

COMPARISON BETWEEN AGILE AND HEAVYWEIGHT METHODOLOGY: AN ANALYSIS

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Abstract— Everyone is talking about the software development methods but these methods are categorized into the different parts and the most important are two categories, one is agile software development methods and second is using the heavyweight software development methods. Agile software methods are relatively considered to be quick and for the small teams. Our main mission is to check which method is better from each other, so for that purpose we go out in the software development market to meet the professional to ask about their satisfaction on these software development methods. Our research is based on to see the suitable method for the professionals; see the challenges on the adaptability of methods and which method is quicker. To perform this study we have gone through a survey questionnaire, and results are analyzed by using mixed method approach. Split half method, Cronbach's alpha and chi square test statistical methodologies have been applied in order to find out the reliability and internal consistency of the data.

Index terms: SP: Software Process; SDM: Software Development Methodology; AM: Agile Methodology; HM: Heavyweight Methodology; ASD: Adaptive Software Development; SDM: Software Development Methodology; UP: Unified Process; XP: Extreme Programming; DSDM: Dynamic Systems Development Method; FDD: Feature-Driven Development.

I. INTRODUCTION AND OBJECTIVES

Agile methodologies are the new age of software development, it's methods are serving their best, commonly they are focusing on people relations, customer satisfaction, producing best product, cost benefit analysis and much more. The aim of the dissertation is to find out the comparison between agile methodology and heavyweight methodology. For this, we investigate the agile and heavyweight methodologies. For agile methodology, we introduced some agile approaches such as Extreme Programming, Scrum, Dynamic System Development Method, Feature Driven Development and Adaptive Software Development underlining the characteristics of agile methods. Next, we followed the same procedure for heavyweight methodologies. We reviewed several methods such as Waterfall, Unified

Process and Spiral. We also discussed an overall view of the characteristics of heavyweight methodology. Furthermore; we carried out a comparison of the different agile methods in order to highlight the similarities and differences between them.

The information is gathered from quantitative research methods which are used to find out the comparison between agile and heavyweight methodology. For this, the questionnaires are conducted to gather feedback from software developers to analyzed which methodology was used to develop software and as well as their views on agile and heavyweight methodologies The research methodology was completely based on a comprehensive survey in different organizations by questionnaires.

The objectives of this work is to be analyze whether Agile or heavyweight methodologies are an effective methodology for software development.

II. DESIGN AND IMPLIMENTATION

The scope of this research is to find out the comparison between heavyweight method and agile method. Bearing this mind, we are interested to collect data by using survey that consists of structured (close ended) questions. Evolution methods are used to validate the results. Evaluation is done on the basis of the results received from the different professionals from different organizations, which helps us to compare these methods.

We used *sample size calculator* in order to find out that how many people we need to interview in order to get results that reflect the target population as precisely as needed .We have received 87 responses from different type of software development professionals with confidence interval 5 and confidence level 95%.

Completion rate ratio is used in order to find out the number of people who were interviewed by the total number of people in the sample who were eligible to participate and should have been interviewed.

In our research eighteen questions are used and the reliability of the questionnaire are analyzed by finding split half, Cronbach's alpha, chi square testing and p value.

Cronbach's alpha comes out to be 0.7524 for the total eighteen questions of satisfaction, which shows the data reliability because. For the Cronbach's alpha test be reliable the score must be greater than or equal to 0.7.

Number of Items(Question Result's)	Number of Respondents	Mean	Standard deviation	Sum of standard. Deviation of all results	Cronbach's alpha
18	87	2.7681	.3859	13.96685196	0.754

Table 1: Cronbach's alpha calculation

Split-half method is used to determine internal consistency and that comes out to be 0.74072853, which means that the test results will 74 % reliable.

Chi square test used to determine whether there is a significant association between the two categorical variables.

Where O_i are the observed values and E_i are the expected values. That is, chi-square is the sum of the squared difference between observed (O_i) and the expected (E_i) data divided by the expected data in all possible categories.

chi square calculators is used to find out the chi square value and the p value. The p value should be less than 0.05. For eighteen questions; the p value comes out to be shown in table 1.2.

