

Inayat and Salim (2015) identified seven challenges of Agile Requirements Engineering poses to project organizations include reducing documentation, estimation of budget and schedule, improper architecture, neglecting the idle requirements, waste management, customer unavailability and contractual issues. In order to sort out the budget and time estimation constraint, recurrent communication and story prioritization are found to be required.

Brhel et al. (2015) proposed to combination of the merits of two major approaches in software development: Agile software development, which aims to perceive high rate of accessibility and to achieve pliability during the development process, and user-focused design, which ensures the end results and the user requirements at the center of software development in order to provide the software with required and designated usability. They record the current state of ASD and UCD integration and notes generic principles that make up an integrated User Centered Agile Software Development (UCASD) approach. The five principles of UCASD are unique discovery of product and product creation, incremental design and development, parallel interwoven creation tracks, proper stakeholder involvement and communication with the clients.

Chakravorty and Chakraborty (2014) focused on IT projects linked with manufacturing sector by finding out the importance of various agile project testing attributes to market their product across various phase of information systems development life cycle (SDLC). The various traits include prioritization of specifications as per customer requirement, customer participation in planning phase, incremental and iterative methods, flexibility with less documentation and complexity management.

The success attributes of project management have been implemented via the golden triangle, but the relation between project iteration factors and critical decisions is unknown. Agile teams discussed four categories of iteration objectives: Functionality, Schedule, Quality and Team Satisfaction. Two of these objectives lead directly to two facts of the golden triangle: schedule and quality. The agile teams' critical decisions were verified to understand the different decisions made by the teams to ensure success, which resulted in four categories of such decisions: quality, team work, iteration objectives and team satisfaction (Drury-Grogan, 2014). Requirements & specifications (beginning of the project), project scheduling (planning phase), team work and the client collaboration (Stare, 2014) are the main advantages of agile approach over the traditional approach.

Recently agile became popular among the practitioners over the traditional methods since it supports in developing software in changing environments and requirements with low cost and high quality. The data from Indian software companies reveals that agile is having an upper hand over traditional methods in software development (Sruthy et al., 2016).

It is important to recognize that the agile approach concentrates initially on the project execution phase and does not elaborate the whole project life cycle, which in principle is similar (initiating, planning, executing and closing), rather than the final stage of the initiation (definition of specifications) and portions of the planning are taken to the execution phase (Stare, 2014). The accuracy of the planning phase can be affected due to this method– it is necessary to define a vague schedule for whole project at the beginning, while discrete iterations are planned in detail in the project implementation phase (e.g. tactics, tasks, hours of work, performers).

Extreme project management is an upgraded version of agile (offering a higher level of agility). According to Thomsett (2002), the latter is more flexible and is grounded on the dynamic needs, development cycles, virtual teams, changing technologies and the collaborative participation of all the project stakeholders. He emphasizes that partnership is the key factor contributing to the client (user) and the contractor (project team) relationship. Wysocki (2009) points out that the variations in approach results from the range of acquaintanceship with the solution at the project's initial stage. The main differences are the way of planning, the greater role of risk management, and more mingling with the client.

The only known research on agile product development was made by Berger & Beynon-Davies (2009). Using the iterative development principles, they demonstrated several issues with the application of, particularly considering the conduct of stakeholder participation within joint design. In general, initially the stakeholders were reluctant in their involvement and, even though formally empowered, stayed stubborn in decision making outside their expected positions. Conveyance within design sessions was also sparse rather than open. Such difficulties in turn impacted the project's course causing unwanted retards in complying with key project deadlines.

The studies over past two decades reveal the success of agile project management in software companies. This paper is mainly focusing on the success stories of non-IT companies and the factors affecting their project success. Also the challenges faced while implementing agile methods and the advantages of agile approaches are also discussed.

3. METHODOLOGY

An online survey conducted using google forms and posted it in LinkedIn project management groups. Also data collected from different practitioners who are members of project management related groups in LinkedIn.

4. SURVEY RESULTS

An online survey conducted using google forms and 322 practitioners from various industries responded to it. The largest percentage of respondents were from (shown in fig 1) software and IT services (37%) and manufacturing (26%) and the rest includes consulting (18%), telecommunications (7%), hospitality (5%), oil and gas (4%) and others (3%). The different practitioners as shown in fig 2 include: Project Manager (26%), Software developers (22%), Project Coordinator (15%), Quality analyst (14%), Program Manager (6%), Business lead (6%) and others.

