IJCSE International Journal of Computer Sciences and Engineering Open Access
Research Paper Vol.-6, Issue-9, Sep 2018 E-ISSN: 2347-2693

Agile Software Quality of Adaptability Risk Measurement using Fuzzy Inference System

Anand Kumar Rai[1*], Shalini Agrawal[2*], Mazahar Khaliq[3*]

[1]Computer Science and Engineering, Shri Ram Swaroop Memorial University, Deva Road, Barabanki,UP,India
[2]Computer Science and Engineering Shri Ram Swaroop Memorial University, Deva Road, Barabanki,UP, India
[3]Computer Application, KMC Urdu Arabi Farsi University, Lucknow,UP, India

[*]*Corresponding Author: anandrai07@gmail.com , Tel.: +91-94533020611*

Available online at: www.ijcseonline.org

Accepted: 25/Sept./2018, Published: 30/Sept./2018

***Abstract*—** Quality of agile software is one of the major issues in software vigorous systems, and it is important to examine methodically it as early as possible. An increasingly important quality attribute of complicated software systems is adaptability. Agile software development methodologies are very useful since their beginning to improve the quality of the software product. In this paper an innovative practice has been presented for evaluating agile software quality of adaptation using the Fuzzy Inference System in order to determine the developed software quality acceptance degree.

***Keywords*—** Agile Software Quality of Adaptation, Risk Indicators, Fuzzy Rule Base, Fuzzy Inference System

I. INTRODUCTION

Software quality assurance is a supervision method that objectives to improve and attain the quality of software to make guaranteed the product fulfills the user requirement. The software quality management goals are to make definite the product ends guidelines and achieve the quality values expected by the customer. Before releasing the software product the software quality administrators have to experiment. They expose and fix it by an order of phases called the software phases. Their work is not only to make sure that their software is appropriate and satisfactory as per the customer needs, but it has to inspire the quality values with an appropriate improvement. This is important to measure software quality but it is very difficult to identify meaningful metrics. Even though no bugs have been identified, does that mean the software is of the highest quality? On the other hand, when a large number of bugs have been created does that mean the quality assurance team is doing a great job and the software is poor in quality? [1],[2],[3],[9]. In this study agile software quality of adaptation risk indicators identified and fuzzy rule base is created by literature review and interview with the help of agile experts. Agile software quality of adaptation risk evaluated by Fuzzy Inference System MATLAB simulators.

The present study structured as follows, Section II presents an overview of research on agile software quality of adaptability, and we examined journal publications and citations related to agile software quality to trace the outline of the structure of the field. Section III, describe the new methodology to identify the agile software risk indicators which works behind quality of adaptability of agile software. This section also describes the fuzzification and de-fuzzification of risk indicators on the basis of fuzzy rule base which was created with the help of allied literature review. Section IV, contains study discussion and result. Section V, describes the research conclusion and future work.

II. BACKGROUND

Software development became a very tiresome work due to growing technology and there is constantly a need to develop high quality product, therefore agile methodologies were introduced which minimizes development life cycle. Agile methodologies have several benefits and are easy to adopt and apply. Its greatest advantage is its light weight characteristic which mainly emphases on the of high quality product delivery. Extreme Programming (XP), one of the thorough going suitable and largely used agile methodologies, it supports the association of small team to change requirements, tight schedules and come across high quality demands.

Agile methodology has three important dimensions consequences in the greatest promising practices. The three dimensions are people, process and product which are not completely self-governing from each other and therefore require identification of all metrics combined in entirely three dimensions. Agile methodology basically emphases on

the quick repetitions and small issues so that customers can notice the change of requirement to more rapidly. XP (extreme programming) which emphasize on the development feature of software life cycle relatively than managerial aspect and scrum, which has its emphasis on both managerial and development features [11], [12]. Agile software development has abundant future scope. There is always conflict between the formal methods and agile software developments methods because of lack of communication and understanding, therefore interaction is needed to extract the best practices from both methods [4],[5], [6],[8]. Agile software quality defined in relations of, timeliness, efficiency, ease of use, cost effectiveness, integrity, maintainability, robustness, extendibility, and reusability. In this study risk factors are considered and evaluated before software adaptation [10].