Chi Square value	p-value
19.43	0.0016
17.90	0.0031
15.87	0.0012
13.10	0.0224
10.72	0.05
9.65	0.008
0.083	0.007
12.12	0.016
15.42	0.008
15.23	0.005
6.44	0.009
16.18	0.0010

Table2: Chi square and p-value

III RESULTS AND FINDINGS

Q1. Which software development method do you use?

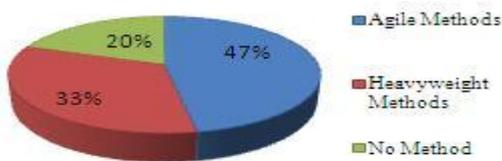


Figure1: Percentage of professionals with respect to their methods

After analyzing the results it was evident that 47% population using agile software process while 33% population using traditional software development. 20 % professional responded that he does not use any software development method.

Q2. Which option describes your position in your organization?

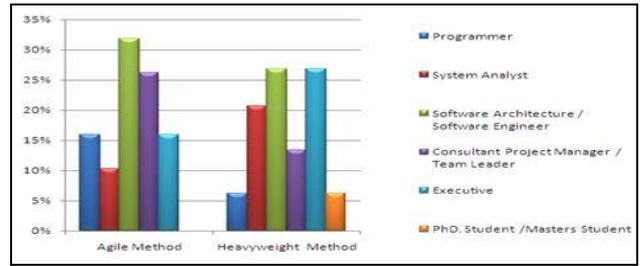


Figure2: Number of professionals with their Designation

This figure depicts the participants of agile and traditional methods with respect to their designation.

Q3. What type of applications, does your organization work on?

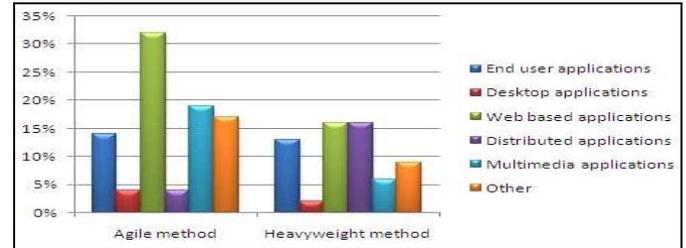


Figure3: Agile/Heavyweight development method professionals with respect to software applications

We analyzed that approx. 33% of professionals with agile methods are developing web based applications. Approx. 19% of agile professionals are developing multimedia applications and approx. 15% are developing end user applications. Whereas approx. 20% of professionals with heavyweight methods are developing web based applications, 20% of professionals from heavyweight methods develop distributed applications and 12% of professionals from heavyweight methods develop end user applications.

Q4. How many software development professionals are working in your organization?

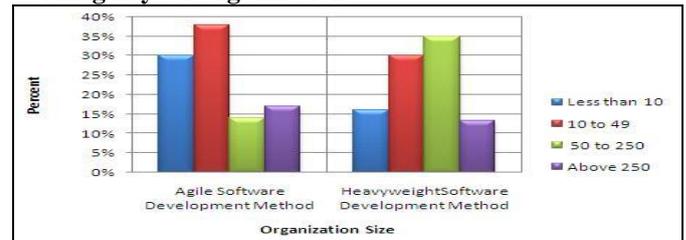


Figure4: Number of professionals in different size of organization.

Another observation can be made on organization size where 70 % participants are quite agreed to use agile practices and approx. 40% using heavyweight practices are from small scale having 10 to 49 professionals. Approx. 50 % respondents from large scale are agreed to use heavyweight methodology and only 30% respondents are agreed to use agile methods.

Q5. How satisfied you are with your software development method?

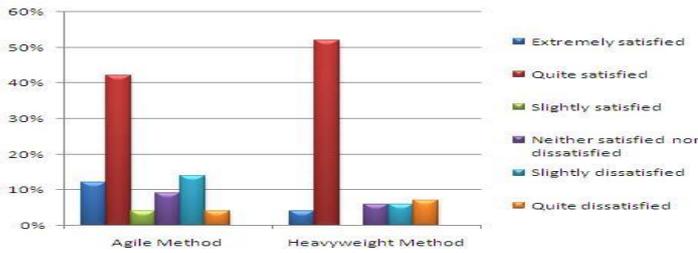


Figure5: Ratio of professional satisfaction from Agile and Heavyweight practices

As we categorized the professionals with respect to their methods, when we compared different survey results with each other, we find that approximately 70% of professionals with heavyweight software development methods are satisfied, whereas 13% are dissatisfied and 17% answered neutral, and approximately 60% of professionals with agile software development method are satisfied, whereas 31% of professionals are dissatisfied with agile methods, whereas approximately 9% answered neutral.