According to the survey results, fig 3 explains the challenges most of the companies facing while implementing agile project management. The important challenges they are facing are Budget and schedule estimation (30.5%), Minimal documentation (24.9%), Waste management (18.2%), Contractual issues (10.3%), Neglect of non-functional requirements (9.3%) and Customer unavailability (4.2%).

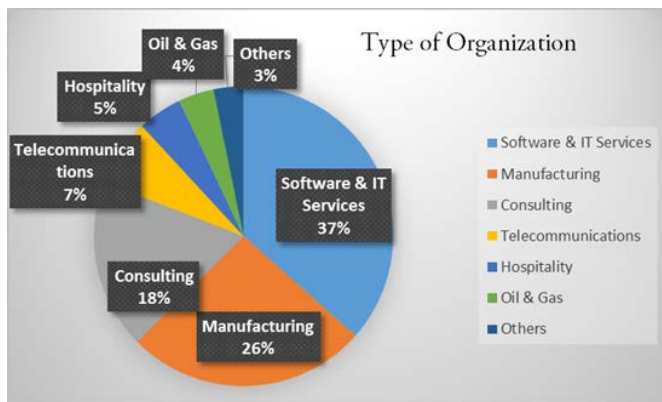


Fig 1: Type of organization

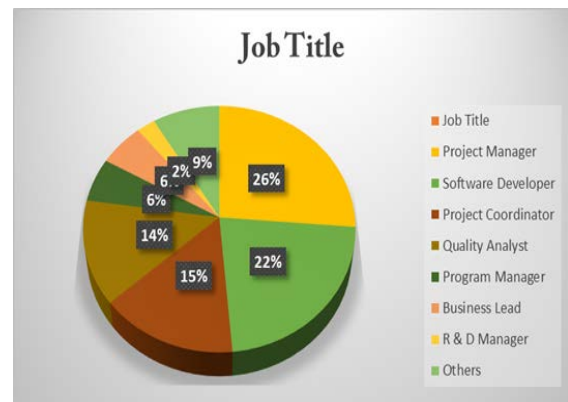


Fig 2: Job title

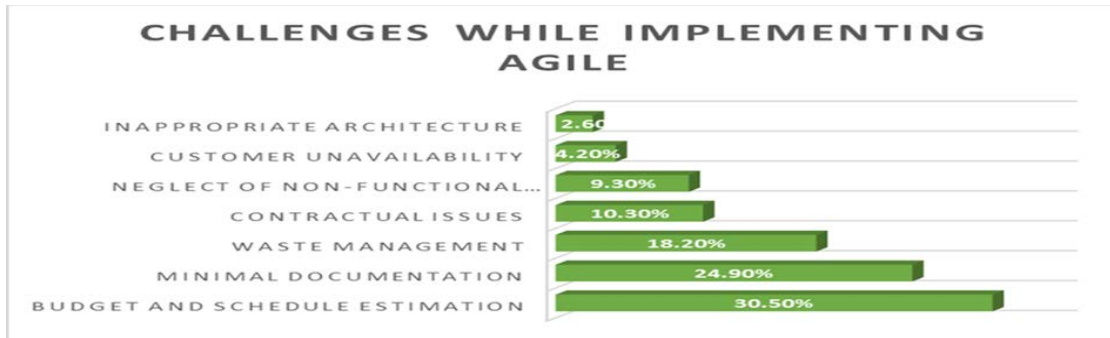


Fig 3: Challenges faced while implementing agile

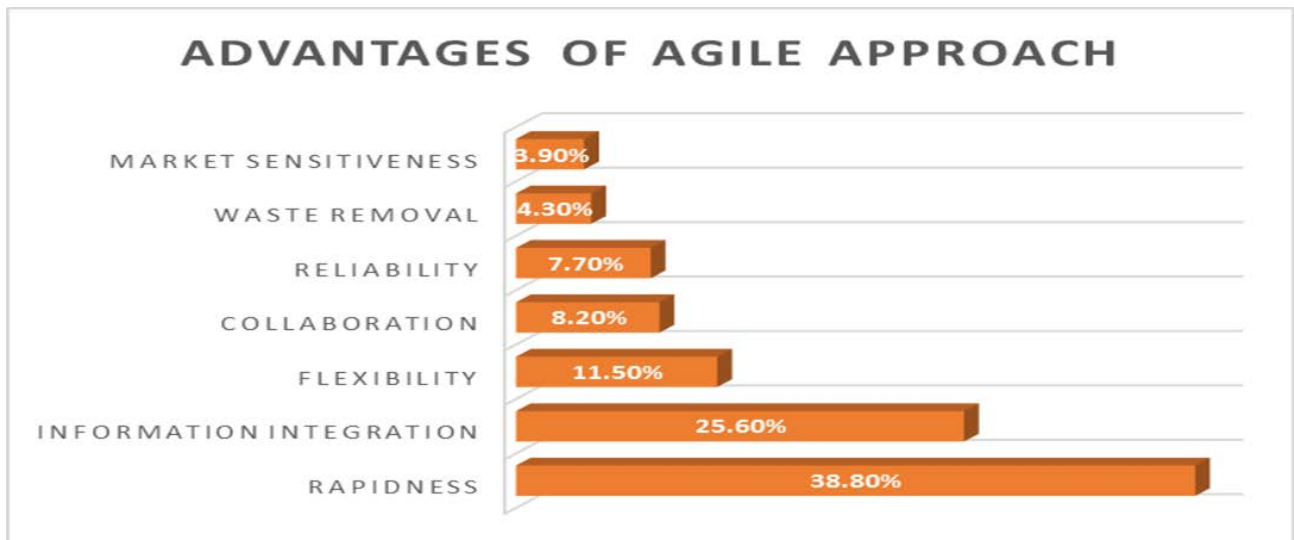


Fig 4: Advantages of agile approach

As shown in the fig 4, the main advantages of implementing agile project management techniques are Rapidness (38.8%), Information integration (25.6%), Flexibility (11.5%), Collaboration with the stakeholders (8.2%), Reliability (7.7%) and Waste removal (4.3%).

Success factors





Fig 5: Success factors

The success factor of each project is analyzed according to four different dimensions of project success. Practitioners responded to each success factors by rating it from unsuccessful to very highly successful. Fig 5 represents the four different dimensions of project success, meeting project budget goals, meeting scope and requirements goals, achieving client's satisfaction and achieving end user satisfaction. For meeting project budget goals, 46.1% of the projects are moderately successful and 25.2% are highly successful. Around 36% projects are moderately successful in meeting scope and requirements goal and around 32% projects are highly successful. Considering the satisfaction factor, 45.6% are highly successful in achieving client's satisfaction and 43.2% are highly successful in achieving end user's satisfaction.



Fig 6: Overall Project Success

