FACTORS AFFECTING JOB SATISFACTION OF SOFTWARE QUALITY ASSURANCE PROFESSIONALS

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Degree of Master of Business Administration in Information Technology

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Declaration

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ABSTRACT

Software Quality Assurance (SQA) is started as just debugging and evolved over seven decades to the established and salient position now. SQA is not just testing it is an extensive area which required a special set of skills. But satisfaction of the SQA professionals compared to other occupations in software industry is questionable.

Substantial amount of studies and researches were done concerning job satisfaction without considering occupation as well as considering different occupations all over the world. Unique job satisfaction factors have merge for different occupations because of the nature, responsibilities and skill levels required for specific jobs. Therefore finding these unique factors are important for keeping employees satisfied to get effective and efficient output from them.

CareerBliss have been conducting a survey in America each year to identify the "Happiest job in America". Over the last five years, SQA was among top ten happiest jobs according to the survey. But at the same time, questions such as "How to keep good testers in SQA jobs, why good SQA professionals leave their jobs" were raised by Quality Assurance (QA) managers and SQA professionals' community all over the world as well as survey conclusions such as good Information Technology (IT) graduates do not consider QA as a good career path was also found in literature. Finding factors that affect SQA professionals' job satisfaction is vital for the future growth as a career which enhances software industry. Research was started from the personal experience and feedback received from colleagues.

Qualitative research was used for the research. Five point likert scale online questionnaire was developed based on the selected set of factors under test. Before distributing for the sample, a pilot survey was carried out capturing entire spectrum of sample based on the gender, experience and organization size. Recognition, Career growth opportunities, Training and certifications, Salary, Budget allocations, Support from Top management and organization culture and general perspective towards SQA profession were the factors under test.

Output of the research gives important findings related to the factors under test whereas five factors were negatively affected with the job satisfaction of SQA professionals and two factors shows that there is no influence for job satisfaction. Other than the main findings intended few other findings were reviled with demographic information.

Organizations and managers can consider these findings to improve job satisfaction of their SQA professionals and beside as a community and responsible authorities, can look in to findings to enhance SQA as a profession essential to the growth of software industry.

Key words

Software Quality Assurance, Job satisfaction of SQA professionals, Job satisfaction, Recognition, Career growth opportunities, Training and certifications, Salary, QA Budget allocations, General perspective towards SQA.

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List of Abbreviations

Abbreviation	Description
QA	Quality Assurance
SQA	Software Quality Assurance
SDLC	Software Development Lifecycle
BA	Business Analyst
SHRM	Society for Human Resource Management
SE	Software Engineering
IEEE	Institute of Electrical and Electronics Engineers
HR	Human Resource
ICT	Information and Communications Technology
IT	Information Technology
PM	Project management
MBA	Master of Business Administration
CEO	Chief executive officer
Org.	Organization
HoH	Hierarchy of hypotheses
SLICTA	Sri Lanka Information and Communication Technology Agency
CAGR	Compound Annual Growth Rate

1. CHAPTER 1 - INTRODUCTION

1.1. Introduction.

This chapter presents the background, motivation for the research and overview with justification of the research problem. Scope of the research, research methodology and research objectives are also included with the structure of thesis.

Focus of this study is to find the factors that affect software quality assurance (SQA) employee job satisfaction with adopting a conceptual framework which categorize independent variables in to three, namely psychological, physical and Environmental. Especially this paper focused on areas such as recognition, career growth and future opportunities, training, certifications and competencies, salary and compensation, budget allocations (such as time, resource and cost) and support from higher management and team members and general perspective towards quality assurance (QA) for SQA professionals compared to other professions in software industry. Many numbers of researches have been conducted for factors affecting job satisfaction and also for different occupations including IT sector as well. With the new concepts and trends, QA plays a major role in software development lifecycle (SDLC). Testing and SQA were there from the beginning of software industry but more opportunities and demand has been created over last decade as a profession. Therefore it is important to identify the driving job satisfaction factors of SQA professionals to make full use of efficient, effective, committed and satisfied labor force.

1.2. Background of the Study

Number of researches have conducted their researches on employee satisfaction. Maslow's Hierarchy of needs is the base of developing job satisfaction theories and studies related to job satisfaction and employee satisfaction according to "Study of Job Satisfaction in Software Industry– Myths and Realities" by Dr. Lal. Maslow's Need Hierarchy theory, a motivation theory, laid the foundation for job satisfaction theory which explains that people seek to satisfy five specific needs in life (Dr. Indu Bhushan Lal, 2015). Some factors are common to every profession but some factors are occupation specific based on the nature of employment. Therefore researches were conducted focused on different occupations to identify specific factors related to occupations. As an example, Society for Human Resource Management (SHRM) is doing an annual employee survey and identifies factors that influence overall employee satisfaction and engagement in the workplace (Management, 2013). With the

impact of employee satisfaction researches on different occupations, employee satisfaction of software professionals is also a common area of research with immerge of software industry over past years. Now it has moved to country and city level because of the different work cultures and environments are affecting different types of occupations. As examples, exploring 'Employee Satisfaction' as a Quality and Productivity Enhancement Tool for IT Sector of Pakistan was carried out for Pakistan. As a conclusion from this study "The study provides support for some key factors serving as stimulators for employee satisfaction. These factors are pay, job interest, leadership (encouragement, feedback, and performance appraisal), and career growth, working environment, broadly defined job responsibility, organizational objectives and trainings. These factors if not provided, result in dissatisfaction of employees." (Hina Sohrab Kiani, 2007) . Employee Job Satisfaction in Software and ITeS units in Bangalore - An Empirical study, is focused on Bangalore, India. As a conclusion from this study. The findings of this study have also pointed out that the key items in HR practices (performance appraisal and remuneration) have lesser impact on job satisfaction in the IT sector. (Jyothi B.S, 2012)

Even in the software industry, different job roles and occupations such as software engineer (Developer), business analysts, SQA engineers/testers, project managers have different duties and responsibilities. Project involvement, authority and salary ranges are also can be different for each job role. Even if it is the same company, because of some factors affecting employee satisfaction of different employee groups may differ based on the job role.

In software industry these different job roles have different responsibilities and tasks to perform. Even though it is considered as software industry, each of these job roles is totally different. There can be new factors affecting these professionals job satisfaction as well as common factors of job satisfaction may affect differently for different occupations. In the beginning of software industry there were no clear differentiated job roles. But with the enhancement of the industry job roles are differentiated with unique responsibilities. Therefore factors of job satisfaction change based on the job role.

History of software testing and SQA is important to recognize why the profession of software tester/software quality assurer became an important aspect of software industry.

Also it is necessary to have an idea about the future of SQA occupation to identify the factors of job satisfaction. In 1915 method of testing was debugging. Then it was time of trying to break the system and find holes or gaps in the code. It was a successful method till prevention

oriented methodologies seems to be more effective. In late seventies hypothesis of debugging and software testing should be two deferent thing came to the picture. In 1970 nine, Glenford J. Myers has hypothesized this concept and evolved to the level that software development industry is considering software testing as a different occupation in software industry (Fox, 2011).

1.3. Motivation

With the evolution of software industry, software companies now have different job roles, responsibilities and duties allocated for different occupations. One of the main occupations is SQA profession. With the experience, observation and general discussions with peers and collogues, there seems to be different factors affecting uniquely to different jobs roles affecting job satisfaction such as recognition, workload, deadline pressure, best practices, career growth, salary and compensations, support from top management and organizational culture and general perspective of SQA profession.

Identifying these specific factors affecting job satisfaction of SQA professionals is the primary step to address them. With the future growth of software industry, managers and top level needs to take corrective actions to address these issues to get the maximum service from their employees. It is concluded that employee satisfaction serves as a stimulus for the organizational quality and productivity. Therefore, it is proved that employee satisfaction impacts positively on software quality and productivity (Hina Sohrab Kiani, 2007). Detailed analysis showed that the connection between job satisfaction and organizational performance was stronger than the connection between organizational performance and job satisfaction. (Bakotić, 2016)

Motivation behind the research to help managers to motivate SQA professionals and attract more good IT graduates as SQA professionals. As per research done by Perera U.L.A.R, "However in IT, though QA is a critical component, it is a highly misunderstood field. As a result a shortage of skilled QA Engineers exists today in Sri Lanka. This is mainly due to undergraduate IT students not considering QA as a good career path" (Perera, 2013). To attract more good graduates, we need to keep SQA profession among the happiest and recognized jobs in IT industry. Another good example is survey done by CareerBliss in every year "Happiest Job in America" and it shows that SQA is in top 10 for several years and became first in 2011. Therefore SQA should have factors that affect job satisfaction than other occupations in America

1.4. Problem Statement

With the evolution of software industry job specialization has also happened and different job roles were immerged within the industry with different responsibilities. At the moment there are different departments also exists within a software development organization. Proper job description was necessary to accomplish work objectives and to have proper job descriptions, clear differentiation is a must.

There were many researches carried out to find job satisfaction factors. Also same research has conducted to identify factors affecting different industries including software industry. But those are more of industry based research. Because of the different job roles, responsibilities and job descriptions there can be unique factors affecting job satisfaction of different job roles.

Job responsibilities, descriptions, salary schemes, work load, recognition, and specific natures of work such as general standards, best practices and general discussions of industry such as QA effort should be 30% from development estimate, QA always get less time, not understanding the value of QA by management and clients, development effort taking more time or QA team getting the test environment very late than requested can be some concerns that should get attention. These factors may affect job satisfaction and IT graduates do not consider quality assurance as a good career path in Sri Lanka. As a result good graduates do not come to quality assurance jobs (Perera, 2013).

Therefore identifying factors affecting job satisfaction of SQA employees is paramount. Synopsis of problem statement can be given as "What factors affect the job satisfaction of SQA employees with compared to other occupations in software industry." it is vital to identify same factors affecting differently as well as unique factors to the occupation.

1.5. Objective of the research

Main objective of this research is to find any specific factors affecting job satisfaction of SQA professionals based on the job descriptions and difference of the work compared to other occupations in software industry. Other than the general and industry related factors, identifying these unique factors or same factors affecting job satisfaction differently will help managers and CEOs to offer better working environment and resolve some management problems related to SQA professionals. By improving SQA professional's job satisfaction, managers will be able to get effective and efficient output with their employees that increase productivity and quality of the output. According to the happiest job in America survey done

by CareerBliss, SQA engineer is among the happiest top jobs over the years in America. But when it comes to Sri Lanka it seems QA path is a less recognized one. IT graduates do not consider quality assurance as a good career path in Sri Lanka. As a result good graduates do not come to quality assurance jobs (Perera, 2013). According to the survey it is mainly because recognition, salary scales and QA is not considering by the industry as important function of IT sector. It is mentioned that this perception among graduates is because of tasks currently handled by QA professionals and their job satisfaction levels.

Finding most affecting factors among the common factors of job satisfaction of IT professional's or new factors specially affecting SQAs tasks and other factors other than common job satisfaction factors is important to attract new good graduates as well as getting effective and efficient out of the QA professionals.

2. CHAPTER 2 – REVIEW OF LITRETURE.

2.1 Review of literature.

There are many numbers of researches done for employee/job satisfaction, IT industry and related to SQA worldwide as well as within Sri Lankan context. Study of job satisfaction, IT industry and SQA related research is a must before trying to find the specific factors related to SQA professionals. Therefore a literature review is carried out related to SQA from the start of QA, different roles played by QAs in different SDLCs, problems and issues related to QA, Job satisfaction and other related research were studied. Important and relevant findings of the literature are presented in the following section.