Q6.To what extent, do you agree that your software development method helps you to have understandable communication with your customers?

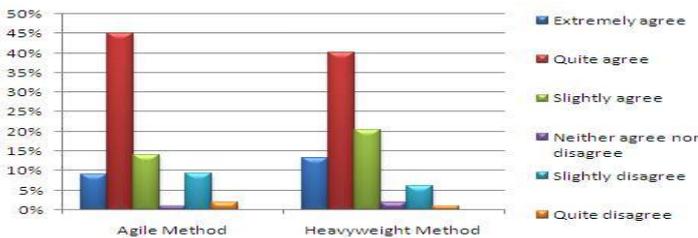


Figure: Ratio of Agile/Heavyweight methods professionals' satisfaction with respect to ability of method to have a good communication with customers.

Ratio of Agile/Heavyweight methods professionals' satisfaction with respect to ability of method to have a good communication with customers Analysis shows that approx. 75% of professionals with heavyweight software development Methods are agreed that their practice with heavyweight methods helps them to have better communication with their customers and approx. 25% of professionals are disagreed. While 88% of participants of agile methods are agreed that their practices with agile methods helps them to have better communication with their customers and approx. 12% of professionals are disagreed. Moreover, figure below depicts respondent ratio on how they are agreed with practices of their method to help them to have a better communication with customers.

Q7.To what extent, do you agree that your software development method help you to fulfill your customer's requirements / demands?

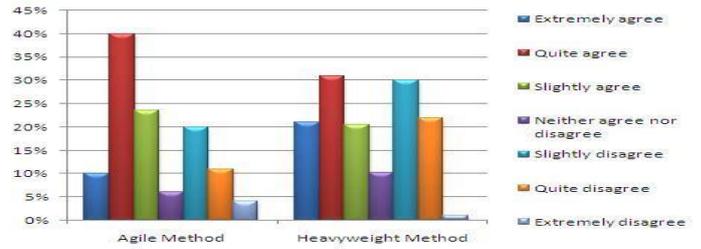


Figure7: Ratio of Agile and Heavyweight methods professionals with respect to customer demands and requirements

We find that approx. (70%) professionals using agile software development methods are satisfied with their practices in order to fulfill customer demands/Requirements and approx. (30%) of professionals from agile methods are dissatisfied, but on other side approx. (64%) professionals using heavyweight software development methods are satisfied with their methodology in order to fulfill customer demands/Requirements and approx. (36%) of professionals are dissatisfied. See figure below to depict percentage of respondents. Agile software development methods are highly adopted to fulfill the customer demands and requirements.

Q8.Do you follow any software quality standards?



Figure8: Ratio of Agile/Heavyweight professionals with respect to following the software quality standards

We analyzed that 48% of professionals with heavyweight software development methods follow software quality standards and about 60% do not follow software quality standards. Whereas approx. 52% of professionals with agile methods follow software quality standards and approx. 48% do not with software quality standards.

Q9.To what extent, do you agree that your software development method helps you to develop high quality software?

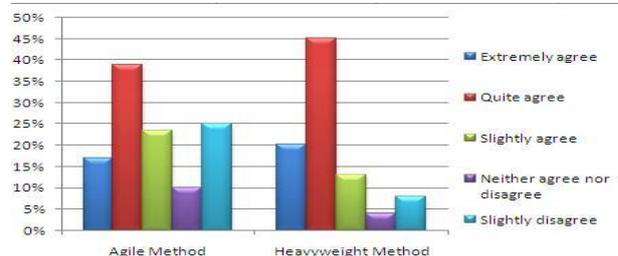


Figure9: Ratio of professionals from Agile and Heavyweight practices with respect to importance of method to produce quality software

A software development method plays an important role, In order to produce quality software. Comparison shows that 78% professionals using heavyweight software development methods are agreed (extremely agreed 20%, slightly agreed 13 %, quite agreed 45%) with their practices in order to produce quality software. On the other side approx. 80% professionals using agile software development methods are agreed (extremely agreed 19%, slightly agreed 23%, quite agreed 38%) with their practices in order to produce a quality software, 25% professionals of agile software development methods are disagreed with their practices, and 10% kept them neutral.