The overall project success is also found out by rating it on 5-point scale. Fig 6 represents the overall project success in a scale of unsuccessful to very highly successful. Around 39% projects are found to be highly successful and 35.9% projects are moderately successful and 11% projects are less successful.

5. ANALYSIS

Principal Component Analysis is used for analysis in order to find out the correlation between the variables used from the literature review.

The communalities represented in Table 2 are computations which a variable is explained by the components. Risk management has the lowest communality value, which represents that it is not much

explained by the analysis like any other factors (more number of factors increases the communality of all the variables).

	Initial	Extraction
Project scheduling	1	0.963
Teamwork	1	0.888
Client collaboration	1	0.92
Requirements and specifications	1	0.829
Changing Technologies	1	0.93
Participation of Stakeholders	1	0.955
Risk Management	1	0.807

Table 2 : Communalities

Component	Initial Eigenvalues		Extraction Sums of Squared Loadings			
	Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %
1	3.823	54.614	54.614	3.823	54.614	54.614
2	1.403	20.036	74.649	1.403	20.036	74.649
3	1.066	15.226	89.876	1.066	15.226	89.876
4	0.322	4.6	94.476			
5	0.206	2.945	97.421			
6	0.129	1.841	99.262			
7	0.052	0.738	100			

Table 3: Total Variance Explained

The three rightmost columns of the total variance in Table 3 explained contain the most important information and it is interpreted as: Project scheduling, team work and client collaboration have been saved from the analysis of seven components. These three factors explains 89% variation in the data. That is, 89% of information in all seven variables can be predicted using these three factors. Project scheduling explains more of the variance than other two factors.