2.1.1. Definition of SQA.

SQA is much more than testing. Testing is a main part of quality assurance (QA) but QA is more than that. As mentioned earlier, debugging is the start of QA from the debugging stage QA has evolved to a whole new level in software industry. Non-functional testing such performance, security, usability user experience and now automation has also a major part of QA. Not only in the testing phase, quality assurance is monitoring the software engineering process and methods use to ensure quality (Software Quality Assurance, 2011). Intention of software testing is finding bugs in a software system which is an important task of SQA but cannot be defined as entire SQA process.

IEEE standard ANSI/IEEE 730-2002 defines SQA as "a planned and systematic pattern of all actions necessary to provide adequate confidence that the software conforms to established technical requirements" (IEEE, 2000)

2.1.2. Role of software quality assurer in different software development lifecycle

Waterfall method was the most common and widely used SDLC method for long period of software industry. Requirement analysis, system design, implementation, testing/QA, deployment and maintenance are the stages of waterfall method. It is shown that testing is the 4th step that is where QA team is involved mostly. But theoretically, QAs should involve from the beginning till the end of waterfall method lifecycle.

Test driven development is also a software development method that involves less QA process. Therefore involvement of a specific SQA profession is not a practice in this model. Approach is to find test cases first and development of software based on those test cases.

Spiral Model is a combination of waterfall and prototyping models. After developing each prototype it is tested therefore QA team also involved with QA and testing activities.

Agile is most commonly used successful method resent software development companies all over the world. QA approach is also different compared to other SDLC models. According to Santamaria (Santamaria, 2007)), there are three things that a SQA professional should expect when agile is in practice. Better communication and more collaboration among QA & development teams, a new "peer to peer" relationship between development and QA personnel and Looking for ways to optimize testing efforts should be a "must".

Differences in each of these SDLC models can also have an impact on the job satisfaction of SQA professionals because the involvement and approach of QA is slightly different from each SDLC. But basic of QA concepts and process has no difference. Internal atmosphere, communication with stakeholders, QA-development relations, Involve QA in your development cycles from the beginning and rotating projects and tasks differs based on SDLC method using in the organization. (Santamaria, 2007)

2.1.3. Software quality assurance and effort estimations.

Software testing can be seen from different aspects. Basically there are two different testing techniques known as white box testing and black box testing. Project or embedded testing and product testing are two different and independent scenarios of testing. Unit testing, integration testing, and system testing and user acceptance testing comes under project testing and load testing, volume testing functional testing; negative testing etc. comes under project testing. Organizations carryout combination of necessary testing to make sure the quality of software is acceptable level. Effort estimations are done necessarily for each of testing and QA activity practice in organizations. Test estimation is about estimation of testing size, test effort, testing cost and testing schedule for specific project in a specific environment using defined methods, tools and techniques. There are approaches such as Delphi Technique, Analogy Based estimation, Software Size Based Estimation, Test Case Enumeration Based Estimation; Task (Activity) based Estimation. Approaches such as testing size based estimations are available for carrying out test effort estimations as Chemuturi, discussed in his study. (Chemuturi, 2015)

As mentioned by Chemuturi Software size based effort estimation is a method where determination of person hours to test one functional point and then multiplying it by total functional point which is determined as the size of the project. Test Case Enumeration based

Estimation is done by estimating person hours required for each test case for best case, worst case and normal case. Calculate the expected time using a weighted formula and giving cumulative estimation for best case, worst case normal case and expected case. First project is broken down to phases and phases are further broken down to tasks. Then person hours are determined for each task for best case, worst case and normal case and calculate the overall estimate is known as Task (Activity) (Chemuturi, 2015) Based Estimation. Delphi method is a technique that uses a survey method to gather expert opinion and information about each task and calculate an average effort for testing according to the article published in (Software Testing Class, Complete website for Software Testing Folks). There are many more software test effort estimation techniques such as figure in the air (FIA) or Best guess, ad-hoc method, experience based – Analogies and experts, WBS, Three-point estimation, function points/ Test point analysis, percentage of development effort method, percentage distribution and use case point estimation method according to the web log post from Paul, Hunter and White. (Paul B, 2014).

2.1.4. Job Satisfaction.

After the Hawthorne experiment done by the Elton Mayo (1924 -1933), there were many experiments and researches done related to job satisfaction. According to the job satisfaction research done by Jagodaarachchi.B, conceptual framework of the research shows that employee satisfaction mainly depends on three independent variable categories. Psychological factors, physical factors and Environmental factors are those categories. Job satisfaction is the dependent variable in this study.

Independent Variables   **Dependent**

Variable   **Independent Variable**

Psychological Factors

- Health and safety
- Working responsibilities
- Job Security
- Promotion

Physical Factors

- Payments
- Co-workers
- Welfare services
- Use of skill & abilities

Environmental Factors

- Good working environment
- Management style & culture

Job Satisfaction /

Job Dissatisfaction
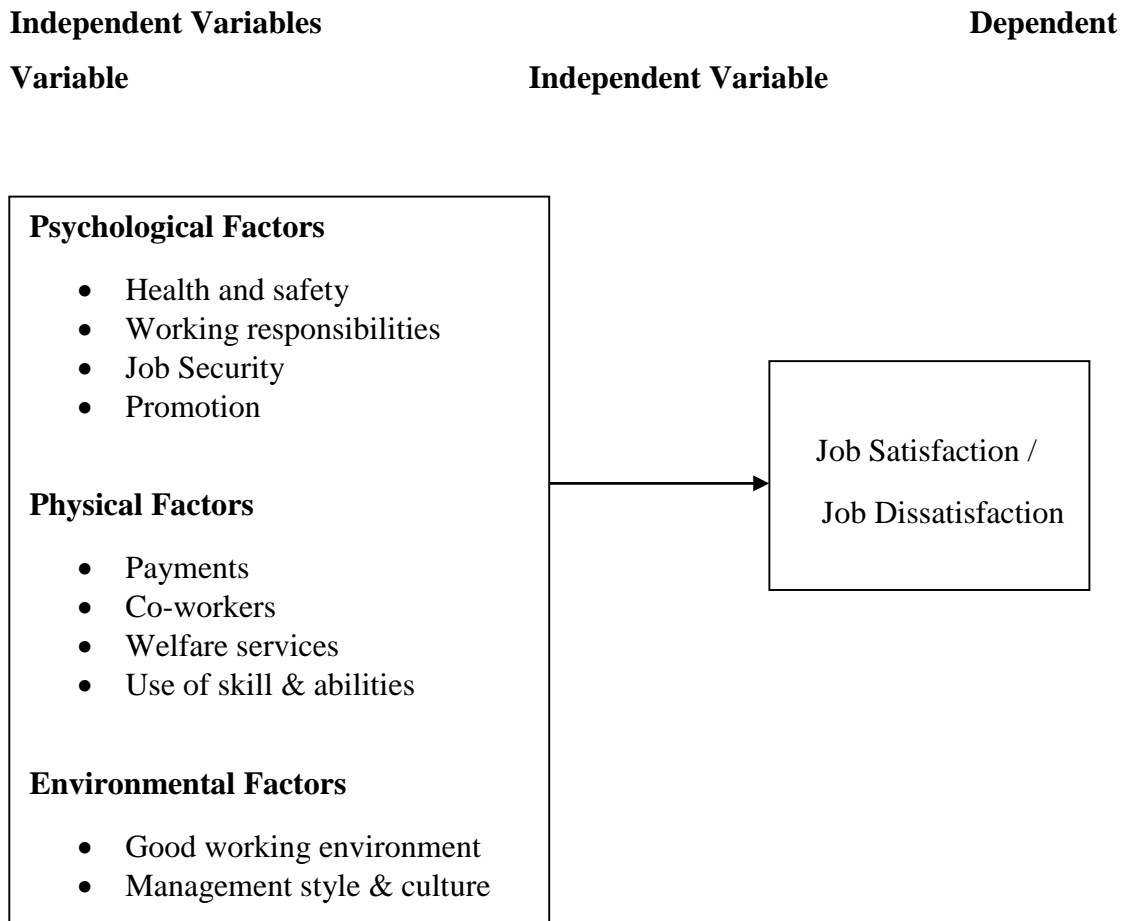
Source: Survey Data, 2012

Figure 2. 1 - Conceptual Framework by Jagodarachchi B.

Source: (Jagodaarachchi, 2012)

As he further mention Employee satisfaction is a measure of how happy workers are with their job and working environment. Keeping morale high among workers can be of tremendous benefit to any company, as happy workers will be more likely to produce more, take fewer days off, and stay loyal to the company (Jagodaarachchi, 2012).

"Happiest job in America" is a survey done by CareerBliss every year to find the top twenty happiest and unhappiest professions in America. Surprisingly SQA engineer is among the happiest top jobs over the past years. SQA became number one in 2011 according to the data collected February 2011 and January 2012. This survey was carried out among more than 100400 employees in America. They were asked to rate 10 factors affect workplace happiness in five point likert scale. Then they sorted out by job title and found out the job title had the happiest workers. A job title should have a minimum of 50 responses to be considered for this analysis. Executive jobs such as chief executive were excluded from this study. Report says that the highest points were for happiest job title was SQA engineer/profession in the period of study. Relationship with the bosses and co-workers, work environment, job resources, compensation, career growth opportunities, company culture, company reputation, daily tasks and control over the work does in daily basis are the factors considered in their study.

According to chief technology officer at CareerBliss, Matt Miller, and SQA is not only testing. QAs involve in the entire software development lifecycle and ensure the quality of the final product. Processes such as requirement gathering and documentation, source code control, code review, change management, configuration management, release management and actual testing are the stages that quality assurers are involved. Empowerment and responsibility was high with software quality assurers, Miller have also mentioned that organizations generally don't release software without fully tested and approved by tester and QA group (CareerBliss, CareerBliss Happiest and Unhappiest Jobs in America, 2016). This statement clearly shows the responsibility, empowerment and trust given for this profession.

Furthermore same survey was carried out in 2012 by CareerBliss and senior QA engineer job title came as the happiest job which is also SQA profession. (CareerBliss, Happiest and Unhappiest Jobs in America 2012, 2012). Again for the same survey carried out in 2013, SQA engineer came first (CareerBliss, CareerBliss Happiest and Unhappiest Jobs in America -- 2013, 2013). But surprisingly in 2015 SQA profession is not there at top ten. Automation engineer has become 4th place which is the new trend of SQA engineers. Nowadays SQA need to have automation skills and more or less now automation capabilities are a must for testers. Therefore it may be not a happiest job as it was before. But again SQA is ranked 9th in the same list in 2016.

Working long hours and intense demands is the main reason for dissatisfaction among work for software engineer, but SQA engineers seems feel rewarded and happier than software engineers (Smith, 2012) says Forbs magazine. Furthermore Forbs has also refers to CareerBliss study and confirm that the happiest SQA make the list along with lead engineer and lead developer (Dill, 2016).