Q10.To what extent, do you agree that your software development method helps you in risk analysis?

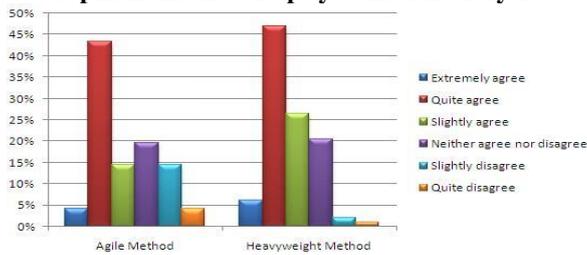


Figure10: Ratio of the Agile /Heavyweight method users with respect to method ability to analyze the risk.

After comparing the results, we find that approx. 81% of heavyweight software development methods user agreed that their method helps them in risk analysis, and approx. 19% heavyweight of methods users are disagree. Whereas approx. 62% agile software development methods users are agreed that their method helps them in risk analysis, and 19% of agile users answered neutral and rest of the percentage answered disagree.

Q11.Which factor is most important for you as a professional when adopting a method?

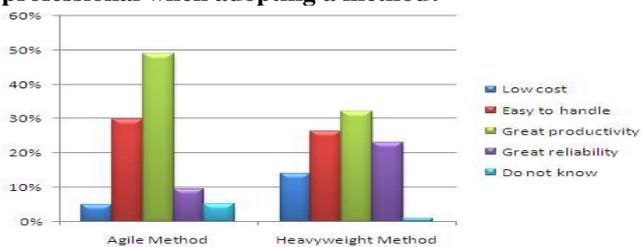


Figure11: Ratio of Agile and Heavyweight participants on adoptability factor

As survey results depict the picture on adoptability factors that agile participants (50%) are agreed on agile methodology, which has great productivity while heavyweight participants are 30%. With great reliability perspective, participants from heavyweight (20%) are satisfied than agile approach. Additionally, 20% traditional community recommended that heavyweight methodology is more suitable when they have low cost factor. Indeed, as survey result reflects, we can conclude that heavyweight methods have low cost with great

reliability, but on another hand to adopt an agile methodology is cost effective with higher productivity of processes.

Q12. What type of project scale followed by your company?

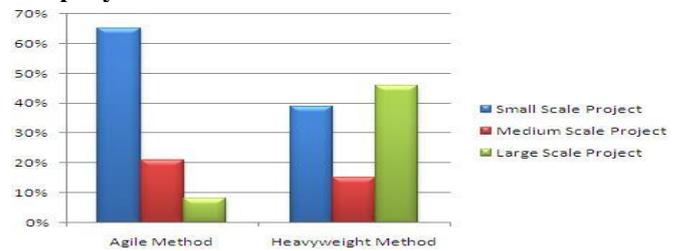


Figure12: Represent the percentage of project scale followed

When we categorized the respondent according to the project scale followed we analyzed that approx.66 % of the participants are coming from small scale projects used agile method whereas 40 % of respondents followed heavyweight from small scale.Approx.70 % of the respondent followed heavyweight methodology and 30 % followed agile methodology are from large scale projects.

Q13.Which Methodology do you mostly use for different kinds of Software development?

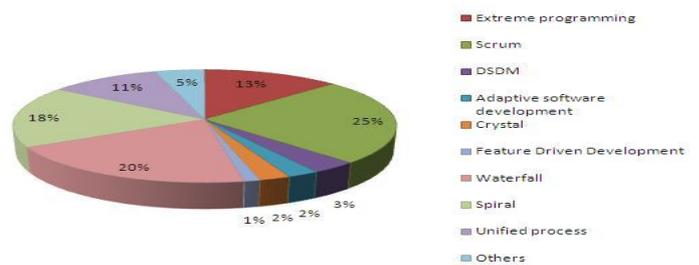


Figure13: Represent the percentage of selection of software development method

The figure shows that mostly professionals (25%) are agreed on Scrum method. Extreme programming (13%) and Unified process (11%) respondents have same level and to assist in working with large projects; Waterfall and Spiral are most suitable methods.

