IT Implementation Type: ERP/SAP (ERP Stands for Enterprise Resource Planning. Which is an end to end solution supporting all the business Departments like Supply Chain, HR, Finance etc. SAP is an ERP tool developed in Germany.)

Types of Projects: Fixed Budget Project (The project is to be executed by the implementation partner within the agreed budget), Time and Material (The resources are provided to the client and only the resources are charged at a daily rate) and Hybrid of Both

Industry Sector: Energy/Petro Chemical (Information Technology implementation in Petrochemical Industries)

IT implementation Partners: IBM/INFOSYS/CAPGEMINI/ACCENTURE

		Methodologies in Scope	
		Water Fall Model	Agile Scrum Master
Parameters Considered for comparing methodologies	Scope	30 Objects	35 Object
	Complexity	10 Simple, 15 medium Complexity and 5 High Complexity use cases	15 Simple, 10 medium Complexity and 10 High Complexity use cases
	Client	World Leader in Petro Chemical Industry	Equivalent competitor to the World Leader
	Implementation Partner	Big 5 IT Companies	Big 5 IT Companies
	Project Completed in	36 months	18 Months
	Cost of the Project	40 Million USD	25 Million USD
	ERP Tool Used	SAP ECC 6.0	SAP ECC 6.0
	Mode of Project Implementation	Onshore	70% Onshore and 30% Offshore
	ELF (Engagement Level Feedback Client Rating Provided on a Scale of 1 to 10 with 10 being best)	6	8
	Number of Changes Handled during the project	3 (Upon approval from Change Control Board)	14

The data is collected to compare both the project management methodologies using almost similar set of data. The clients are both located in US, State of Texas at Houston and are part of Energy Sector at a similar scale. The ERPs considered in Study are SAP in both the cases. The study below clearly shows how adopting to Agile Scrum Methodology can improve the execution of a project.

Hypothesis: How Agile Scrum Methodology is successful in replacing traditional waterfall models in ERP Project Implementations
Project Management Methodologies:

There are 5 dependent parameters of project management in which case if one parameter changes the rest will change automatically:

1. Cost
2. Quality
3. Scope
4. Schedule
5. Resources

If any one of the parameters is varied the rest of the 4 will automatically change to accommodate the change. Any project management methodology chosen should ensure that the changes are to be useful.

Earlier the IT projects were using traditional Waterfall project model of project management methodology where each phase of the project used to go through one phase of the project after the other in a sequential way. This includes Requirements gathering phase of Project Initiation Phase followed by Planning phase, followed by Execution Phase of the project, with continuous Monitoring phase of the project and finally followed by the Project Closure.

Each phase of the project includes the discovery phase of the project consisting of:

Project Planning, Defining, Project Design, Build, Testing and Deployment.

Initially traditional waterfall model was initially used in IT industry and consequently extended to the manufacturing industries.

Waterfall Model is the classic project management methodology. In the case of Waterfall model since the methodology is Linear and Sequential any changes or new requirements that come up at a later point in time cannot be accommodated. Just like the way water falls from a higher altitude in a single direction and water cannot be sent back in a reverse direction - Waterfall model is unidirectional and not Bi-Directional model.

Definition(Waterfall):

The **waterfall model** is a breakdown of project activities into linear sequential phases, where each phase depends on the deliverables of the previous one and corresponds to a specialization of tasks. The approach is typical for certain areas of engineering design. In software development, it tends to be among the less iterative and flexible approaches, as progress flows in largely one direction ("downwards" like a waterfall) through the phases of conception, initiation, analysis, design, construction, testing, deployment and maintenance.

Source: https://en.wikipedia.org/wiki/Waterfall_model

In the case of Waterfall outcomes of each phase of the project are independent and needs to be executed before the start of the next phase. Just like the SDLC (Software Development Life Cycle) where the Life Cycle as shown below



Source: <https://www.dignitasdigital.com/blog/easy-way-to-understand-sdlc/>

This is also known as P-D-C-A approach which stands for Plan Do Check Act. This approach works good when the

1. Scope is clearly defined
2. Changes are not added after the requirements gathering phase is completed
3. Resources are readily available.
4. Change Management is strictly controlled and stake holders who clearly defines the Change Management.

This type of methodology is feasible in the case of Materials Industry or Industrial Engineering or Manufacturing Sector. Since these sectors include physical objects as output, unlike the software projects which handle data and not direct physical objects.

But this methodology is not providing high margins and the product that is developed after 3 years is not of any use to the business anymore. In today's world the technology is transforming with the advent of Android, Big Data, Cloud, Robotics Process Automation and currently Artificial intelligence. These technologies need huge amount of data and with the concept of virtual machines the infrastructure set up doesn't need much of a time.

In earlier world in the Waterfall model – The requirements are gathered all at once. For example, in the case of any typical ERP implementation, the requirements use on an average around 30 processes per department. The requirements were all gathered at once and the Design/Development and testing done all at once. With this the respective team is on boarded at once (i.e.) in the initial phase the Design team is on boarded and the design team does the design and hands over to the requirement gathering team. The requirement gathering team in return will hold workshops and gathers the requirement. The Development team will develop the code during the Development phase.