	Component		
	1	2	3
Project scheduling	0.588	-0.594	-0.514
Teamwork	0.718	0.593	0.146
Client collaboration	0.689	0.518	0.42
Requirements and specifications	0.903	0.057	0.104
Changing Technologies	0.779	-0.524	-0.22
Participation of Stakeholders	0.624	0.26	-0.705
Risk Management	0.822	-0.291	-0.218

Table 4: Component Matrix

Table 4 represents the component matrix. The first principal component is strongly correlated with all the original variables. It increases with increasing project scheduling, teamwork, client collaboration, requirements and specifications, changing technologies, participation of stakeholders and risk management. First component seems to measure the efficiency of the project.

The second principal component is correlated with only four of the original variables. Even though the project is having a proper team and client collaboration, the improper technology will affect the project scheduling.

The third principal component is also correlated with only two variables. It represents if proper participation of stakeholders are not involved, it will affect the project scheduling. It represents the stakeholder satisfaction.

	Initial	Extraction
Project budget goals	1	0.858
Scope and Requirements	1	0.761
Client satisfaction	1	0.896
End-user satisfaction	1	0.539
Overall project success	1	0.966

Table 5: Communalities of success factors

The communalities of success factors are illustrated in Table 5.

Component	Initial Eigenvalues		Extraction Sums of Squared Loadings			Cumulative %
	Total	% of Variance	Cumulative %	Total	% of Variance	
1	2.087	41.75	41.75	2.087	41.75	41.75
2	1.933	38.669	80.418	1.933	38.669	80.418
3	0.812	16.245	96.663			
4	0.167	3.337	100			
5	1.63E-15	3.25E-14	100			

Table 6: Total variance explained for success factors

As shown in Table 7, achieving end user satisfaction has the lowest communality, which indicates that it is less well explained by the analysis than any of the other factors. Meeting project budget goals and scope and requirements explains 80% variation in the data.

	Component	
	PCA1	PCA2
Meeting project budget goals	0.843	-0.385
Meeting scope and requirements	0.53	-0.293
Achieving client satisfaction	0.461	0.827
Achieving end-user satisfaction	0.051	0.732
Overall project success	9.39E-01	2.91E-01

Table 7: Component matrix for success factor

Table 7 shows the component matrix for success factors. The first principal component is strongly correlated with three of the original variables. Meeting project budget goals and scope and requirements will result in the overall project success. It represents the overall efficiency of the project. The second principal component is correlated with mainly with only two of the original variables. Achieving client's satisfaction will lead to end user's satisfaction. This represents the stakeholder satisfaction.

6. LIMITATIONS AND FURTHER SCOPE OF RESEARCH

A limitation of this research is an evaluation of the percentage of agile used in each project and its effect on the project success. Future research should verify this relationship and find out the correlation. Also agile project management techniques are not widely implemented in consulting firms. So the reason for rejecting or not implementing agile methods can be found out in the future research. Future research can include the importance of hybrid agile methods, a combination of agile and traditional project management methods. That is mainly focusing on the companies using hybrid agile methods and the factors determining the success. This research doesn't include the different planning methods in agile approach. So future research can include how structured planning impacts the agile success.

7. CONCLUSION

From a past few years, agile has been replacing the traditional methods for project planning and execution mainly due to the success rate in IT industries. This paper has explored the efficiency and success rate of Agile project management in Non-IT sectors and shows a quantitative analysis of different success factors. Our findings reveal that the range of Agile used in a project does have a statistically significant impact on all five dimensions of project success, meeting project budget goals, scopes and requirements, client satisfaction, end user satisfaction and overall project success. The main challenges the organization faced while implementing agile project management techniques are in budget and schedule estimation, for minimal documentation, waste management and contractual issues. The main advantages of agile approach are rapidness, information integration, flexibility and collaboration. From the survey conducted, around 82% of the total respondents revealed that they are aware of the agile project management methods used in the organization. Other respondents from consulting firms are unaware of the agile methods and also some employees in the lower level management of the companies implementing agile are unaware of agile methods. For proper implementation of agile, communication with all the stakeholders is needed, since it is lacking in most of the firms.

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