Q14.When your company is adopting new technologies and methods?

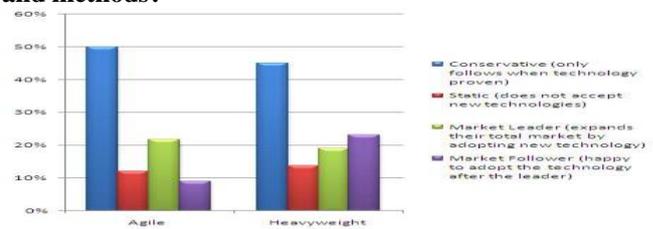


Figure14: Represent the percentage when adopting new technology and methods

50 % participants from agile likely to work with proven methods, somehow (21%) follow market leading approach and less than 10 % participants follow the market followers means they are happy to adopt the technology after the leaders.10% professionals are perfectly fine with their software development processes, and they do not want to adopt new methodology. However, 45% participants from heavyweight recommended using proven methods.Approx.15% respondents does not accept any new technology.21% follow market followers and somehow 17 % follow market leading approach.

Q15.To what extent, you agree that your software development method support you in rapid development?

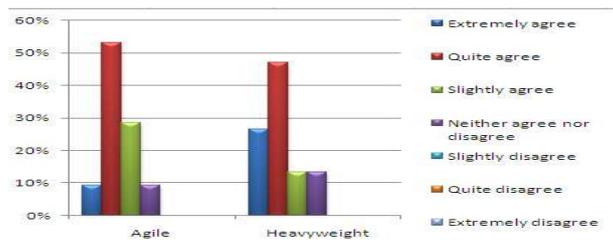


Figure15: Represent the percentage of software development method support in rapid development

This section comprised of analysis on methods support with rapid development and agile values. After comparison we found that participants from both type of methods i.e. “heavyweight & agile” are agreed that there methods help them in rapid development. Such as approx.87% professionals from heavyweight practices are agreed and approx. 91% professionals from agile practices are agreed and importantly there is no disagreement from any professional.

Q16.Which of the listed aspects of Agile Methodologies most appeal to you compared with Heavyweight Methodologies, for the 3 sizes of software development project?

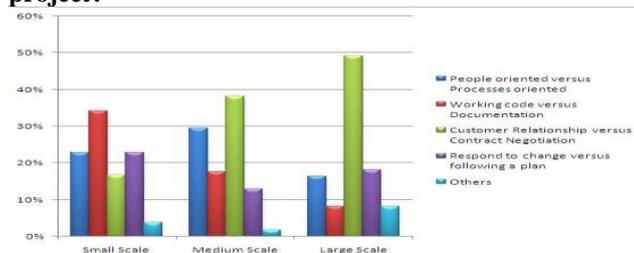


Figure16: Represent the percentage of most appealed agile methodology with respect to Heavyweight methodology

We analyzed which is very interesting, after comparison that the participant following agile in small scale projects, approx. 22% professionals are agreed with first option, 34% are agreed with second option .Approx 50% of the respondents from large scale, 40% from medium scale and about 18 % from small scale will like the customer relationship option means they wants the transparency between the developers. In small scale projects working code will be more liked over large documentations i.e. 35% and the same option liked by the

medium scale (18%) and large scale (7%).The 22 % (small),13%(medium)and 18%(large) participants will liked the change over following a plan.

Q17.Which aspect of agile methodologies, do you dislike the most for different kinds of software development?

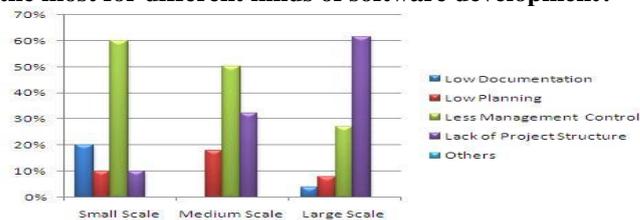


Figure17: Represent the percentage of Agile methodologies disliked by the different kinds Software development

Q18.Which aspect of Heavyweight methodologies, do you dislike the most for different kinds of software development?