Disadvantage	Advantages
It is unidirectional.	The respective specialists are working in the project throughout during the corresponding phases. The project duration is fixed and planning is to be carried within this period. Further, it is useful for Long term projects
Any changes in requirements cannot be accommodated.	In earlier days the requirements were all provided at once on a particular day and with the project duration of 3 years, the implementation is completed after 3 years at once. So the client is able to visualize the final product only after 3 years. If any further changes are to be included, then these are to be taken up as a separate project at separate cost. This type of approach worked during the 1990s and 2000s. With the advent of cloud, automation and open source, some of the processes are partially automated and some completely automated.
Doesn't work for Long term Projects.	One of the best processes that can be quoted in here is the Software Testing. With reference to the testing cycle – testing was initially done manually. In the case of testing we have two parameters. expected result and the actual result. Both are compared in the following lines – If they are same test result is Pass whereas, if not the test result is Fail. The test cycle includes test plan, test design, writing the test scripts, execution and regression if any. 70% of the testing is automated in today's world using the apt technology at the right time. The execution of the test scripts is 100% automated and these test scripts can be executed for N different types of scenarios. This reduces the time and cost of testing by 70%. The test scripts can be reused as well based on the previous artifacts
Planning can only be made based on current scenario and possible future risks.	With the advent of latest technology procurement of the technology is available with a click of a button and the lead time is as well is shorter now.

Agile Scrum:

Source:<https://www.guru99.com/agile-vs-scrum.html>

Agile is a development **methodology** based on iterative and incremental **approach**. **Scrum** is one of the implementations of **agile methodology** in which incremental builds are delivered to the customer in every two to three weeks' time. **Scrum** is ideally used in the project where the requirement is rapidly changing. Further, Agile methodology is a practice that helps continuous iteration of development and testing in the SDLC process. Agile breaks the product into smaller builds. In this methodology, development and testing activities are concurrent, unlike other software development methodologies. It also encourages teamwork and face-to-face communication. Business, stakeholders, and developers and clients must work together to develop a product.

Scrum is an agile process that allows us to focus on delivering the business value in the shortest time. It rapidly and repeatedly inspects actual working software. It emphasizes accountability, teamwork, and iterative progress towards a well-defined goal. The Scrum Framework usually deals with the fact that the requirements are likely to change or most of the time not known at the start of the project.

The need of the hour today is adaptability with reference to the time, Technology, Client needs, Infrastructure and contemporary requirements. Hence arises the concept of Agility. Agility means adaptability as per the client needs. The evolution of Agile methodology has drastically reduced the redundancy of effort and Scope creep. Scope creep is not acceptable in today's world as the cost for specialized labor is too high and not available at a given point of time. In today's world the open source technologies (Technologies which are available freely on websites without any restriction) are so many and available in the market which are free to use thus reducing the cost of licenses.

With the advent of the agile methodology the implementation partners of the software are able to work along with the client on the schedule, scope and cost. But the problem is with reference to the ownership. Most of the projects are outsourced and the client doesn't have a definite control on the overall project execution in the case of outsourced projects. With the Agile methodology the requirements or the project can be and have definite ownership of the overall scope of the project and on the change control board as a part of the change management. Now one can control the ownership of the project and divide the responsibility between the client and the implementation partner. The entire project will be divided to a fixed period called a scrum period (Sprints) and the project is being planned and executed with the definite ownership by a scrum master and the scrum team. The Scrum team is responsible for all the different phases of the project. In other words, the scrum team will comprise of Cross Team - Business Analyst, Developer, Scrum Master, Scrum Owner, Test Analyst and others. The entire team is cross trained

on different technologies and the entire Scrum Team is responsible for overall deliverables. Generally, the Scrum period (Sprints) is defined as low as 3 weeks. Hence, the implementation partner will have to deliver a deliverable for every 3 weeks without any exception and if any deliverable gets delayed the implementation partner will have to deliver with a no cost as per the SOW signed between the client and the Partner. As per the best practices of the Agile Scrum methodology, the deliverables are to be planned and executed within the scrum period without fail. Imagine in a large organization once they adopt to the Agile Scrum Methodology and execute a project successfully then the same Scrum Team can be moved across and this easily helps to get funding from the Stakeholders. Hence Agile Scrum Methodology needs efficient and effective planning as well as execution of the project. The Selection of the Scrum team as a part of the selection and recruitment process as well is very key into the project. Backup plan should be in place in the case of any deviation from the normal. The entire Scrum Team should be collectively responsible for the overall execution of the project. Unlike in case of the Waterfall model where the team is disconnected across different phases of the project and the responsibility of the team is discrete while in the case of Agile methodology it is collective and definite. Since the overall ownership of the project is held with the client itself, the change in the case of a management as well as the scope in management, there won't be any delay in the decision making. In case of Agile Scrum, the project is divided into multiple sprint as illustrated below. Sprint is a fixed duration in the Agile framework where a deliverable is to be given to the client. Below is a typical visual illustration of the Agile Scrum



Phases of the Project	Scrum Team
Requirement Design	Scrum Owner
Development	Scrum Master
Unit Testing	Developer
Integration Testing	Tester
	Business Analyst

Disadvantage	Advantages
Agile project management has its disadvantages such as less easy identification of project risks and poor management of resources.	Agile approaches empower those involved; build accountability; encourage diversity of ideas; allowing the early release of benefits; and promotion of continuous improvement.
A flexible system like Agile can make it difficult to focus and push the projects to completion if one is not careful. There's less set in stone, and no process to make sure the project is continuing smoothly, making it easy for projects to lose direction.	Agile helps build client and user engagement because changes are incremental and evolutionary rather than revolutionary: it can therefore be effective in supporting cultural change that is critical to the success of most transformation projects.
	Agile allows decision 'gremlins' to be tested and rejected early: the tight feedback loops provide benefits in agile that are not evident in waterfall.

Conclusion:

The above mentioned are 2 reference able clients project data. On comparing many of the similar data sets (Ranging from 40-45 projects) it can be concluded that Agile Scrum methodology can be used for effectively managing the projects.