Table 1 Agile Software Quality of Adaptation Risk Indicators

RISK INDICATORS	ABBREVIATION	DESCRIPTION
Expandability Risk	EXP	The risk of effort required to increase software capabilities and/or performance by improving existing functions or by adding new functionality
Flexibility Risk	FLX	The risk of effort for changing the software goal, functions or data to meet changing needs and requirements
Portability Risk	PRT	The Risk of effort to transport software to another environment and/or platform
Reusability Risk	RUS	The Risk of effort to use the software and its components in another software applications
Interoperability Risk	INO	The risk of effort needed to join the software on one platform to another software and/or another platform
Intra-operability Risk	ITO	The risk of required communications between components in the same software system

III. AGILE SOFTWARE QUALITY OF RISK INDICATORS IDENTIFICATION AND RULE BASE CREATION

Figure 1, shows the process of study, the study carried out in five steps.

(i) Identification of quality of adaptation risk indicators.
(ii)Fuzzification of risk indicators.
(iii) Fuzzy rule base creation and applied in FIS.
(iv)Defuzzification.
(v)Collection of risk indicators crisp values and quality of adaptation crisp values with the help of MATLAB simulators rule view. Agile Software Quality of adaptation Risk Indicators are identified by allied literature review and interview/discussion with agile project expert [8],[9],[10].

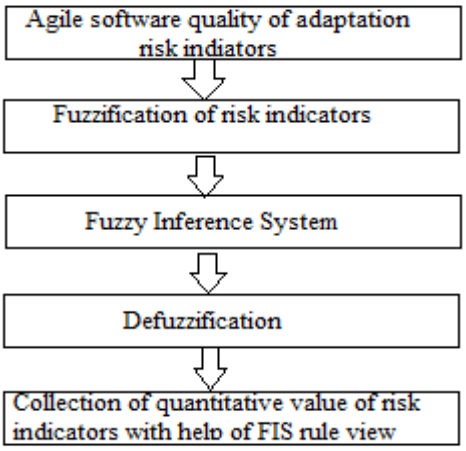

Figure 1. Risk evaluation of agile software quality of adaptation process

IV. DISCUSSION & RESULT

Table1, describes about the identified risk indicators which are always clamps in qualitative values low, medium and high. In this study these qualitative values are represented and evaluated with the help of fuzzification and defuzzification process. “Fuzzification is the process of converting crisp values into grades of membership equivalent to fuzzy sets conveying linguistic terms” [7],[13]. The qualitative value low lies between 0-0.4, medium lies between 0.1-0.9 and high lies between 0.6-1.0, with its membership values between 0 to 1, the fuzzification process

is shown In Figure 2. Created fuzzy rule shown in Table 2, these rules are based on the some successful case study and literature reviews. The created fuzzy rule base has been applied in Fuzzy Inference System (FIS). Figure 3 shows the relationship between inputs (Risk indicators), FIS and output Quality of Adaptation (QOA). Figure 4 shows FIS rule base where the created rule base applied. On the basis of these rules the quantitative values of input (risk indicators) and output QOA risk quantitative values are produced.

The data set shown in Table 3 has been collected through the fuzzy rule view of the matlab simulator. Figure 5 shows that the vertical lines have been formed with the triangle, the value of the risk indicators are determined by sliding these lines forward or backward and based on the values of these indicators the quality of adaptability risk is calculated by the aggregation of the rule base, thus, the values of the risk indicators and the values of the QOA risks are read. Hence the set of 10 input/output quantitative values have been collected for analysis purpose. The quantitative outputs are very helpful in taking precise decision

Table 2 Software Quality of Adaptation Rule Base

RULE	EXP	FLX	PRT	RUS	INO	ITO	QOA Risk
1	L	L	M	L	H	H	M
2	H	M	M	H	H	H	H
3	M	M	L	L	L	L	L
4	H	H	H	H	M	M	H
5	L	L	H	H	H	H	H
6	H	M	L	H	M	L	M
7	L	H	M	L	H	M	M
8	H	L	L	L	H	H	L
9	H	H	M	M	M	M	M
10	M	M	H	H	H	L	H
11	H	H	H	M	M	L	H
12	L	L	L	M	L	L	L
13	M	L	M	M	H	H	M
14	H	L	L	M	L	L	L

Table 3 shows the result, in which Expandability risk high (0.948), Flexibility risk low (0.366), Portability risk medium (0.657), Reusability risk high (0.924), Interoperability risk high (0.866) and Intra-operability risk high (0.841) therefore QOA risk is high (0.855), wherever Expandability risk low(0.215), Flexibility risk low (0.355), Portability risk low(0.320), Reusability risk low (0.273), Interoperability risk low (0.331) and Intra-operability risk low (0.276) therefore QOA risk is low (0.181). Figure 6, shows graphical representation of Table 3 quantitative data set of the QOA risk based on the risk indicators quantitative value. In this study, it was found that the Expandability, Reusability and Interoperability risks are the sensitive risk indicators for the agile software quality of adaptability risk measurement.

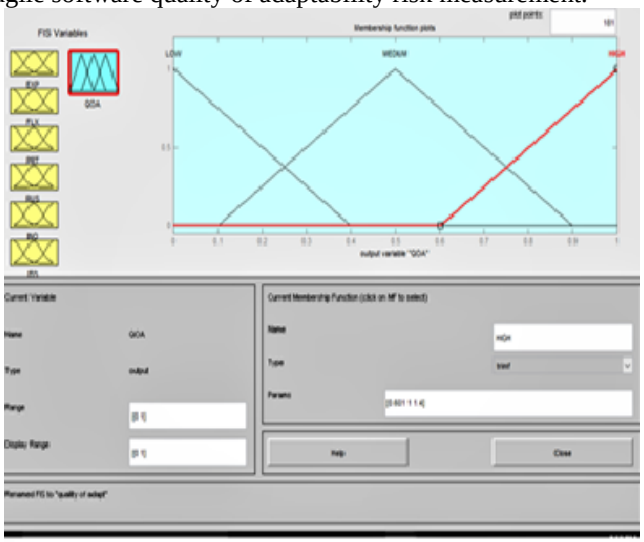

Figure 2. Agile software quality of adaptation analysis

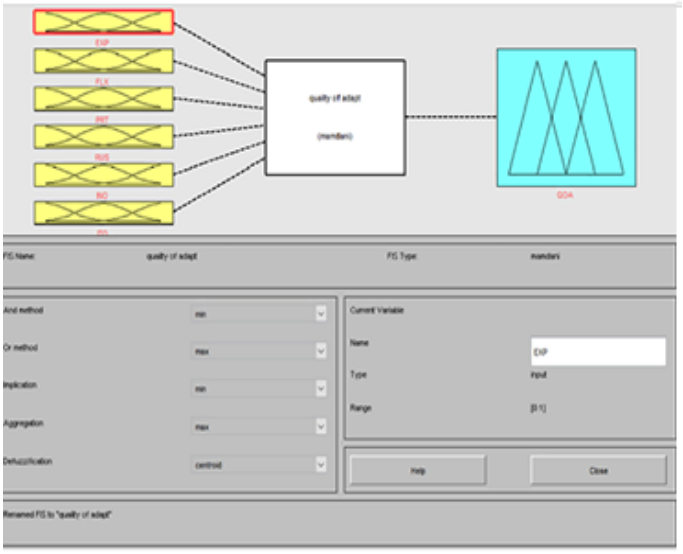

Figure 3 Agile software quality of adaptation factors and FIS to evaluate quality of adaptation

Table 3. Agile software quality of adaptation quantitative value

Rule	EXP	FLX	PRT	RUS	INO	ITO	QOA
1	.215	.355	.320	.273	.331	.276	.181
2	.343	.436	.413	.355	.424	.406	.500
3	.669	.297	.448	.692	.680	.688	.562
4	.738	.366	.517	.692	.727	.688	.666
5	.738	.424	.506	.610	.645	.665	.806
6	.750	.715	.273	.273	.297	.324	.447
7	.750	.762	.657	.273	.762	.253	.534
8	.599	.762	.657	.634	.680	.288	.812
9	.564	.831	.692	.890	.820	.241	.820
10	.948	.366	.657	.924	.866	.841	.855

Figure 4. Fuzzy Inference Rules to evaluate quality of adaptation

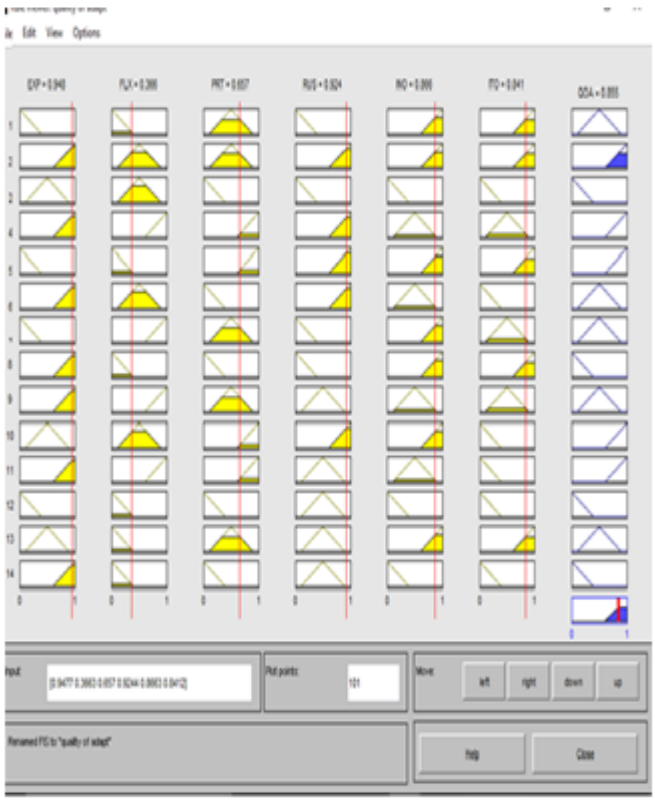

Figure 5. Agile software quality of adaptation rule view

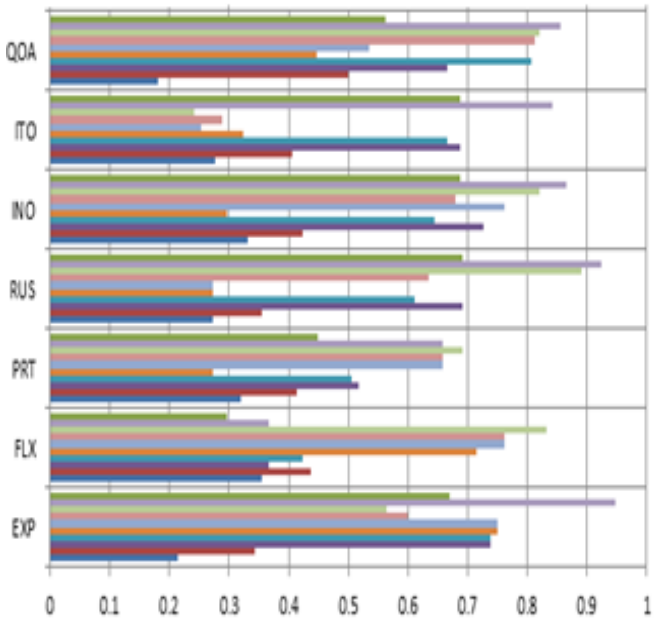

Figure 6. Agile software quality of adatation rule view

V. CONCLUSION & FUTURE WORK

Agile software customers need full satisfaction and quality assurance before adaptation of software project, so there is need to describe the agile software adaptation criteria. In this study, rule base has been made on the basis of agile literature reviews and discussion with agile project expert's previous experiences. Risk indicators qualitative value converted into quantitative value with the help of FIS. In this study three sensitive risk indicators have been identified out of six for the measurement of quality of agile software adaptation. In future few more risk indicators can be identified and few more rule base can be created for more precise risk prediction of agile software quality of adaptation. Using AI machine learning approach, accuracy of this research can be enhanced in future.

ACKNOWLEDGEMENT

I would like to express my special thanks of gratitude to my research guide Dr. Shalini Agrawal, Associate Professor, Computer Science and Engineering, Shriramswaroop Memorial University, Deva Road, Barabanki, as well as our co-guide Dr. Mazhar Khaqliq from Khwaza Moinuddin Chisti Urdu Arabi Farsi University,IIIM Road, Lucknow who provided insight and expertise that greatly assisted the research. Doing this wonderful project on the topic "Agile Software Quality of Adaptability Risk Measurement using Fuzzy Inference System ", which also helped me in doing a lot of Research and I came to know about so many new things. Secondly I would also like to thank my family and friends who helped me a lot in finalizing this project within the limited time frame.

REFERENCES

[1]Agarwal A., Garg N K. and Jain A, "Quality Assurance for Product Development using Agile", International Conference on Reliability Optimization and Information Technology -ICROIT 2014, IEEE, India , Page(s):44 - 47 , Feb 6-8 2014, ISBN: 978-1-4799-2995-5.

[2]Alawairdhi M," Agile Development as a change Management Approach in Software Projects: AppliedCase Study", Information Management (ICIM),IEEE,UK, Pages 100-104, 7-8 May 2016, ISBN**:** 978-1-5090-1471-2.

[3] Bhasin S.," Quality Assurance in agile: a study towards achieving excellence", AGILE India (AGILE INDIA), IEEE, India, Pages 64-67, 15 March 2012. ISBN: 2326-6015

[4] J. Madison, " Agile Architecture Interactions," IEEE Software, ©IEEE Computer Society,Vol. 27. Issue 2,Pages 41-48,2010.

[5]Kropp M., Meier A. and Perellano G.," Experience Report of Teaching Agile Collaboration and values.Software Engineering Education and Training (CSEET)", 2016 IEEE 29th International Conference,USA, Pages 76-80, 5-6 April, ISBN-13: 978-1-5090-0765-3

[6] L.R. Vijayasarathy and D.Turk, "Agile Software Development: A survey of early adopter," Journal of Information Technology Management, Vol. 11(2), Pages 1-8, 2008.

[7]Lotfi A. Zadeh, **"**Is there a need for fuzzy logic?", Information Sciences, Elsevier, Vol 178(13),Pages 2751–2779,2008.

[8] Misra C. S., Kumar V. and Kumar U." Identifying some important success factors in adopting agile softwaredevelopment practices", In The Journal of Systems and Software, Elsevier,Vol 82 Pages 1869–1890,2009.

[9] Padmini K.V., Dilum H.M. and Perera I.," Use of Software Metrics in Agile Software Development Process",Moratuwa Engineering Research Conference (MERCon),IEEE, Shri Lanka Pages 312-317,7-8 April 2015, ISBN: 978-1-4799-1740-2.

[10] Sishar M. and Arif M.(2012)," Evaluation of QualityAssurance Factors in Agile Methodologies", InternationalJournal of Advanced Computer Science, Vol. 2(2), Pages .73-78, Feb. 2012.

[11] Silva, F. S., Soares, F. S. F., Peres, A. L., de Azevedo, I. M., Pinto, P. P., & de LemosMeira, S. R.,"A Reference Model for Agile Quality Assurance. Quality of Information and Communications Technology (QUATIC)",9th International Conference (IEEE).Pages 139-144, 23-26 September 2014, ISBN**:** 978-1-4799-6133-7

[12] Sagheer. M, Zafar. T &Sirshar.M (2015, Februray)," A Framework for Software Quality Assurance", International Journal Of Scientific & Technology Research Vol 4(2), Pages 44-50, February 2015.

[13]Teimuraz Tsabadze,"A method for fuzzy aggregation based on group expert evaluations", Fuzzy Sets and Systems, Vol. 157(10),Pages 1346-1361,May 2006.

[14]Xu.B.(2009),"Towards high quality software development with extreme programming methodology: practices from real software projects". In Management and Service Science, 2009.MASS '09. International Conference, IEEE,China, 20-22 September 2009, ISBN: 978-1-4244-4638-4.

Authors Profile

Mr. Anand Kumar Rai completed his M.Sc.(Computer Science) degree in 1999 from Gurughasi Das University, Bilaspur,CG.He Completed his M.Phil(Computer Science)in 2008 from Alagappa University,Karaikudi, Tamilnadu. He has been serving as an Assistant Professor in Mumtaz PG College since 2000. Now he is doing his research work on the topic" Risk minimization plan for agile software using fuzzy logic" from Shri Ramswaroop memorial University, Deva Road ,Barabanki.

Dr.Shalini Agarwal completed BSc(Mathematics) in 1998 from University of Allahabad and DOEACC A Level Certification in 2001. She also completed MSc(Computer Science) in 2005 from J.K Institute of Applied Physics and Technology, University of Allahabad and M.Tech(Computer Science & Engineering) in 2010 from Amity University. She is a PhD from Babasaheb Bhimrao Ambedkar University (A Central University), Lucknow in 2015. Her area of specialization is Cloud Computing, High Performance Computing and Software Engineering. She joined Sri Ramswaroop Memorial University as HoD of Department of Computer Science and Engineering, in the year 2015. She has also guided two M.Tech Projects and presently guiding two PhD students in their research work. She is also the chairperson of Digital Monitoring Cell of the University where she is taking initiatives to develop MOOC courses and streamline other University processes in accordance with Smart Campus directives of MHRD. She is a professional member of IEEE and CSI.