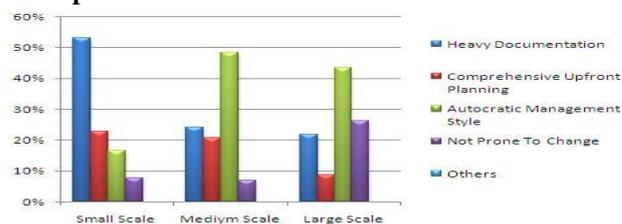


Figure18: Represent the percentage of Heavyweight methodologies disliked by the different kinds Software development

When we depict the comparison on the basis of methodologies disliked by the different participants from different project scale we analyze that in small scale projects (60%) less management control agile approach and (55%) heavy documentation heavyweight approach will be most disliked by the different kinds of software development professionals. In medium scale projects, 50% less management control (agile approach) and approx. 55% autocratic management style (heavyweight approach) will be most disliked by the respondents.

In large scale projects, 62% lack of project scale (agile) and approx.42% autocratic management style (heavyweight) will be most disliked by the respondents.

IV CONCLUSION

With respect to our study, we conclude that professional from both of types of method (agile/heavyweight) are satisfied with their methodologies. Such as, with regards to professional communication with customers agile methods are assumed to be preferred. Whereas to produced good quality software and risk analysis heavyweight methods are considered appropriate. We encapsulate that both types of methods are suitable to fulfill customer requirements and demands.

For method adoptability, we capture that professionals apply proven methods where agile is most productive and heavyweight is considered reliable. During adoption of agile methodology, changes in roles and structure of organization

are considered challenging issues. Moreover, we summarized that professionals need to investigate communications issues, time, and cost of implementation and impact of new methodology on project budget.

According to our study we conclude that professionals from both type of methodology are satisfied with their methods support in rapid development, but on the other hand no method fully support the agile values, but to gain the agility we can customize the features such as, from heavyweight methods follow the project plan and requirement specification whereas from agile methods good software developers and focus on software can be referred to higher positive attitude.

Although, professionals are satisfied with their methods but process needs to be purified and repeated with large size of respondents to focus on each part of the research by dividing it in small sections. Research finding can be implemented on organizations success factors for profitability. Furthermore, advanced study on methods required, especially on agile methods. Therefore, they can equally helpful for experienced and inexperienced professionals, also it should be purified, so that, large size teams can also work with agile methods.

As we mentioned earlier, the need for business to respond rapidly to the environment in an innovative, cost effective and efficient way is compelling the use of agile methods to developing projects. According to the surveys reports taken from internet have shown that the percentages of companies using agile methods have increased each year. Just as mobile phones have completely reduced the need for telephone landlines agile methods are reducing the need for heavyweight methodologies.

REFERENCES

- [1] Rupali Pravinkumar Pawar," A Comparative study of Agile Software Development Methodology and Traditional Waterfall Model", *IOSR Journal of Computer Engineering (IOSR-JCE)*, 2015, pp 01-08.
- [2] Sujit Kumar Dora and Pushkar Dubey,"Software Development Life Cycle (SDLC) Analytical Comparison and Survey on Traditional and Agile Methodology", *National Monthly Referred Journal of Research Science and Technology*, volume 2, issue 8, 2015.
- [3] A.Constangioara, G.L. Florian and O.E.Brad, "Comparative Study of Lean and Agile Organizations Evidence from Romania", *proceedings 9th international management conference on Management and Innovation for Competitive Advantage, Romania*.2015.
- [4] Martin Tomanek and Tomas Klima," Penetration Testing in Agile Software Development Projects", *International Journal on Cryptography and Information Security (IJCIS)*, Volume 5, Number 1, 2015.
- [5] Saleh M, Al-Saleem and Hanif Ullah,"A Comparative Analysis and Evaluation of Different Agile Software Development Methodologies", *International Journal of Computer Science and Network Security*, Volume 15 issue 7, 2015.
- [6] Shubhinder Kaur and Er. Amanpreet Kaur Boparai,"Process of Moving from Traditional to Agile software Development: A Review", *International Journal of Advanced Research in Computer Science and*