Iqbal and Qureshi (2009) have developed a hypothesis to Improvement Key Problems of Software Testing in Quality Assurance. As per their hypothesis key problems are shortcuts in testing, reduction in testing time, let go deliver now correct errors later attitude, poor planning and co-ordination, lack of users involvement, poor documentation, lack of management support, inadequate knowledge of application environment, improper staffing and poor testability. Paper provides strategies to overcome key problems (Nayyar Iqbal R. J., 2012).

2.1.5. Job Satisfaction of IT graduates in Sri Lanka.

Because of the skilled human resource can be obtained from Asian counties, offshore outsourced IT work demand is more in Sri Lanka. According to the findings from "Predictors of job satisfaction among IT graduates in offshore outsourced IT firms", female IT graduates are less satisfied with all the five facets of job satisfaction (work content, promotion, supervision, pay, and co-workers) and overall job satisfaction than their male counterparts (Vathsala, 2009).

Gender seems to be an interesting factor for the study because there is tendency of selecting a career path related to software industry based on the gender. Therefore job satisfaction of QA professionals may change based on the gender as well. Expectation of work content, promotion, supervision, pay, and co-workers may differ based on the gender.

IT graduates do not consider quality assurance as a good career path in Sri Lanka. As a result good graduates do not come to quality assurance jobs (Perera, 2013). This research was carried out to why majority of IT graduates do not consider QA as a career option. At the same time answer for the question of whether QA engineers are satisfied with their current work duties. This is a good indication of finding whether QA professionals are satisfied with their jobs and most affecting factors of job satisfaction of SQA engineers. Based on the findings it is concluded that good graduates are not interested in joining and selecting SQA as career path. According to the survey it is mainly because of salary scales and quality assurance is not considering by the industry as important function of IT sector. It is mentioned

that this perception among graduates is because of tasks currently handled by QA professionals and their job satisfaction levels.

2.1.6. Motivate Quality Assurance Team.

According to an Oracle publication by Marina Gil Santamaria Hiring QA team and relaxing is not enough in the competitive job market these days it is favorable for the QA engineers. Things like coaching your team, empowering team members, plan professional growth, deep appreciation for hard work and letting team members to balance work and family life are the considerations of satisfied employees. But other than these factors there are special factors affection QA professionals' satisfactions. It is mentioned that compared to development, satisfaction among QA professional satisfaction is low. External misconceptions such as "anybody can do QA", "hire some out of school kids to test our applications", or "QA folks are in reality 'developer wannabees, QA doesn't provide much value to the organization, QA is a boring, repetitive job with no creativeness involved' (Santamaria M. G., How to Keep & Motivate Your Qa Team -- Without increasing your budget, 2008) can also be factors of job satisfaction and team moral. According to Santamaria sometimes QA teams seem de-motivated, discouraged or disengaged because of reasons mentioned above.

Simple factors such as Evaluate internal atmosphere (Are development team respectful to QA engineers, or do they look down at them, involvement of QA team in project meetings), communication with your stakeholders, Improve QA-development relations, Enhance your QA job descriptions, Involve QA in your development cycles from the beginning, Look for ways to automate, Consider rotating projects and tasks and Involve your team members in customer interactions are suggested by the author to increase motivation and job satisfaction among QA team members. (Santamaria M. G., How to Keep & Motivate Your Qa Team -- Without increasing your budget, 2008).

Some concepts are used and practiced by organizations and managers such as reward testers for finding good quality bugs; name them as "bug of the week", reward testers for logging most number of the bugs in a given week. Combination of this is more recommended because running behind most bugs will omit quality bugs as well as focusing on quality bugs will also omit low bugs such as UI bugs. These are some tactics recommended by "Software Testing Help" (Software Testing Help, How to keep motivation alive in software testers?, 2016).

Furthermore another article by "software testing help" has received a question "In my organization, we've found that it's really hard to keep the good testers in testing. Many of

the really skilled testers are always looking for change and want to get out of testing for some reason. I would love to hear if you have any ideas on how to keep the good testers in testing?" (Software Testing Help, How to keep good testers in testing positions?, 2016). Article highlights that main reason of dissatisfaction and employee turnover is lack of appreciation for employees' hard work. Article lists the complains or dissatisfaction factors among QAs as follows

- Sometimes developers ego as they are better than testers
- Tester is responsible for every fault
- Schedule slips due to testers
- Testers are not getting the respect
- Management doesn't consider them equally with developers.

As per the author these reasons are considered as some common reasons of SQA professionals feel insecure in their job, affecting their daily work and may result in high attrition rate. Same article provide some solutions as follows

- Provide them training
- Appreciate the good work
- Set finite boundaries to everything
- Take every bug as a learning opportunity
- Don't make testing a repetitive task
- Create good relation between testers and developers
- Don't forget to celebrate

(Software Testing Help, How to keep good testers in testing positions?, 2016). Above reasons seems to be familiar with the motivation for this study "Factors affecting job satisfaction of SQA professionals"

2.1.7. Problems with software testing.

Reduction of testing time is one key problem identified by Iqbal and Qureshi (2009). According to them testing is estimated inaccurately and design and development is also take time more than estimated. Therefore we can consider that time estimates and reduction in testing time to meet deadlines (Nayyar Iqbal R. J., 2012) can be a driving job dissatisfaction factor among QA professionals. Under poor planning and co-ordination factor of problem in software testing it is said that testing is not given appropriate time till the last stages of the

project. This might be another dissatisfaction factor because QA team may not be utilized and allocated proper work and not engaged with project work till the end stage of the project. And when it comes to the coordination, test team design and development team must have a complete coordination among them to be successful. Also coordination with customer is required to give satisfaction to customer.

Test team should have management support and management should understand the importance of QA. In this paper lack of management support is another problem of software testing. For any employee relationship with the bosses and co-workers (CareerBliss, CareerBliss Happiest and Unhappiest Jobs in America -- 2013, 2013)is important in another angle this can be seen as support from management for work.

Other than common factors affecting job satisfaction of SQA professionals, there is industry specific as well as occupation specific factors affecting job satisfaction. And those common factors can also affect differently base on the occupation. As an example reduction of testing time and shortcuts in testing mentioned by Iqbal and Qureshi (Nayyar Iqbal R. J., 2012) are specific to QA and testing occupation.

Job satisfaction factors such as company culture and Relationship with the bosses and co-workers, Work environment can be changed based on the country or region as well. Other specific to QA professional such as reduction of testing time and shortcuts in testing may not change based on the country or region. Challenges faced by QA professionals can be both for their job satisfaction as well as dissatisfaction, therefore identifying satisfying challenges and facts are important.

A closer look at the factors affecting job satisfaction of QA professionals is needed to clearly identify key factors and create an effective and satisfied workforce.

From the studies such as "Analysis of SQA profession in Sri Lankan it industry, (Dias, 2015) How to attract good IT graduates for SQA (Perera, 2013) and (Software Testing Help, How to keep motivation alive in software testers?, 2016)" it is revealed that Sri Lankan software development industry does not care about the importance of SQA or clients do not get the expected levels of software quality as well as globally there are some specific and unique factors affecting job satisfaction of SQA professionals.

A study by Peter B. Wilson has identified ten mistakes companies make setting up and managing SQA departments. These mistakes may also cause dissatisfaction among SQA

professionals. Finding out these mistakes are actually in practice and affect employee satisfaction is another objective for this study. "Not properly defining objectives" is the first mistake according to Peter B. Wilson. There should be well-defined objectives, not objectives such as archive CMM levels and improve quality. Those are good secondary level objectives. "Not properly defining a QA department's responsibilities and staffing to meet these responsibilities." is identified as the second mistake in the same study. As correctly identified by the study it is a common mistake and may impact on employee satisfaction of the department. Also another eight Important mistakes has identified by the study "Senior management not understanding their responsibility for QA, Not holding the QA department accountable for project success, Assuming existing standards/processes are followed and are sufficient, Separating methodology responsibilities from review and enforcement responsibilities, Not integrating measurement into the process, Ignoring, misunderstanding, or not communicating risk, Lack of management reporting from the QA department and The QA department is positioned too low in the organization." Which is another factor identified by few studies and interpreted in different ways such "less recognition for QA work" (Wilson, 2009). As per the common factors of employee dissatisfaction, most of the above mentioned factors are roots of lack of support from management and not empowering the employees.

Software effort estimations and QA estimates are also seems to be a common issue and challenge faced by QA professionals. Reduction of testing time, design and development is also take time more than estimated. And testers are pushed to reduce testing time because management don't appreciate the value of QA is a combined issue of lack of management support, not recognizing the importance of QA and inaccurate time estimates. Therefore other than the above factors, it is important to have a closer look at software effort estimates and QA estimates.

2.1.7.1 SQA effort estimates

When considering the software project management, estimating software effort accurately is a major concern. (U.C.J.L.Perera, 2007). As discussed by Iqbal and Qureshi (2009), reduction in testing time, design and development time taking more time than estimated and testing is not given appropriate time till the last stages of the project are reasons of poor software effort estimates and those factors do directly affect to employee satisfaction. Also without a reliable estimate, project planning and controlling is also impossible (U.C.J.L.Perera, 2007) Therefore lack of support from management can happen because planning and controlling are mostly

considered as monument functions. Perera has done a research analyses for software effort estimation process of several companies and identified the issues, barriers and have suggested improvements to overcome the estimation issues and develop more accurate and reliable software effort estimates to get control over proper planning and controlling of software projects. It has identified that there are issues with software effort estimates, and as a last step of SDLCs testing and QA department may have an extra pressure and force from management towards deadline that cause dissatisfaction among SQA professionals.

Involvement of team members and leads and adopting their ideas and suggestions, referring historical data from similar projects helps to do more accurate effort estimations. Requirement complexity, Knowledge and experience of human resource and Scope are considered as the three main factors to consider for accurate software effort estimates.

Jayasekara in 2008 has also done a research to find out the reasons affecting the reliability of project estimates in Sri Lankan offshore software development organizations, and to propose corrective measures to mitigate those issues. Recommendations show that more importance should give on current estimation processes in Sri Lankan offshore software development organizations (Jayasekara, 2008).

Both the above researches done show that software effort estimation done in Sri Lanka is not accurate and dependable. In reality testing is often estimated inadequately (Nayyar Iqbal R. J., 2012) Iqbal and Qureshi further confirm the same issue globally and more importantly because of some best practices and theories, SQA estimates are also done based on the development effort so the error possibility and deviation of SQA effort estimation is higher. Also because of the inaccurate design and development estimates appropriate time to testing may not be given forcing QA team that leads to job dissatisfaction. It is a fact that in most occasions adequate time is not given for testers and that makes mandatory task of testing in QA is a stressful and testers may find it difficult to release the software with confident. Design and coding generally take more time than estimated or planned therefore proper management must be done in order to avoid from reduction in testing time says Iqbal and Qureshi (Nayyar Iqbal R. J., 2012).

As an example of test estimations are influenced by design and development estimates, best practices such as QA estimates should be thirty percent from the development effort, keeping three to one developer to tester ratios can be highlighted. Main logic behind these ratios is based on the assumption that there must be some relationship between amount of code and

amount of developers needed and there should be an amount of testing needed based on the amount of coding done according to Iberle and Barlett in 2002 (Kathy Iberle. Sue Bartlett, 2002). But this method is mostly recommended when there is not enough information about the project, quick estimation is required and large number of error is acceptable. According to Randall tester to developer ration has been a commonly sought matric and many organizations are interested in industry norms for this to do resource planning based on this matric. But adopting this directly may not be correct because differences in People factors such as skills, experience and attitude, processes and tools and skills in using those tools. It says that just because one company is successful using a tester to developer ratio, same ratio is applied to and successful with another company. Developer to tester ratios may be a helpful metric to understand and adjust the workload in a test organization rather than to determine staffing levels says Randall (Rice, 2009).

Factors affecting QA effort estimates.

Factors that influence test estimations are discussed by Black in 2002. Article looks at the test estimations form project manager perspective. How a project manager troubles to estimate time and number of resources allocated to project for testing is the main consideration. According to the article to do good test estimation, combination of good estimation techniques and understanding of the factors that influence effort should be there. Factors arise from the process by which work is done, factors arise from the nature of the project, tools at hand, available resource, factors arise from the people on the team and finally complicating factors such as process complexity, stakeholder involvement, many sub teams and etc. simply process, material, people and complications on each project affect the QA effort estimations. Forgetting just one of these factors can turn a realistic estimate into an unrealistic one. (Black, 2002).

3. CHAPTER 3 – METHODOLOGY

3.1 Introduction.

This section is to mainly describe the research methodology used for this study. How data was gathered for the research and how those data was analyzed is the objective of this chapter. Chapter further describe the population of the study, sample selection and techniques used to select the sample, data collection methods interviews and pilot survey done to identify and expand the data collection process.

Human satisfaction cannot be quantified. Most of the research methodologies done for job satisfaction are qualitative but quantitative methodologies have also been used such as likert scale questionnaires. Some factors such as accuracy of effort estimations, completeness of requirements, career growth, work load, recognition, duties and responsibilities and salary ranges are quantifiable to some extent. This research would require both qualitative and quantitative research methods to find the answers to the research questions. Therefore research methodology should be qualitative approach combined with quantitative approach. Research is conducted as pragmatic approach with interviews and an online questionnaire, because of the above primary reasons. But more weight of the research is from five point likert scale online questionnaire, therefore this research can be considered as a quantitative research.

To serve the purpose quantitative data analysis has been done but general qualitative data analysis is difficult to be applied for this study.

3.2 Conceptual Framework.

There is an abundance frameworks developed and adopted by researchers to study job satisfaction. This study can be seen as a study with a dependent and independent variables having a consequence on independent variable. Dependent variable of this study can be identified as "job satisfaction". With reference to the study by Jagodaarachchi 2012, Independent variables are categorized in to three namely psychological factors, physical factors and environmental factors. This model is used by Employee Job Satisfaction research done previously. (Jagodaarachchi, 2012). Following diagram shows the conceptual framework used for this research paper.

Independent Variables   **Dependent variable**

| Psychological |

- Recognition
- Career growth opportunity
- Training and certifications

| Physical |

- Salary
- Budget allocation
  (Time, Resources, Money)

| Environmental |

| Job Satisfaction / Dissatisfaction of SQA professionals' |

- Support from top management & Org. culture
- General perspective of QAs
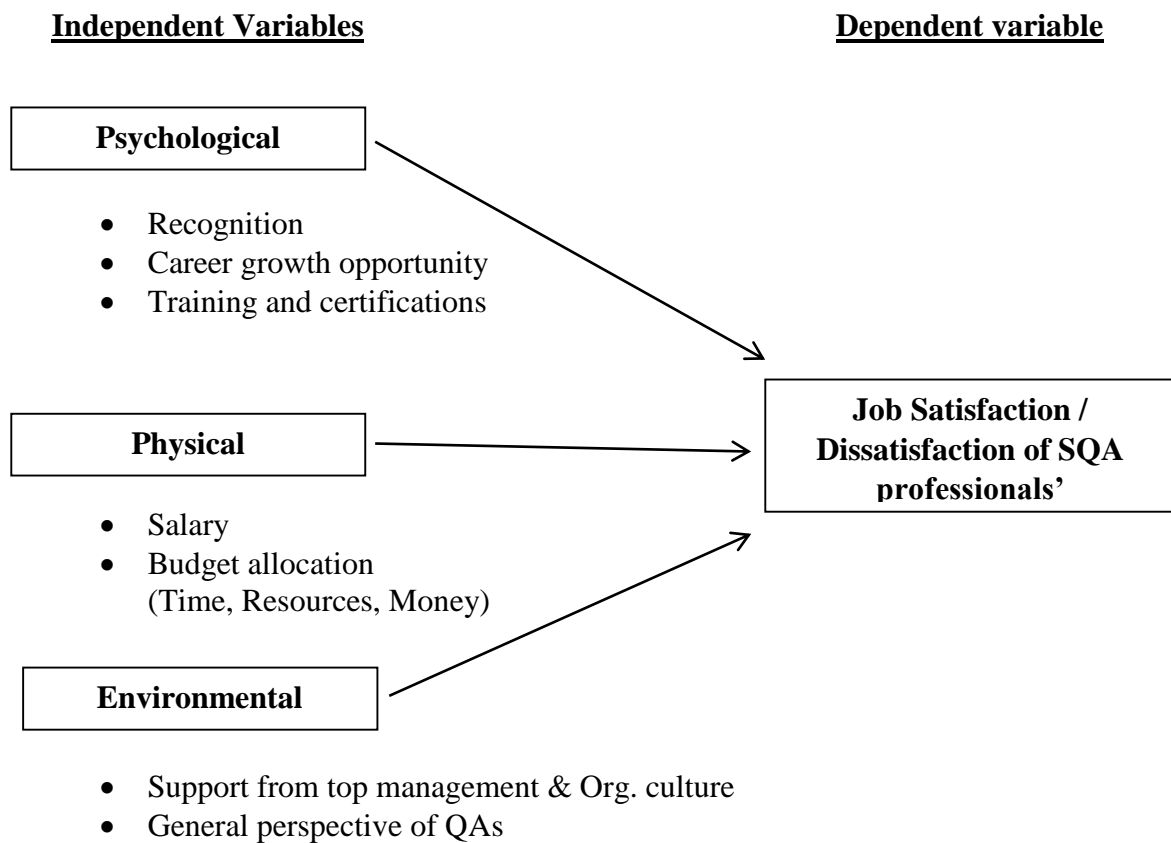
Figure 3. 1 - Conceptual Framework

Motivation to find the research topic was based on personal experiences and peer feedbacks and discussions. Based on that, a literature review was done and identified the need of finding specific job satisfaction factors with compared to other occupations in software industry.

To validate the research topic, a pilot survey was done with ten QA professionals who capable of interviewing for further clarifications. This ten include beginner level QA professionals to expert level. A questionnaire was developed based on the conceptual framework and distributed among the selected participants for pilot survey. Furthermore five questionnaires were distributed first and collected the feedback for questionnaire and answers for the questions. Interviews were carried out for further clarifications and questionnaire was modified. Then it was distributed among the next five selected QA professionals and finalized the questionnaire to be distributed among the sample. Before the data analysis, necessary measurements to confirm the validity of collected data set were done according to the standards.

Research model used for this study is visualized bellow.
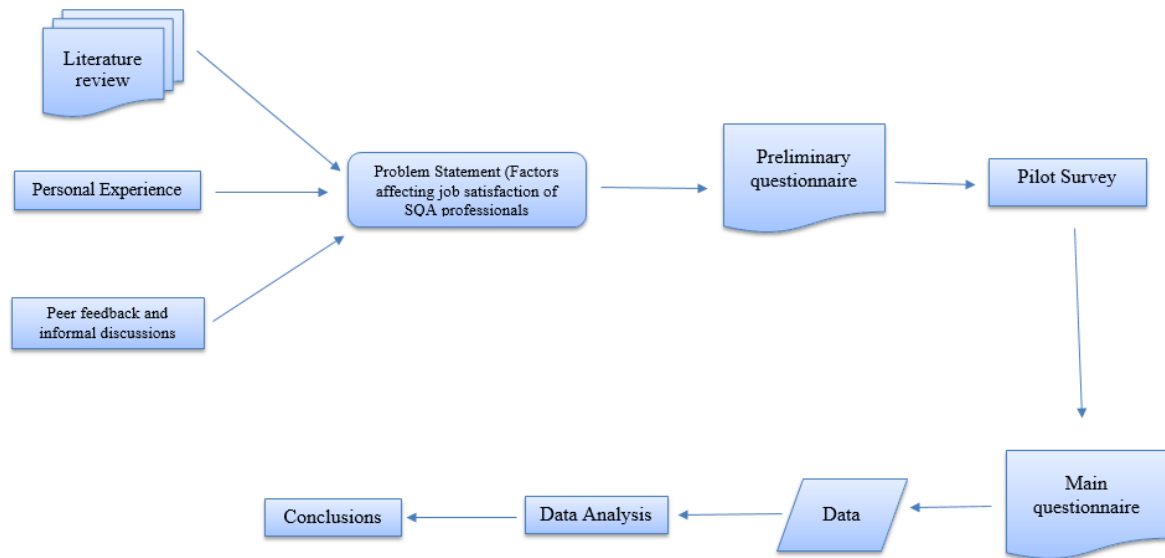
Figure 3. 2 - Research model

Table 3. 1 - Mapping of Variables to Research questionnaire

Independent variable category	Independent variable	Q #	References.
Psychological	Recognition compared to other occupations in software industry • Industry and internal recognition about QA role • Appreciation of achievements	5, 6, 7	(SHRM, 2016), (AZIRI, 2011), (Dias, 2015),
	Career growth opportunities compared to other occupations in software industry • Fare and enough growth opportunities internal/external • Clear career path until retirement	8, 9, 10	(SHRM, 2016), (Dias, 2015), (Gokuladas, 2009), (Hina Sohrab Kiani, 2007)

	Training, certifications and competencies compared to other occupations in software industry • Not enough external training opportunities • Not enough certifications from recognized and accepted authorities • Not enough opportunities for self-training and enhance skills due to internal project types	11, 12	(SHRM, 2016), (Dias, 2015), (AZIRI, 2011),
Physical	Salary compared to other occupations in software industry • Internal salary scale is lessor for QA • Compensation given to QA	13, 14, 15	(SHRM, 2016), (Dias, 2015), (Al-Zoubi, 2012), (PR Daily),
	Budget allocations such as (Time, resource and cost) compared to other occupations in software industry • Not allocating skilled and experienced QAs • Complains about time used for QA	16, 17	(SHRM, 2016), (Dias, 2015), (U.C.J.L.Perera, 2007), (Black, 2002),
Environmental	Understanding and value for QA by other project members specially management and leads and Org. culture • Appreciation from management • Attention to QA suggestions • Omitting QA tasks and trying to achieve deadlines	18, 19	(SHRM, 2016), (Dias, 2015), (Claude Y. Laporte)

	Industry opinions and beliefs about QA compared to other occupations in software industry • QA is not a good career path compared to other occupations • Good IT graduates do not apply for QA careers • Anyone with basic IT knowledge can do QA	20, 21	(SHRM, 2016), (Dias, 2015), (Perera, 2013), (Gokuladas, 2009)

3.3 Population analysis and sample design.

All the QA professionals from Sri Lankan offshore software development companies are the population for this study. All the employees and managers in QA department and all the employees doing QA, testing and test automation are considered as the population for this study.

3.3.1 Population analysis.

According to the survey "National ICT workforce – 2013" done by information and communication technology agency Sri Lanka, ICT workforce is 75107 in Sri Lanka and Projection figure for 2014 is 82,854. According to the article this trend seems to be continuing for future as well. It suggests that the momentum of growth is likely to continue in the future also (ICTA, 2013). Sample selection has to be done based on the population and this report is the base for deciding population for the study.

Additional measurement to select a fair sample is hierarchy of QA profession. Nature of the QA professional hierarchy is that top level such as QA manager, QA architects and QA leads are lesser that compared to bottom level QA professionals such as associate QA engineers, test analysts and QA engineers. Therefore the sample should include proportion from all levels of the hierarchy.

Another important aspect is the gender. According to the findings from Predictors of job satisfaction among IT graduates in offshore outsourced IT firms, female IT graduates are less satisfied with all the five facets of job satisfaction (work content, promotion, supervision, pay,

and co-workers) and overall job satisfaction than their male counterparts. Females are less satisfied with their jobs and feel a loss of interest in IT jobs but wish to remain in their present workplace. (Vathsala, 2009). Therefore sample needs to be selected without gender bias. But there are more tendencies of females looking for QA jobs than males. Therefore sample selection was not considered about the gender but data collection and analysis was done collectively as well as separately for males and females to identify any difference with gender related to job satisfaction of QA professionals.

Last consideration for a fair sample is that QA professional has divided in to Automation QAs who are more into programing aspects and manual QA professionals who are more into traditional manual testing. In most organizations, same QA professionals play both roles but some cases; there is a special team for automation only. Both these technical and non-technical are under one department which is QA department/section. Therefore sample should cover spectrum of highly technical QAs to manual testers. Importantly, data collection is not considered whether he or she is a technical or manual QA profession. Idea is to find job satisfaction compared to other profession SQA as a profession.

Additional consideration for any analysis is the company size. When it comes to Sri Lankan software development companies, there are big companies with large number of employees as well as small companies with few employees. There is a risk of majority of the sample includes QA professionals from one or two large companies and dominate the sample. These companies have different level of QA processes and resources available and also different salary scales as well. Therefore company sizes also a factor when considering about the sample size. Data collection addresses this by collecting demographic factor such as company size.

3.3.2 Sample Design.

Sri Lanka Information and Communication Technology Agency (SLICTA) is the head ICT agency of Sri Lanka and affiliated with government. According to the survey done by SLICTA overall workforce has grown from 50,159 to 75,107 from 2010 to 2013 a rise of 50% in the total work force at 14.4% compound annual growth rate (CAGR). And workforce figure of 82,854 for 2014 is a projection based on number of employees required for the coming year in the survey. It also suggests that the momentum of growth is likely to continue in the future.
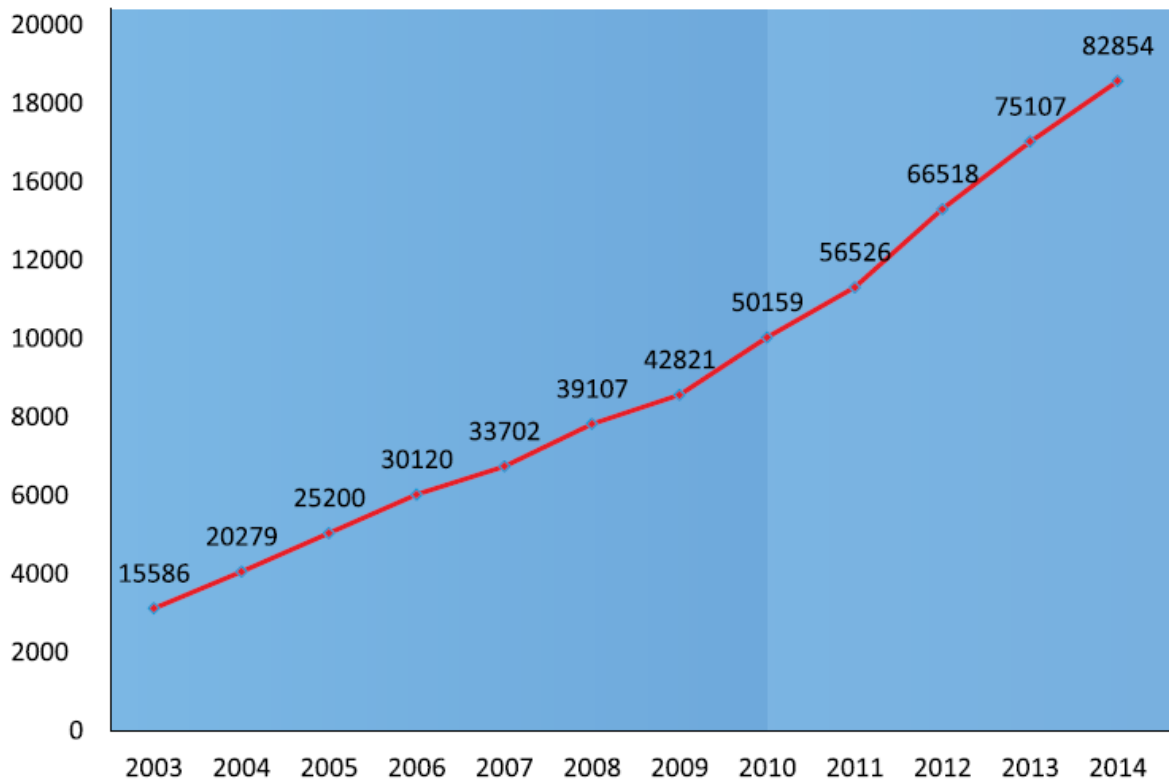
Figure 3. 3 - Growth of ICT Workforce

Another finding from the survey is that the programming/software engineering category still has the highest share among job categories. Technical support and systems/network administration categories that were the second and third categories earlier still hold the same positions with equal shares of 12% each. Database administration and development and SQA are the next largest categories is the population for this research topic. SQA percentage from the ICT workforce is 8% according to the survey findings. Based on the given values, ICT workforce to be 108,434 in 2016 and 8% of that will come under SQA category.
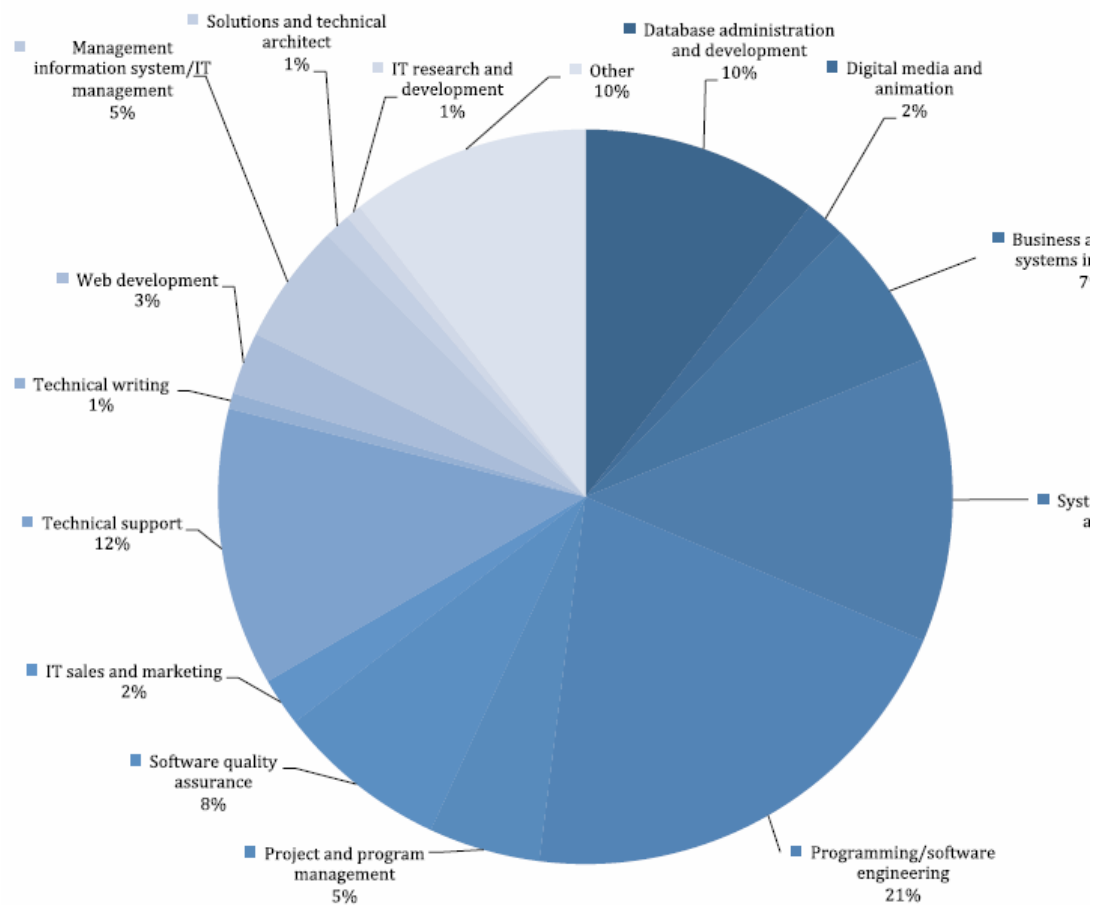
Figure 3. 4 - Profile of ICT workforce by job categories

3.3.3 Data Collection.

Research method for data gathering was online questionnaires because of the audience under analysis. A pilot questionnaire was developed before the final questionnaire to be distributed. One-on-one interviewing and discussions were conducted before developing the questionnaire with few industry professionals such as QA managers and QA leads to identify and better understand problems and what area research should be more focused on. And as mentioned earlier, necessary clarifications were gathered and questionnaire was modified after the pilot survey with ten QA professionals.

Then a secondary pilot survey was conducted. Questionnaire was distributed among 10 QA professionals who were included in population and get the answers and feedback about the

questionnaire before sending it to the entire selected sample. Both these pilot surveys are to determine the validity of the research topic, adequacy of the questionnaire and to enhance the questionnaire to correct mistakes before collecting actual data so that help to eliminate false data gathering.

It was a structured questionnaire. First part of the questionnaire is to capture the demographic information such as gender, age, designation, experience, company size etc… that need to analyses and classify collected data. As mentioned in above there can be few demographic factors that differentiate job satisfaction.

Second part of the questionnaire includes closed likert scale questions to further collect data which related to job satisfaction of QA professionals. Collect valid data from the sample is critical to analyze and to come to reasonable conclusions and to identify and rate factors affecting satisfaction of QA professionals. All responses were recorded and collected and analyzed at a later time. The participants were not tracked based on a personally identifiable information such as name, phone number or company. Global factors such as organizational culture, coworker manager relationship and salary are also considered but modified to capture specific aspects of SQA and to compare related to other occupations in software industry.

The pilot questionnaire and final questionnaire are attached in appendix 1 and 2. Each questions and statements are designed to capture the agreed or disagreed ratings as a likert scale.

4. CHAPTER 4 – DATA ANALYSIS

4.1 Introduction.

Finally gathered data was filtered, analyzed and inspect for identifying relationships, impacts and capture the most affecting factors of SQA professionals' job satisfaction. Then information are interpreted and conclusions were done to satisfy the research question. Therefore the analysis is more objects oriented. This chapter describes the data analysis of the research questionnaire.

From the first part of questionnaire, analysis is done for the collected data based on the demographic information. This will give a good understanding about the sample that has responded for the survey. This analysis was done under descriptive statistics section. Data collected under the second section of the questionnaire was mainly analyzed under psychological, physical and environmental factors to identify QA professional's satisfaction of different aspects. Psychological, physical and environmental factors under test which are recognition, career growth opportunity, training and certifications, salary, budget allocation (Time, Resources, Money) Support from top management & Org. culture, General perspective of QAs are derived based on the conceptual framework mentioned in chapter three.

As mentioned in earlier chapters the questionnaire built to analyze the impact of job satisfaction of SQA professionals was distributed among the sample population. This chapter will focus on a thorough analysis of the empirical data completed and they were presented with facts and figures, which will help the research to approve or disapprove the conceptual model.

4.2 Questionnaire Respondents Analysis

This section is to present the demographic information collected with the questionnaire. Importance of demographic information is that it allows to group the respondent to meaningful groups. Gender distribution (figure 4.2) replied for the questionnaire along with the rejected records (figure 4.1) are the first graphical presentation given. After cleaning the data for rejected records, other important demographical information such as work experience and size of the organization are illustrated below.

4.1.1. Questionnaire Completion Profile

Before the analysis few responses were taken out from the data sheet because of the incompleteness and answer was same for all questions considered as obvious outliers. 3% of the data collected was rejected.
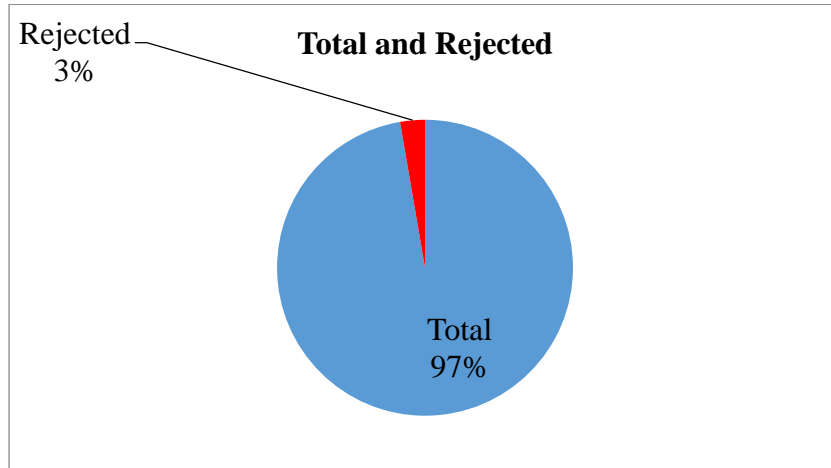
Figure 4. 1 - Total responses Vs. Rejected
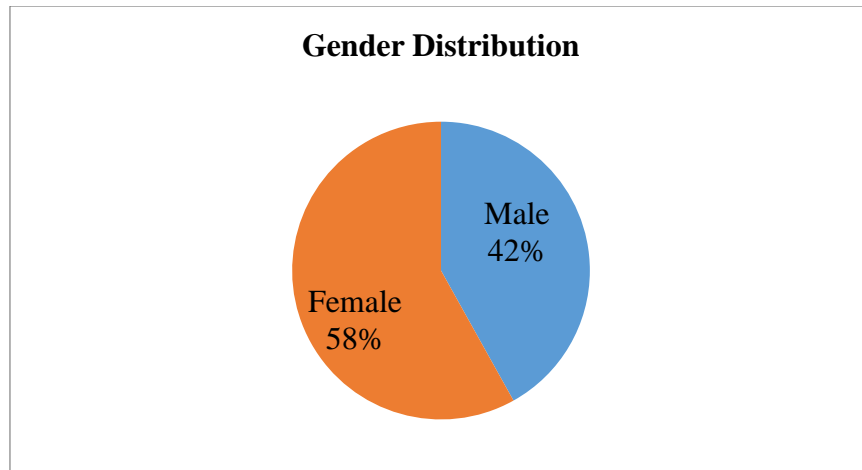
Figure 4. 2 - Gender distribution of respondents

Table 4. 1 - Gender distribution of respondents

Gender	Male	Female
Count	88	122

Total of 207 responses were recover around 350 questionnaires distributed. Exact number of questionnaires distributed was not captured because of the bulk distribution among companies that have access to one or two direct contacts. Out of received 207, 11 responses were removed due to not completing full survey which is 5% form overall responses. As expected, majority of the QAs are females that have responded compared to male responses.

4.1.2. Respondent Experience Profile
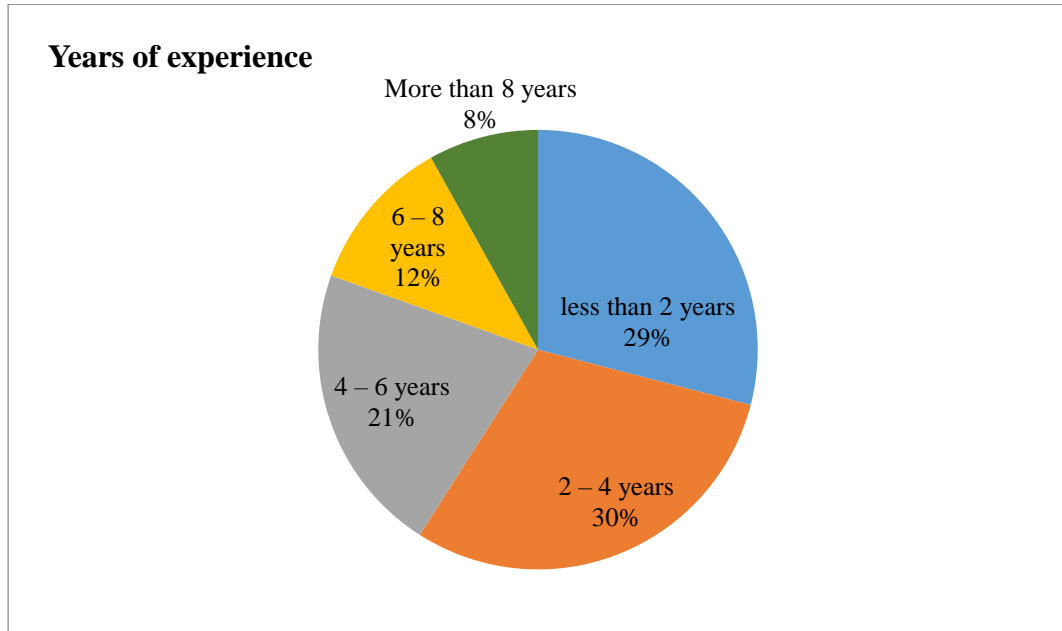
Figure 4. 3 - Respondent experience profile

Distribution of years of experience of respondents

Table 4. 2 - Years of experience

Years of experience	Count
less than 2 years	61
2 – 4 years	63
4 – 6 years	45
6 – 8 years	24
More than 8 years	17

Around 50% of the respondents are two to six years experienced. 75% respondents are less than 2 years to six years experienced. Only 19 responses were collected who has more than 8 years' experience resulting 9% of the total responses. This is also an expected behavior for responses, general observation of Sri Lankan QA professionals is that majority of QA professionals are less than 8 years. Other than the above two important factors considered

with the other factors collected, following are the demographical factors collected with the survey

4.1.3. Respondents organization size Profile
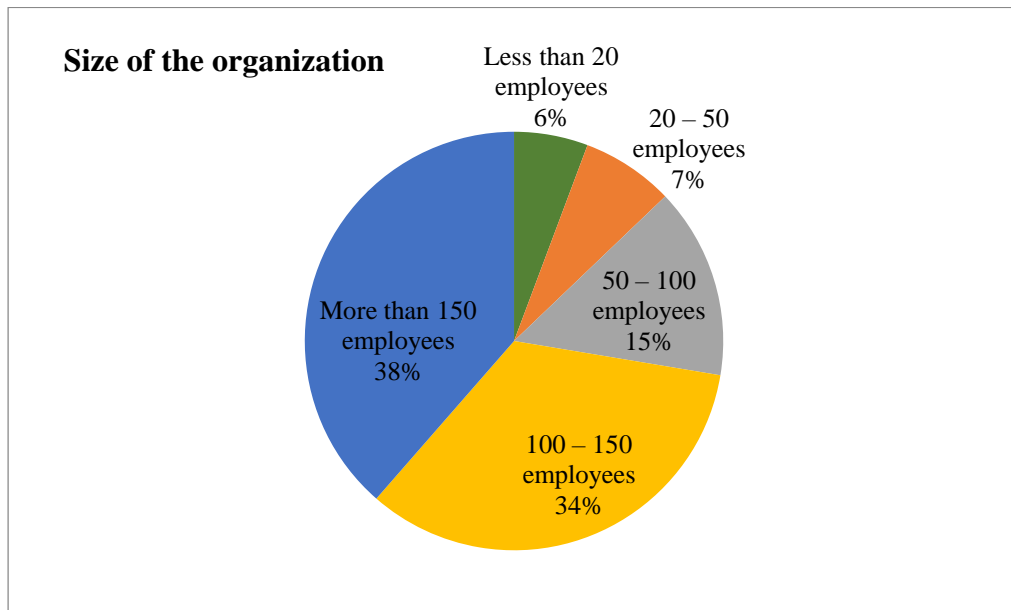
Figure 4. 4 - Size of the organization

Size of the organization currently employed

Table 4. 3 – Size of the organization

Size	Count
Less than 20 employees	12
20 – 50 employees	15
50 – 100 employees	31
100 – 150 employees	71
More than 150 employees	81

4.1.4. Respondents Job title profile

Respondents Job Title
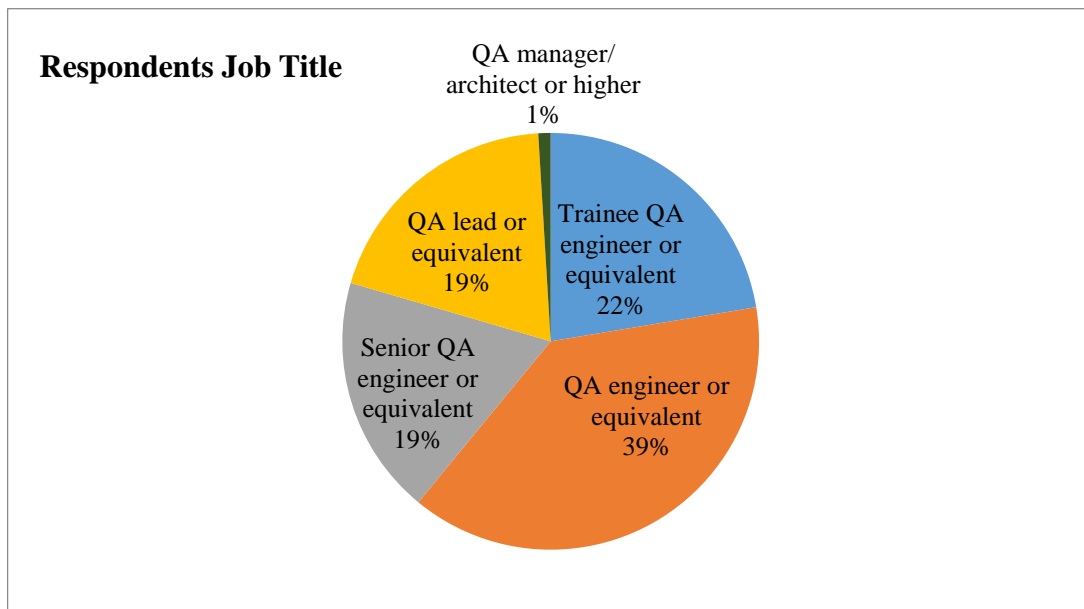
Figure 4. 5 - Job title distribution

Table 4. 4 - Job titles

Job Title	Count
Trainee QA engineer or equivalent	47
QA engineer or equivalent	81
Senior QA engineer or equivalent	39
QA lead or equivalent	41
QA manager/ architect or higher	2

4.2. Validating the data set

It is important to clean and validate the collected data set before analyzing for findings. Data cleaning will ensure the data use for analysis completeness of data and data validation measurements such as Cronbach's Alpha, Kaiser-Meyer-Olkin (KMO) test, Average Variance Extracted (AVE) is to make sure that analyzed data is useful, and the elimination of erroneous values.

4.2.1. Cronbach's Alpha Outcomes

The following Cronbach's Alpha tests were carried out by this researcher in order to check the internal consistency of the dataset. According to Nunnally (Nunnally, 1978), a Cronbach's Alpha of 0.700 is indicative sufficient reliability of the scale. Likewise, an outcome of 0.500 and above is accepted as a valid measure in this type of a test. Values obtained for the four

variables are above 0.7 and demonstrate a higher degree of consistency. It must be noted that only 186 respondents fulfilling the proposed stratified sample measures were used to answer the questionnaire in filled and returned it. (Tavakol, 2011). Following table was calculated using SPSS.

Table 4. 5 - Cronbach's alpha of independent variable summary

Independent variable	Cronbach's alpha
Recognition	0.843
Career Growth	0. 642
Training and Certifications	0. 742
Salary	0. 749
Budget allocations	0. 606
Support from top management & Org. culture	0. 832
General perspective of QAs	0. 880

Variable 1 –Recognition compared to other occupations in software industry (Cronbach's Alpha Outcomes)

Variable 1 represents recognition compared to other occupations in software industry as against job satisfaction. Recognition is a good measure of success or failure of job satisfaction. Particularly whether the job satisfactions affect recognition could be tested by using it. As per the study, The Effects of Employee Recognition, Pay, and Benefits on Job Satisfaction: Cross Country Evidence, conclude that "Both financial and nonfinancial rewards, as measured by pay, benefits and recognition have a role in influencing job satisfaction." (Mussie T. Tessema, 2013). Three questions were used to test recognition compared to other occupations in software industry. The Cronbach's Alpha value is 0.843. It is the one of the not strong values in the whole series. Therefore this is a sufficient reliability of the scale to proceed with data analysis.

Variable 2 – Career growth opportunity compared to other occupations in software industry (Cronbach's Alpha Outcomes)

Career Growth opportunities could be measured by using a number of questions as against job satisfaction, in this case three questions has been tested. Career Growth is usually measured by job satisfaction   using in other researches too. Study by Kaya and Caylen in 2014 shows that Career growth and development programs has a significant effect on job satisfaction. Conclusion of the study state that "Results of the analysis indicate that career development programs and organizational commitment have a partial effect on employee's

job satisfaction." (Çiğdem Kaya, 2014). SHRM also state that "Developing career paths and ladders are two techniques that can encourage employees to evolve in their profession." (SHRM, 2016) This research aim is to measure career growth opportunities with other occupations in software industry. Cronbach's Alpha for Career Growth is 0.642. It is not a strong value in the series but it is above 0.6. Most of the accepted value for Cronbach's Alpha is greater than .7, but it is not a hard and fast rule. Cronbach's Alpha greater than .5 is also accepted in some cases. Therefore the consistency of the data is acceptable to proceed with further analysis is good. (ResearchGate, 2013)

Variable 3 – Training and Certifications compared to other occupations in software industry (Cronbach's Alpha Outcomes)

Training and certifications available with compared to other occupations in IT industry was tested with two questions. Cronbach's Alpha for training and certifications is 0.742 which represent a good level of consistency to proceed with further analysis. According to the report by SHRM, job specific training is a factor of job satisfaction for any occupation. Same study mentions that certifications and degrees for professional development is also affecting employee job satisfaction (SHRM, 2016). In this case training and certifications with compared to the other occupations in IT sector is measured because of the feeling that QA specific trainings and certifications are limited compared to occupations such as SE, networking and BA.

Variable 4 – Salary compared to other occupations in software industry (Cronbach's Alpha Outcomes)

Salary compared to other occupations in software industry was tested by using three questions. Cronbach's Alpha for Salary and compensations is 0.749 which represents a good level of consistency to proceed with further analysis. As much as financial benefits have an impact on job satisfaction and it will affect positively. Therefore Salary and compensations impacts on job satisfaction to a greater extent. SHRM also state that "Along with job security, compensation/pay has been one of the top five contributors to job satisfaction since 2002" (SHRM, 2016). But there are debates that money/salary is not a factor of job satisfaction. But the intention of these questions is to compare with other occupations same in software industry that has same experience and academic qualifications.

Variable 5 – Budget allocations compared to other occupations in software industry (Cronbach's Alpha Outcomes)

A budget allocation such as SQA time and effort estimations compared to other occupations in software industry was tested with three questions. Cronbach's Alpha for this is 0.606. Again it is not a strong value for the collected data. But going with the career growth opportunity variable, (variable 2) .606 is adequate to proceed with the data analysis. Also overall Cronbach's alpha is above 0.7. Therefore further analysis was carried out for hypothesis testing.

Variable 6 – Support from top management and organizational culture (Cronbach's Alpha Outcomes)

Support from top management and organizational culture is important to understand how job satisfaction grows among employees. This factor is an ideal and important factor to measure, because support from top management and organizational culture will have a direct impact towards the job satisfactions. Two questions were asked and Cronbach's Alpha for support from top management and organizational culture is .832. Yet again this is a very good statistic confirming internal consistency of the dataset. SHRM has divided this into several categories. From those factors "Management's Recognition of Employee Job Performance" is most relevant to this study. Forty-eight percent of employees reported that management's recognition of employee job performance was very important to their job satisfaction in the SHRM study carried out related to job satisfaction in 2016. (SHRM, 2016)

Variable 7 – General perspectives of QA compared to other occupations in software industry (Cronbach's Alpha Outcomes)

Variable 5 represents general perspectives of QA as against job satisfaction. This variable is again a good measure of success or failure of job satisfaction. Two questions were used to test this variable. The Cronbach's Alpha value is 0.880 indicating a good internal consistency to proceed with data analysis. This variable is related to perspective of SQA professionals towards their profession as well as industry perspective towards SQA profession.

Cronbach's Alpha is a good measure of internal consistency, but to provide more evidence that data set is suitable for analysis; research has used Kaiser-Meyer-Olkin (KMO) Test, Average Variance Extracted (AVE) and Composite Reliability (CR) in primary analysis of the dataset.

KMO test and p-value of Bartlett's Test of Sphericity both are a measure of how suited your data is for factor analysis and is a measure of sampling adequacy. According to Fornell and Larcker, the convergent validity of the measurement model can be assessed by the Average Variance Extracted (AVE) and Composite Reliability (CR) (Fornell, 1981). Both AVE and CP is also calculated and validated for the data set before further analysis.

4.3. Validity testing

The following table summarizes the key measures that caused in testing convergent validity of data.

Table 4. 6 - Validity Testing summary

	Kaiser-Meyer-Olkin (KMO)	p-value of Bartlett's Test of Sphericity	Average Variance Extracted (AVE)	Composite Reliability (CR)
Independent Variables				
Recognition	0.717	0.000	0.366	0.597
Career growth	0.684	0.000	0.496	0.725
Training and Certifications	0.500	0.000	0.407	0.410
Salary and compensations	0.516	0.000	0.309	0.650
Support from top management and organizational culture	0.600	0.000	0.731	0.845
General perspective of QA	0.500	0.000	0.710	0.830
Dependent Variable				
QA professionals job satisfaction	0.665	0.000	0.542	0.777

4.3.1. Justification of validity testing

Use of Cronbach's Alpha was described in above chapter for reliability of data set. KMO and Bartlett's test of Sphericity is a measurement of factorability of the data set. Factorability is the assumption that there are at least some correlations amongst the variables so that coherent factors can be identified (wikiversity, 2016). It is recommended that if the KMO is greater than .5 and Bartlett's test of Sphericity is significant it is adequate to proceed with factor analysis. To be accurate for factor Analysis to be recommended suitable, the Bartlett's Test

of Sphericity must be less than 0.05 and KMO should be greater than 0.6 is the recommended. But some authors KMO should be greater than 0.5. for this study, all the KMO values for independent variables are greater than 0.5 and two out of six has values greater than 0.6. It is another measure to do before the factor analysis is confirmatory factor analysis with convergent and discriminate validity. Convergent validity means that each measurement item has high correlations with other items which measure the same hypothetical construct (Reliability and Validity, 2011). According to Wynne W. Chin, convergent validity can be proved when all factor loading of same construct be higher than 0.7. Additionally, average variance extracted (AVE) should be higher than 0.5 and Composite reliability should be higher than 0.7 for all constructs of a measurement model (Reliability and Validity, 2011). (Chin, 1998).

Following table 4.3 present the justifications for the outcome presented in table 4.2 under each validity and reliability test, KMO and AVE above 0.5 and CR greater than 0.7.p-value of Bartlett's test is less than 0.05.Therefore all measures are within the required limits to ensure the reliability and validity of the data set.

Table 4. 7 - Validity testing justification

Cronbach's Alpha	Cronbach's Alpha outcome shows above 0.7, therefore, the reliability is high.
KMO	KMO outcome shows above or equal to 0.5, therefore, it shows the high applicability of factor analysis
Bartlett's Test of Sphericity	Bartlett's Test of Sphericity outcome shows below 0.05, therefore, the factor analysis is much suitable.
Average Variance Extracted (AVE)	Convergent validity cannot be considered as high. But AVE outcome shows above 0.5, for three variables including dependent variable and .49 for one independent variable which is very close to five. Because of other values shows a strong validity, research can proceed with further analysis of captured data
Composite Reliability (CR)	Construct validity of each variable also cannot be considered as high. But CR values outcome shows above 0.7, for four variables. .6 And .5 for the other two, therefore, research is good to go with further analysis with a strong Cronbach's Alpha and KMO values.

Other than the different variables measured individually in Table 4.3 above, entire data set should be reliable and validity of data set should be checked before the analysis. According to table 4.5 and 4.6 Cronbach's Alpha outcome for the entire variable set is 0.909 which is above 0.7 and therefore, the reliability is high. KMO is also 0.749 and Bartlett's Test of Sphericity outcome shows 0.000, therefore, the factor analysis is much suitable.

4.4. Descriptive Statistics.

Following descriptive statistics were utilized by the researcher to exhibit the qualities for mean, standard deviation and fluctuation for each of the variables. Descriptive statistics is the term given to the analysis of data that helps describe, show or summarize data in a meaningful way such that, for example, patterns might emerge from the data. Descriptive statistics do not, however, allow us to make conclusions beyond the data we have analyzed or reach conclusions regarding any hypotheses we might have made. They are simply a way to describe our data (Descriptive and Inferential Statistics). Descriptive statistics involves summarizing and organizing the data so they can be easily understood. Descriptive statistics, unlike inferential statistic, seeks to describe the data, but do not attempt to make inferences from the sample to the whole population (Albright, 2016). Descriptive statistics help us to simplify large amounts of data in a sensible way. Each descriptive statistic reduces lots of data into a simpler summary. (William, 2006).

Therefore following section of descriptive statistics of the collected data from SQA professionals help to simplify in a sensible way. It can be consider as a simpler summery of the dataset before further analysis for conclusions with inferential statistics.

4.4.1. Variable 1: Recognition compared to other occupations in software industry (Descriptive Statistics)

For the recognition compared to other occupations in software industry three questions were asked from the participants. Average score for the three questions were calculated for each respond and stored in to a one variable for the calculations.

The following descriptive statistics table shows the total distribution and means score of the 'Recognition' variable. The overall mean score of this variable stands at 2.4 , with a median of 2.33 and mode of 2.33 Overall, the response for the 'Recognition' variable based on likert scale data falls between 'Neutral' and 'Agree' based on the mode of 3.490.

Table 4. 8 – Table of descriptive statistics (Recognition compared)

Statistics		
Total Recognition	**Recognition Compared**	
N	Valid	210
	Missing	0
Mean		2.458
Median		2.333
Mode		2.333
Std. Deviation		0.743
Variance		0.552
Skewness		1.254
Std. Error of Skewness		0.166
Range		2.667

Histogram for Recognition
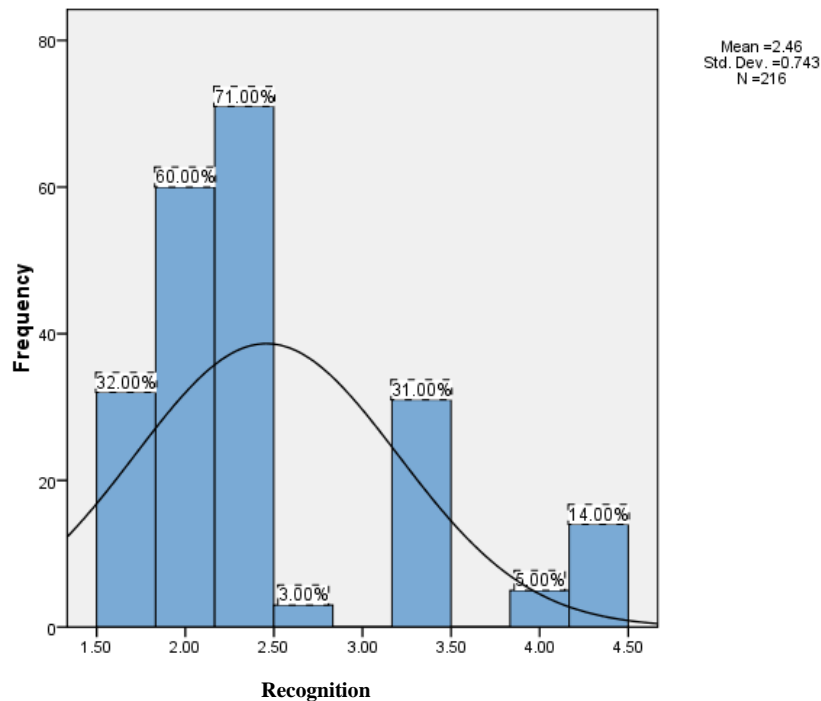
Figure 4. 6 - Histogram (Recognition compared)

4.4.2. Variable 2: Career Growth opportunity compared to other occupations in software industry (Descriptive statistics)

The following descriptive statistics table shows the total distribution and means score of the 'Career growth' variable. The overall mean score of this variable stands at 2.255 , with a median of 2.000 and mode of 2.00 Overall, the response for the 'Career growth' variable based on likert scale data falls between 'Neutral' and 'Agree' based on the mode of 2.00.

Same as other variables, three questions were asked and summarized in to a one variable for analysis purpose.

Table 4. 9 - Table of descriptive statistics (Career growth compared)

Statistics		
Total Career Growth	**Career Growth compared**	
N	Valid	210
	Missing	0
Mean		2.248
Median		2.000
Mode		2.000
Std. Deviation		0.486
Variance		0.236
Skewness		0.787
Std. Error of Skewness		0.166
Range		1.667

Histogram for Career growth
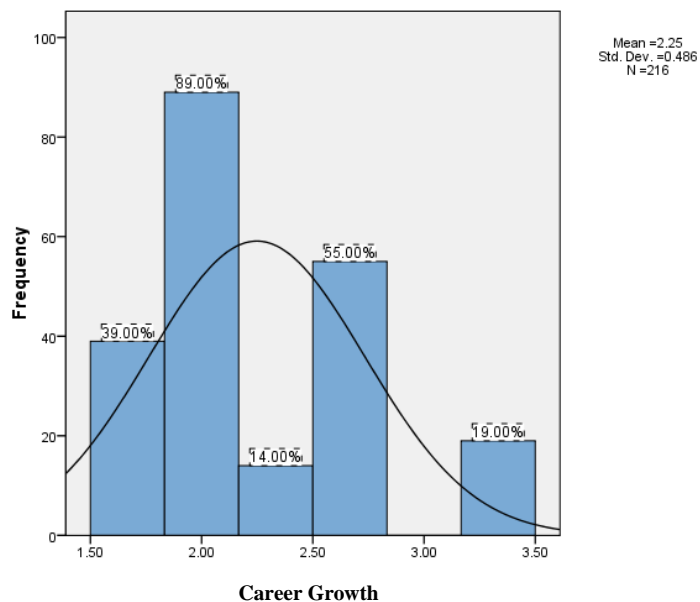
Figure 4. 7 - Histogram (Career growth compared)

4.4.3. Variable 3: Training and certifications compared to other occupations in software industry (descriptive statistics)

The following descriptive statistics table shows the total distribution and means score of the 'Training and certifications" variable. Overall mean score of this variable stands at 2.800, with a median of 2.444 and mode of 2.00. Overall, the response for the 'Salary and

compensations' variable based on likert scale data falls between 'Neutral' and 'Agree' based on the mode and mean scores.

Two questions were asked and summarized for a one variable for the analysis purpose.

Table 4. 10 - Table of descriptive statistics (Training and Certifications compared)

Statistics		
Total Training	**Training and Certification compared**	
N	Valid	210
	Missing	0
Mean		2.444
Median		2.000
Mode		2.000
Std. Deviation		0.748
Variance		0.560
Skewness		0.184
Std. Error of Skewness		0.166
Range		2

Histogram for Training and Certifications
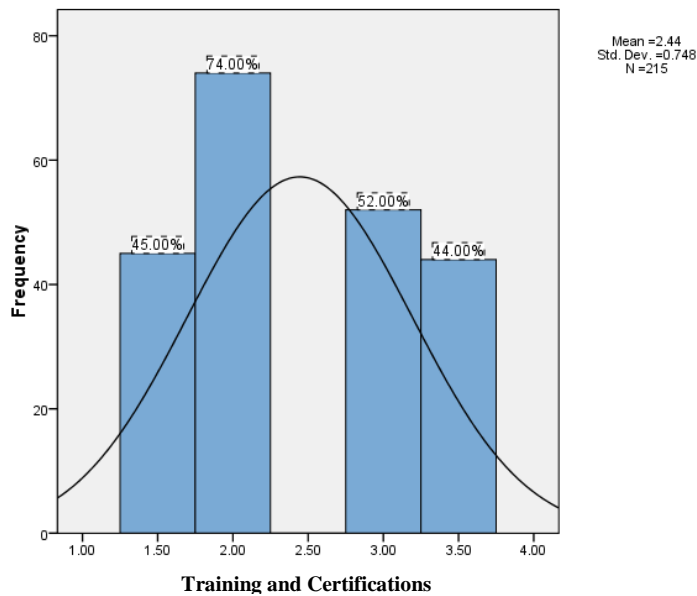
Figure 4. 8 - Histogram (Training and certifications compared)

4.4.4. Variable 4: Salary compared to other occupations in software industry (descriptive statistics)

The following descriptive statistics table shows the total distribution and means score of the 'Salary" variable. Overall mean score of this variable stands at 2.800, with a median of 2.133

and mode of 3.499. Overall, the response for the 'Salary and compensations' variable based on likert scale data falls between 'Neutral' and 'Agree' based on the mode of 3.499.

Three questions were asked and summarized for a one variable for the analysis purpose.

Table 4. 11 - Table of descriptive statistics (Salary)

Statistics		
Total Salary	**Total Salary Compared**	
N	Valid	210
	Missing	0
Mean		2.364
Median		2.000
Mode		2.000
Std. Deviation		0.554
Variance		0.307
Skewness		0.288
Std. Error of Skewness		0.166
Range		1.667

Histogram for Salary
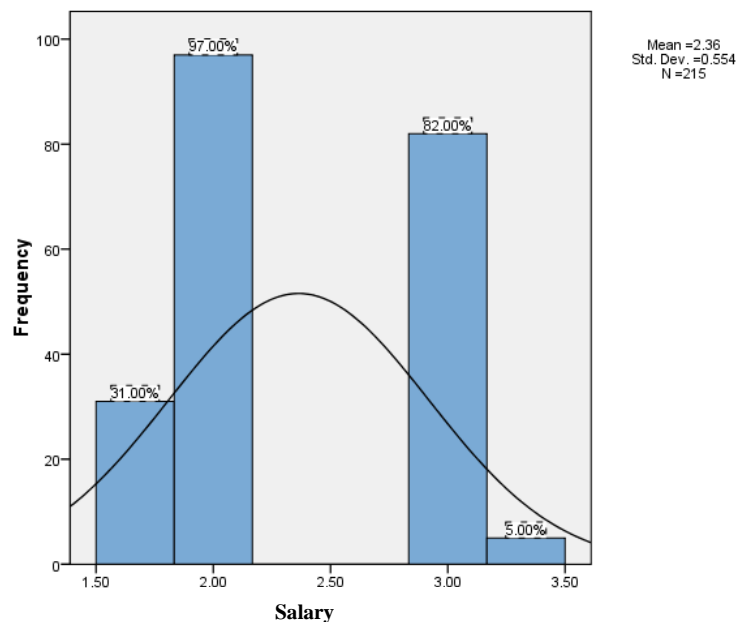
Figure 4. 9 - Histogram (Salary)

4.4.5. Variable 5: Budget allocations compared to other occupations in software industry (Descriptive Statistics)

The following descriptive statistics table shows the total distribution and means score of the 'budget allocation" compared to other occupations in software industry variable. Overall mean score of this variable stands at 2.229, with a median of 2.133 and mode of 3.499. Overall, the response for the 'Salary and compensations' variable based on likert scale data falls between 'Neutral' and 'Agree' based on the mode of 3.499. Three questions were asked and summarized for a one variable for the analysis purpose.

Table 4. 12 - Table of descriptive statistics (Budget allocations compared)

Statistics		
Total Budget	Total Budget compared	
N	Valid	210
	Missing	0
Mean		2.229
Median		2.000
Mode		2.000
Std. Deviation		0.477
Variance		0.227
Skewness		1.770
Std. