CHALLENGES OF AUTOMATED REGRESSION TESTING IN AGILE SOFTWARE DEVELOPMENT - A QUALITATIVE STUDY OF SELECTED IT COMPANIES OF NEPAL

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ABSTRACT

With this dissertation, the importance and essence of regression testing is highlighted. Though the selected IT companies has hands on automated testing there is still scope for the development of test scripts skills and experiences on automated tools to match with the pace of software development technology. The possibility of the uses of automation in regression testing is endless. This can be the key part of continuous integration for agile software development method. Despite of various challenges in automated regression testing, one must overcome those challenges with the proper knowledge, techniques, tools and implementation of automated regression testing in agile software environment. This paper concludes the findings and results of the dissertation along with the conclusion and recommendation for further research in the associated subject matter. This dissertation is dedicated in the automation regression testing field. The limitations of this research can be tackled with proper test scripts, tools and encouragement in the field of automation as it has a greater scope with feasibility in agile software development methodology.

Keywords: Agile Software Development, Software Testing, Regression Testing, Regression Techniques, Automated Regression Testing.

1 INTRODUCTION

Agile development process flows around customer's close collaboration, quick deliveries and short iteration. Software testing in agile software development is conducted to investigate, evaluate and determine nature of software application. It implies the consent of software application in association with regulative purpose, technique, function and client's requirements. Various agile testing practices are available for maintaining software quality. Agile Testing Quadrants presents the importance of testing in software as well as business processes. It completely redefines the traditional way of working by providing clear evident of radical changes in software development with software tests. In regression testing, the tests are performed repeatedly with incremental updates on software product to increase efficiency. The professional testers add value in agile projects by adding better test scenarios bringing up two key challenges: bottleneck tests and coordinate tests between testers and programmers primarily focusing on the importance of testing in agile software. (Gil, et al., 2016)

There are various software development companies in Nepal that acquires Quality Engineers to test the particular software product before handing it over to the clients. Regression Testing is one of type of testing performed in the application software to ensure its completeness in regards to functional/business requirements. It basically focuses on the integration and continuous changes that a software undergoes through its life cycle. For survey, the selected companies of Nepal such as IME Digital Solution Ltd., Swift Technology Pvt. Ltd., F1 Soft International Pvt. Ltd., LogPoint Nepal, and Vesuvio Labs are studied. The challenges, possibilities, implementation and impact of automated regression testing in software applications are identified and evaluated through this dissertation.

1.1 Background of the Study

Software development has rapidly changing its software development environment with agile methodology to develop a user accepted software application with changing requirements. It has been gaining popularity with its practices like short iterations, transparency, stakeholder engagement, meets business changing needs, predictable costs and schedule and quality improvement. (Saleem, et al., 2014) With agile development methods, testing of software product is critical and mandatory as changes in requirements and development goes on a high pace. Testing needs to be done at every stage of agile development. This section provides a brief literature review and the background for the research. Various research papers are reviewed to clarify the relevance of research context, automated regression testing in Agile Software Applications. Some of the literature papers are briefly discussed below.

Effective testing process helps to gain good quality of s software with better performances. Testing phase is a costly process as it takes long time to test a software; even after its delivery, maintenance is to be done. To minimize testing time, cost and effort regression testing is essential. The selection and prioritization of regression test case aids to improve testing efficiency with less chances of bug occurrences. The main idea of this dissertation is to examine and state of regression testing in selected IT companies and their perceptions on questions based on research questions. Moreover, identification of test selection and tools used to automate regression testing can be clarified with the different deadlines and benefit to select appropriate approaches as per the nature of project, its timeline and available resources. (Khatibsyarbini, et al., 2018)

1.2 Need of Automated Software Testing

(Hanna, et al., 2018) in their paper, Automated Software Testing Framework for Web Applications, has empirically studied about the control and monitor of business test scenarios execution using an experimental method. It has enhanced and raised the collaboration to transform automation from theory to practice as it simplifies the test scripts maintenance process by increasing reusability of the automated tests. The researchers have proposed a framework that generates the source code which is updated/added by tester. This saves time and effort in automation process and eliminates effort of creating automation projects from scratch but it is limited to large-scale industrial web applications only having different web application set.

The automated software testing indicates hygiene, quality and on-time delivery. It is used to test previous conditions, present position and future tendencies. The automated software has fine qualities like simplicity, purpose, computable, significant, and have instantly built data. The use of traditional software testing methods can also be adapted for software tests automation. The set of computerized test cases determines the greatest return on investment. The software industry has been growing, with its growth the software testing field is gaining its own importance in industrial software applications. (Valliammai & Sujatha, 2016)

Software automation is vital to minimize cost and facilitate to gauge in the international market. To sum up, the following points emphasizes on the need of an integrated agile software development with a software automation testing.

- Increase testing efficiency
- Expand test overall coverage
- Reduce cost of post release bug fixes
- Thoroughness in Testing
- Bug fixing at a speed

1.3 Problem Statement

Traditionally, manual software testing is used to detect unexpected behaviour of an application. When software application testers need to run test cases frequently. they encounter a problem in

quick updates in versions of software application. Performing or executing test cases in different browsers or several platforms also brings same problem. Thus, with manual tests quality engineer needs to perform test with every new or existing changes which is a time consuming and tedious job. Similarly, it isn't possible to reuse manual tests cases that indicates its significance in unrepeatable tasks. It is usually applicable for disclosing recent unexpected bugs and errors. (Hanna, et al., 2018).

Software automation has become one of the most researched topics for the researchers as well as the industrialists. The extension of this research paper would be to evaluate the testing resources with respect to technical details such as coding, debugging and support of the technologies. The companies need to evaluate and select a testing resources that minimizes the testing cycles and time to market the software product. (Sheth & Singh, 2015). The automated software tests must be performed in the right place at the right time for its efficiency by the right set of resources.

Automated testing is a study of existing research subject matter where there is research is a difference in academic and practical usage in software industry. Here, the merits and demerits of automated tests are highlighted as it is related to test reusability, repeatability, test coverage and efforts saved in test executions. It has also some limitations as investment is high for setup, selecting tool and training. (Rafi, et al., 2012).

Regression tests refers re-testing the software product to examine the existing functionalities is unaffected by the latest change updates and the modifications doesn't hinder with new defects in the system performance. The followings are the problem statement derived from the above literatures:

- Time Consuming and tedious Manual Testing
- Adjusting test sets with frequently changing environment in agile software development
- Lack of skilled and experienced automation resources
- Realization of the benefits of test automation

1.4 Research Questions

Research question is an essential element in any kind of research. The research questions below are the research problems that are considered in this dissertation.

- Is there a scope for automated testing in agile software development environment?
- What will be the challenges in implementing the automation in agile software development environment can be overcome?
- Do regression testing techniques help in automating agile based software applications?

1.5 Hypothesis

Hypothesis are the statements stated from the research questions that are to be tested. It is the prediction between two variables on the basis of observation and preceding knowledge. The hypothesis of this dissertation are as follows:

H1: Regression testing is essential for agile environment

H2: Developing test scripts in regression automation testing is more critical and challengeable as compared to other testing

H3: Regression testing techniques helps in automating agile software application.

1.6 Aim & Objectives

The purpose of this research is to identify, evaluate and implement the issues and challenges of automation in regression testing for agile software application. The objectives are the desired outcomes that are intended to achieve through this dissertation. The primary focus of the dissertation are as follows:

1. To examine the agile software development environment for automation testing.

2. To evaluate the challenges in implementing the automation in agile software development environment.
3. To provide regression test minimization, selection, prioritization and optimization techniques through automation in agile software testing environment.
4. To evaluate reusability of regression test cases for any kind of enhancements or releases by identifying the defects and eliminating them earlier in agile software development life cycle.

1.7 Scope and Significance

The rapid development of technology demands faster completion of project accelerating faster development of software development process. In agile software testing, this paper has a limited scope:
- Useful for time taking agile based projects.
- The survey is conducted within the selected IT companies of Nepal.
- Focus on large scale projects to save time and cost.

Test automation allows to bring better solutions with less effort. Regression testing determines whether problems in software application are the result of software changes. The significance of this paper are as follows:
- Fewer resources are to be applied
- Early bug detection
- Standardized testing with reliability and continuity

2 LITERATURE REVIEW

A literature review is stating the current collective knowledge on a subject. It is a critical analysis of the related subject matter that is essential for a research project to place research findings in the context (Wimchester & Salji, 2016). The literature review of this dissertation is based on the academic research of the journals available in different sources like IEEE, springer, google scholar, research gate, semantic scholar, etc. In this chapter, the literatures are reviewed under various associated topics. Then, the five major papers are reviewed in tabular form.

2.1 Regression Tests Selection Technique

Emelie Engstrom with the team performed systematic analysis of empirical evaluation regarding selection techniques for regression test where they found that there's no single technique is sufficient for test selections as there are many varying factors. Thus, empirically evaluated techniques have to be tailored to specific environment to apply test selection techniques. (Runeson, et al., 2010). The other researchers have conducted regression tests techniques automation approach for agile release to minimize test suite based on resembling issues and the extent of user stories by prioritizing this test suite build upon the accepting test and rate of issues for regression. The proposed architecture includes steps as: 1. Extract Failed Test Cases, 2. Track Issues on Failed Tests, 3. Reduce Test Cases and 4. Generate Parameters, 5. Examine Weight of parameters, and 6. Prioritize Test Cases. There are various techniques applied to achieve the proposed architecture. Some of them are as: test suits are reduced and prioritized with TSR while faults are detected with FDR and the average percentage is evaluated through APFD. With automated software testing, thousands of different and complex cases can easily be executed during every test run providing a large coverage that is applied in regression testing. The techniques are mentioned theoretically only, the practical implementation and its success rate isn't mentioned (Kandil, et al., 2016).

2.2 Regression Test Prioritization Techniques

Traditionally, techniques of regression tests depend on apparatus of source code and whole test set

whereas modern technique emphasizes on prioritized test suits that is lightweight and originated from convenient information sources with simplicity of test suits considering timeframe on the basis of previous failure. Jaspreet and Shivani in their work have discussed several regression testing and test case prioritization methods and approaches to find sever fault earlier stage of the software development. Test cases selection for regression testing are also mentioned for effective regression testing with regression testing tools like Quick Test Professional (QTP) and Rational Functional Tester (RFT) (Rajal & Sharma, 2015). The earlier prioritization can minimize time, effort and cost increasing customer satisfaction. Furthermore, Strandberg with his team has said that SuiteBuilder tool orders the regression test suite automatically that achieves the solutions of issues like limited time to execute a full regression suite, fail to detect errors in a time, and continuously skip tests". (Strandberg, et al., 2017)

2.3 Software Industry in Nepal

IT Industry is one of the emerging sectors of Nepal. IT companies are voraciously growing in Nepalese Market. Nepal has been capable to drive itself into the global market to be a tentative offshore outsourcing country to Europe, United States, Pakistan, India and other Asian countries due to its reasonable costs and favourable time zone. The companies like Cloud Factory, Deerwalk Service Pvt. Ltd., D2Hawkeye, Verisk Health, etc. have integrated their business in Nepal and formulated their own ideal market for their international products.

The growth of IT companies is impacting lives positively with economic growth and awareness of information technology in the nation. However, some of them bloom well whereas most get out of the timeline within few years. Most of the companies follow business model with high technical solutions rather than a problem-solving method. The companies find hard to establish in the market because of lack of domain knowledge, patient and sustainability approach (Banepali, 2017).

3 RESEARCH DESIGN AND METHODOLOGY

The research design and methodologies are discussed in this section of the dissertation. The research design, its approaches and strategies are mentioned with a clarity of research. The data collection methods along with the sampling and sample design are also emphasized. The design of interview and questionnaire questions are presented to have a proper output as per the research objectives. Moreover, Data capturing and editing process are presented. The limitations and assumptions of data collections are also mentioned with valid reasons. All the feedback collected from interviewers are also rectified. Along with it, the research timeframe, validity ethics and confidentiality are also discussed in this chapter.

3.1 Introduction

Many researchers have started to implement the qualitative or quantitative approaches to conduct research on the subject matter by overlapping the traditional purist approach, in recent time. They have used mixture of methods to study the research incorporating facets of both approaches at several phases to perform research study by doing experiments like the forming and managing research hypothesis on the basis of research questions, designing research process, evaluating data, and deliberation of research findings. These assimilations equip the firmness of both methods and derive a methodologically fine research design (Kumar, 2007).

The dissertation has been carried out using inductive research. However, deductive research is also essential for quantifying those inductive researches. The identification of research method leads to the further process as to identify the research approach to conduct research effectively in an efficient way.

3.2 Research Methodology

This section of the dissertation states the research methodology of the dissertation. The research approaches, strategies, methods, data collection methods, sample selection, research process, study and analysis of data, ethical scrutiny and the constraint of research is discussed. The subject matter that is selected for research study of this dissertation is not a new one. Comparatively, several samples of existing academic research are available regarding the challenges of automated regression testing in Agile software development. The subject matter is selected as there is still lack of awareness in testing field of IT sector. Thus, the research topic was selected from a prior research subject that satisfies the objectives of the research with a qualitative study on the associated research matters. The qualitative research implies study of small samples to analyse the results generally where reactions and issues are not significantly perceptible (Collis & Hussey, 2003). The scope of the research isn't restricted with the nature of responses. Meanwhile, it gives an utter description and analysis of the research's subject matter.

3.3 Research Design, Approach and Strategy

Research design, approaches and strategy are critical topics that are central to research studies. The selection of proper research design is another essential task after identification of the research topic and research questions. Recently, there are plenty of literature displaying various approaches to formulate the research design. There are multiple approaches for a research design. This may create confusion in researchers because of less lucidity in the literatures around the methods and process of research design, approaches, and methodologies. The confusion is lessening on research design and providing exceptional consideration of the approaches. It consists of: (a) explanation of phases in research design, and (b) the context of research methods and methodology (Gill & Johnson, 2002).

3.4 Research Design

The present state of literatures is reviewed timely to indicate recent works being undertaken in this area. Mixture of qualitative and quantitative approach is followed with a questionnaire-based survey and a study utilizing various types of literature as primary data sources, including scientific papers, journals, articles, magazines, reports, business reports from companies, consultants' reports, Internet blogs and YouTube videos. The representation of research design is presented in the figure below:
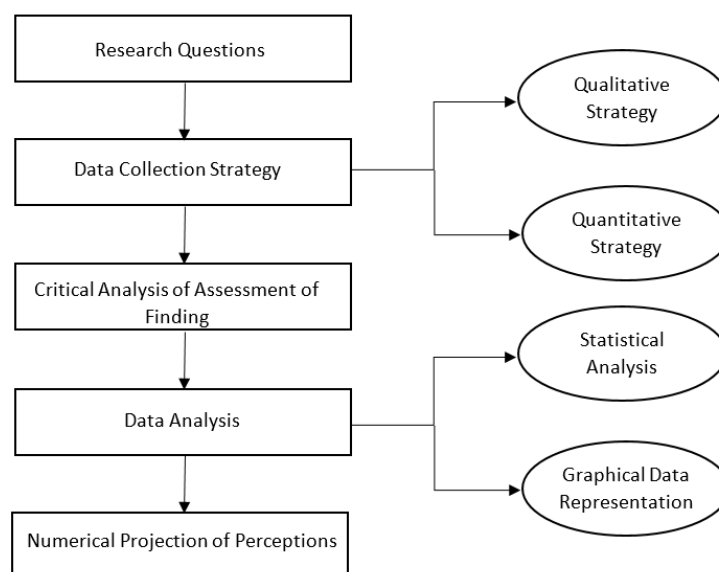

Figure 1: The Research Design

The research questions are prepared and distributed to the surveyors through data collection strategy. The critical analysis of assessment of findings is done with data analysis by projecting the perceptions numerically.

3.5 Research Approach

The inductive research approach is followed for this research. In this approach, researcher starts with particular observation to provide generalized theories and interpretations of research. It is suitable for small sample sizes to produce qualitative data which considers the context and active research effort. The generalization of findings and results on the basis of small number of observations is its major flaw. Thus, the reliability of research results is under question.

- A study on software development environment is performed by sampling some of the software development companies in Kathmandu.
- Feasibility study of applying automation testing environment in the sampled companies are performed.
- The challenges for implications are analysed and evaluated.
- Examining the process and techniques of automation testing.
- Questionnaires are circulated among candidates working in software company.
- Results and feedbacks are considered to automate regression testing with proper feasible and reliable testing tool as per the necessity of the software product.

3.6 Research Strategy

The research strategy addresses the significance, innovation and approach review criteria of this dissertation. There are various academic researches available on the subject matter related to the challenges of automated regression testing in agile software development. The research is not completely new but in a new form of an existing research (Gallin, et al., 2017). An appropriate research strategy helps in the selection of correct methodology to collect and analyse of the gathered data. The research is directed in proper direction with implementation of effective strategies. Generally, there are two basic types of strategies as Qualitative and Quantitative. Many other strategies are available depending on the research type, such as applied, predictive, exploratory, descriptive, interpretive, analytical, etc.

3.6.1   Qualitative Research Strategy

This strategy aims to gather an in-depth understanding and reasoning of human behaviour. It provides intuition of the research problem statements and aids to gain objectives of the research with different methods like open-ended surveys, conversations, interviews, observations, textual material, focus groups, etc. It investigates how's and why's of decision making, not only just where, when and what. It is difficult to quantify such phenomena mathematically.

3.6.2   Quantitative Research Strategy

The quantitative research emphasises on performing data analysis and evaluation using statistical, mathematical or computational techniques. The numerical, statistical and mathematical analysis of data collected falls under the quantitative research strategy. The quantitative research data is collected through questionnaire, polls, and surveys. It examines the occurrences of particular phenomenon on what, how long, when, where and how often of the research data.

This dissertation is focused on qualitative study with interviews of surveyors. The survey is distributed through questionnaires. Firstly, the population for sampling is identified, sample methods, data gathering techniques and data analysis techniques are identified.

3.7 Data Collection

The detailed close interviews were taken for the qualitative data collection of the research. The

unstructured and personal interviews are in-depth that aims to indicate the participant's feelings, affection, concern and viewpoint on a specific subject of the research. The close conversations like interviews are beneficial as it associates direct and personal contact of interviewers and interviewees. This omits non responses scale when the interviewer has enough skills to successfully take an interview. Conversely, the risk of deviation from the research objectives and purposes is higher in the interview.

3.8 Sampling Methods and Sample Design

The interview and survey were conducted to have the reliability and relevant data collection as per the questionnaires. All the participants or respondents of the survey were IT related personnel from various software companies of Kathmandu, Nepal.

The IT companies for distribution of questionnaire were selected on the basis of their quality of standard product, user base, number of employees and area for Quality Assurance. For the interview, phone calls and messages were sent to interviewers to participate in the research. As soon as their responses were received, a quick schedule to interview them were arranged by the means they were comfortable with. The interview and questionnaire must be complied with clear questions that could provide answers to the research questions/hypothesis. The primary and secondary data are the two sources of data for any research. Here, interview and questionnaire are the primary data collected straight from the respondents whereas literatures are the secondary sources to gather the information. The respondents were selected from IT companies as Swift Technology Pvt. Ltd., IME Digital Solution Ltd., F1 Soft International Pvt. Ltd., Vesuvio Labs, and Logpoint Nepal. The interviews were conducted face-to-face while some were conducted in social networks like Skype, messenger calls, viber. The questionnaires were distributed online through questionnaire google forms and offline through hardcopies.

For primary data collection, IT companies were selected to get responses. As for an interview sample size wasn't much only ten participants participated in the research and for questionnaires two hundred twenty-one participants. Thus, the findings are generalized for IT companies. The sample size can be clearly visualized in following table.

Table 1: Mode of Distribution of Questionnaire

Mode of Distribution of Questionnaire	Distributed	Received
Online	237	149
Hardcopy	112	72
Total	349	221

3.9 Data Collection Methods

The qualitative research is effective only when the researcher has the skills and abilities to deal with the participants. The results of this kind of research may not be reliable, researcher's personal judgments and interpretations has an impact on it. The observation of small samples creates a threat of risks while generalizing the results or opinion of the participants.

The two methods as interview and questionnaire are used for data collection. Interviews involve the researcher approaching potential respondents personally. Researcher asked a series of questions and notes to the respondent. It is a more time-consuming method where researcher selects the sample of respondents to balance demographic profile. Similarly, the other method is to send questionnaires to diversely broad sample of participants covering an extensive geographical area. This method has a low response rate leaning on the context and duration took to fill the questionnaire. If the questionnaires are distributed in large samples but the respondents are less then, it is must to consider demographic profile of the respondents reflecting the survey population;

and to offer enough large data set for analysis (Kelley, et al., 2003).

3.9.1 Data Capturing and Data Editing

The main methods of capturing data are the survey and Interview in this dissertation. The most well-known data collection sources are the online or internet survey, where a target participant can respond to the particular set of survey over the internet. The questionnaire is distributed to the participants through several mediums like email, social media etc. in the form of survey. The inexpensive cost and excessive reach of the participants online, is the main reason for implementing online survey. Researchers also prefer conducting surveys online as it is convenient to send surveys from the desktops or laptops. Moreover, there occurs quick responses from the targeted participants. For survey google forms are used and distributed through social media like Facebook, LinkedIn, Viber. The questionnaire data will be analysed through IBM SPSS Statistics Data Editor. For one on one interview experienced professionals were selected and in-depth discussion on each question were noted down to have a proper data analysis.

3.9.2 Data Collection Limitations

There are some limitations while collecting data for the survey. Some of them are as follows:
1. Distributed among IT professionals.
2. The interviewee answers were based on one's knowledge and experience.
3. In questionnaires, interpretation may not be fair if the correspondence is an influence.
4. Respondents were constrained to choose from the available options of the questionnaire.
5. The answers might not be accurate, the respondents respond as per own perception.

3.9.3 Data Collection Assumptions

The data collection consists of certain assumptions while distributing and collecting the data. The assumptions of data collection are as follows:
1. The surveyors are from the IT background.
2. Surveyors and interviewer are well known about the software testing.

3.9.4 Validity

The validity is the fundamental feature in the evaluation of any measurement tool for a good research. It is the soundness of the research that reveals the true findings of the research to meet the research purpose and to obtain the objectives. It is establishment of proof to use the specific instruments in specific setting of circumstances with a specific population (Morgan, et al., 2001). It is an extent at which requirements of research method have been followed during the process of generating research findings.

There are two types of validity. First is the internal validity and second is the external validity. Internal validity is concerned about the interview participants. The focused group of IT professionals were identified with appropriate knowledge of testing. The participants were not familiar with the terms though they are working with it. The questions were explained thoroughly for the interviewee to answer.

External validity is another type of validity which is concerned with the application of the research findings to related scenarios (Mohajan, 2017). When the data has been gathered, and the reliability and validity have been proved, the data musts to be evaluated to get significant evidence from the data. Each validity is measured for the true representation considering the factors affecting it.

3.9.5 Feedback from Interview Participation

Feedback from participants were collected where the first few participants said the addition in question is to be made for proper response. The changes were done accordingly and then; another interviewee was interviewed. The interviewee said that the questions covers the testing criteria to

extract the information regarding software application. Meanwhile, they found the interview interesting as discussion on the testing was in-depth. The importance of the testing is clearly stated but the implementation of the procedures was lagging behind due to different challenges. The participants said that this research would serve as a step towards the deeper insight of regression testing to take necessary actions to over the challenges for implementation.

The collective view of interviewee states that there exist the challenges while performing automated regression testing. Automation itself is a challenging task where regression testing is the complex one. Combining both the automation with regression testing is very critical yet essential for efficient and time saving measure of the software application.

Limitations

The interviews and questionnaire survey took longer than the planned schedule. It was planned for three weeks but due to some difficulty to get through the participants with all the questions; it took almost two months for gathering data.

4   DATA ANALYSIS AND FINDINGS OF RESEARCH

This section of the research is about the data analysis with their quantifiable statistics. The data analysis and the findings are crucial in the research because this will lead to the final outcome of the whole research whether the research aims and objectives are fulfilled or not. The results obtained from the questionnaire with direct the research future in a proper way. The data analysis and findings of the research are discussed below in details.

4.1 Mode of Analysis

The data collected through interviews and questionnaires are to be analyzed and interpreted. In order to do so, the qualitative data of the interviews need to be edited to make it significant with the research questions. The data collected through the questionnaires are analyzed statistically using tool.

Several tools like Google Analytics, SPSS, Microsoft Excel, etc. are available for data analysis. For data analysis, IBM SPSS tool is used as it is efficient and easy way to represent data in different forms with its value. SPSS is a statistical software that entirely addresses the conferred statistical process with an illustration of problems, data sets and comprehensive analysis of the associate data sets. The point-and-click process of IBM SPSS consists of detail data view and output manipulation with various data importing methods, variable names, and degrees of sequential instructions for every analysis. (Aldrich, 2018)

4.1.1   Overview Analysis of Questionnaire Results
4.1.1.1   Questionnaire Duration

The question duration for users was of thirty minutes.

4.1.1.2   Profile of Participants

The participants were from the IT Companies specially the one who is involved in software development process.

4.1.1.3   Number of Participants

The questionnaire was distributed both online and hardcopy for the participants. The target population for the survey was three hundred respondents. In total there were two hundred and twenty-one respondents who completed the survey. The result of the survey is presented in the following section.

4.1.2   Analysis of the Survey

The analysis of the data collected is very essential to figure out the outcome of the whole survey. The questionnaire is focused on software testing so the opinion of the respondents as per their perception of the questions with their knowledge about research domain is analyzed. The list of twenty-nine questions is presented with their frequencies and graphical representation below:

4.1.2.1   Organization following Agile Methodology
Table 2: Organization following Agile Methodology

Organization Following Agile Methodology

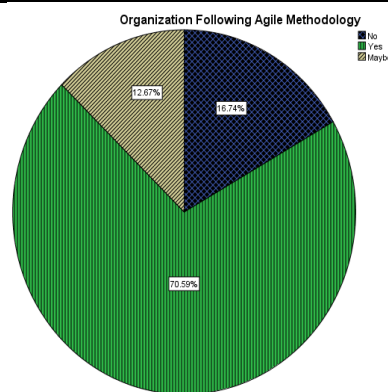|		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	No	37	16.7	16.7	16.7
	Yes	156	70.6	70.6	87.3
	Maybe	28	12.7	12.7	100.0
	Total	221	100.0	100.0	

Figure 2: Graphical Representation of Organization Following Agile Methodology

Agile methodology is one of the most used methods for software development. The selected IT companies are following agile methodology with higher percentage as 70.59%.

4.1.2.2   Most Used Method for Software Development
Table 3: Most Used Method

Most Used Method

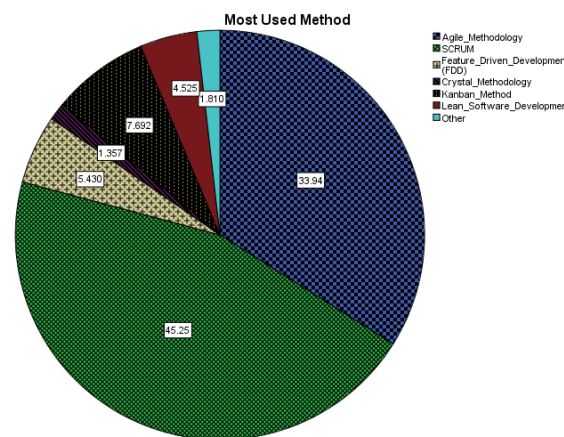|		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Agile_Methodology	75	33.9	33.9	33.9
	SCRUM	100	45.2	45.2	79.2
	Feature_Driven_Development_(FDD)	12	5.4	5.4	84.6
	Crystal_Methodology	3	1.4	1.4	86.0
	Kanban_Method	17	7.7	7.7	93.7
	Lean_Software_Development	10	4.5	4.5	98.2
	Other	4	1.8	1.8	100.0
	Total	221	100.0	100.0	

Figure 3: Graphical Representation of Most Used Method

Different methods are used for the software development as per the nature of the software product. Here, it is visible that the companies using SCRUM methodology for the software development is higher with 42.25%.

5   CONCLUSION AND RECOMMENDATION

This section of dissertation is all about the findings and pursuit to acknowledge the research questions. The recommendation depending on the research findings for further research are deliberated in this chapter. The evaluations and analysis of all the findings of previous chapters are presented together in this section. The results of the literature reviews, research methodologies, data analysis, the conclusion, recommendation and the future research on the subject matter is discussed in this section of dissertation.

5.1 Discussions and Findings

The findings from the research show that there are challenges in implementing automates regression testing in agile software development. The changes in requirements, lack of skilled resources, knowledge of programming language, etc. has a great impact in the implementation of the automation. The findings as per the research questions are as follows:

1. Is there a scope for automated testing in agile software development environment?

The ten questions included in this section indicates the use of tests automation in agile software development. The basic questions related to the agile software development, it's methods, testing crucially, methods of testing, time spend on testing, types of testing performed, tools preferred for testing and use of automation are included in this section. The majority of respondents agrees on use of agile methods SCRUM with both types of testing manual and automation with maximum use of Selenium tool can be stated. The maximum respondent tests API using testing tool but now the focus must shift on Regression testing and its automation for minimum defects in the system.

2. What will be the challenges in implementing the automation in agile software development environment can be overcome?

This section includes five questions with three Likert-scale questions regarding basis for automated tool selection, issues with existing tools, challenges in test automation followed by types of test automated and positive changes in software performance due to automated testing. As per the respondents, the level of skills and experiences, level of programming language and good test reports leads to the selection of automated testing tool. The API tests are automated, then, integration and functional and then, regression test is

automated. There are challenges in automating regression testing as the requirements are changed frequently. It is difficult to sort application modules for automation and there is lack of documentation. All of the respondents agree on the positive changes in software performances because of software testing.

3. Do regression testing techniques help in automating agile based software applications?

For the relevant answers of this research question, nine questions were designed regarding the regression test awareness, need of regression testing, level of regression testing, conducting regression testing, identifying preference of test cases for effective regression testing, executing automated regression test, updates made in test cases, beneficial of regression testing and recommending to use automated regression testing.

The majority of respondents are aware of regression testing as there is continuous changes in requirements and code modifications according to the requirements. The automated regression testing helps to ensure better performances of the software due to early identification of bugs and errors. The regression test is carried out on single component, module and whole system at the time of integration testing. The test case with frequent defect is selected for effective regression testing by prioritizing the test cases with bug fixes and new changes updates. The respondents say it is beneficial and recommend to use automated regression testing in the projects.

5.2 Expectation

The collected data and the literatures clarify the need of automated regression testing in software development for saving time, money and effort with minimum errors and maximum client's satisfaction in IT companies of Kathmandu.

5.3 Summary of the Findings

Based on the research, number of findings were achieved, some of the major points are discussed below:

- Comparison

Mostly manual traditional method was used in for testing software. With this research, it is clear that selected IT companies are preferring both type of testing as Manual and Automation. Manual testing cannot be totally replaced by the automation as automation requires proper skills, resources and efforts. Automation for a whole system processing and interaction will be big achievement.

- Awareness

The awareness of using automated testing is visible among the respondents. Yet, the proper implementation of the automated testing is rare due to many challenges. The selected IT companies are focusing more on automated testing to minimize number of bugs and maximize clients' satisfaction.

5.4 Future Recommendations

Future recommendations are the further scope of the research presented in this dissertation. The research, with various literatures and survey implies that it is must to automate regression testing in agile software development for better performance and efficiency in work. There are some recommendations that are stated below:

- There must be resources available for increasing awareness regarding automated software testing
- Proper training and its effective implementation must be put forward in the associated department

- Documentation must be maintained as per the versions of the software application
- The knowledge of business process is mandatory while selecting and optimizing test cases for regression testing.
- Research can be taken further with the implementation of automated regression testing with actual scripts.

These recommendations while followed with effective management and execution in actual industry are achievable. The resources must be made available for the automated testing. Proper training must be provided with feasible implementation to spread awareness about the knowledge, benefits and positive impact of regression test automation. The documents for each versions of software released must be maintained. The clarity of business process helps in using regression testing techniques for automation. The application of all the above-mentioned points in actual development and testing environment reflects the benefits and positive impact of automated regression testing in various situation. With proper research and research material in associated subject matter may lead to other numerous possibilities in this line of work.

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