- Software Engineering*, Volume 5, Issue 2,2015, pp 586-599.
- [7] Versionone,"9th Annual State of Agile Development Survey", Available:www.stateofagile.versionone.com ,2015.
- [8] M.Sagheer, T.Zafar and M.Sirshar ,"A Framework For Software Quality Assurance Using Agile Methodology", *International Journal of Scientific and Technology Research*, Volume 4, issue 02,2015,pp 44-50.
- [9] Sriramasundararajan Rajagopalan," Product Personification: Parag Model To Successful Software Product Development", *International Journal of Managing Value and Supply Chains* Volume 6, Number 1,2015,pp 1-12.
- [10] Adel Alshamrani and Abdullah Bahattab," A Comparison Between Three SDLC Models Waterfall Model, Spiral Model, and Incremental/Iterative Model", *IJCSI International Journal of Computer Science Issues*, Volume 12, Issue 1, Number 1, 2015.
- [11] Tefo Sekgweloleo," Understanding Agile System Development Methodologies", *International Journal of Advanced Research in Computer Science and Software Engineering*, Volume 5, Issue 7,2015, pp 18-24.
- [12] Mohammad Almseidi ,Khaled Alrfou , Nidal Alnidami and Ahmed Tarawneh," A Comparative Study of Agile Methods: XP versus SCRUM", *International Journal of Computer Science and Software Engineering* , Volume 4, Issue 5,2015,pp 126-129.
- [13] Sriramasundararajan Rajagopalan," Review Of The Myths On Original Software Development Model", *International Journal of Software Engineering & Applications*, Volume5, Number 6,2014,pp 103-111.
- [14] Veselin Georgiev and Kamelia Stefanova," Software Development Methodologies for Reducing Project Risks", *Economic Alternatives*, Issue 2, 2014, pp 104-113.
- [15] Versionone,"8thAnnualStateofAgileDevelopmentSurvey",A available:www.stateof agile.versionone.com ,2014
- [16] Preeti Rai and Saru Dhir," Impact of Different Methodologies in Software Development Process", *International Journal of Computer Science and Information Technologies*, Volume 5,issue 2 , 2014, pp 1112-1116.
- [17] Gurdeep Singh," An Informative Research study of Software Development and Testing according to Agile Methodology",*International Journal of Advances in Computer Science and Communication Engineering* ,Volume 2 ,Issue 1 2014,pp 32-36.
- [18] Prateek Thakral and Saurabh Sharma,"Comparison of Software Life Cycle Models", *International Journal of Software and Web Sciences*,Volume 10, Issue1, 2014, pp 73-76.
- [19] M.M.M.Safwan, K. Senduran, C.D. Manawadu, Vijayarajah N and Thavarajah G," An Empirical Study of Agile Software Development Methodologies: A Sri Lankan Perspective", *International Journal of Computer Applications*, Volume 84, Number 8, 2013.
- [20] S.Nithila, K. Priyadharshani, Y. S. G. Attanayake, T. Arani and C.D. Manawadu,"Emergence of Agile Methodologies: "Perceptions from Software Practitioners in Sri Lanka", *International Journal of Scientific and Research Publications*, Volume 3, Issue 11, 2013.

- [21] Lea Hannola, Joel Friman and Jyri Niemimuukko, 'Application of agile methods in the innovation process', *International journal of Business Innovation and Research*, Volume 7, Number 1, 2013, pp 84-98.
- [22] Daniel Glen O'Sheedy, "A study of agile project management methods used for IT implementation projects in small and medium-sized enterprises", *DBA thesis, Southern Cross University, Lismore, NSW*, 2012.
- [23] Sabah Nouri Mohammed Hussain, "Agile Method Implementation: A literature review exploring challenges and solutions when implementing agile", *Department of Computer Science and Engineering University of Gothenburg Sweden*, 2012, pp 197-225.
- [24] Gamage Asha Lakmini Senanayake, "The Effectiveness Of Scrum In Project management In The Sri Lankan Context", *International Journal of Computer Science and its Applications*, 2012, pp 123-204.
- [25] Daniel Adjei and Peter Rwakatiwana, "Application of Traditional and Agile Project Management in Consulting Firms", *A Case Study of PricewaterhouseCoopers, Umea School of Business*, 2009, pp 81-103.
- [26] Malik Hneifsiew and HockOw, "Review of Agile Methodologies in Software Development", *International Journal of Research and Reviews in Applied Sciences*, Volume 1, Issue 1, 2009.
- [27] Ernest Mnkandla, "A selection framework for agile methodology practices: A Family of Methodologies Approach", Available: www.researchgate.net/publication/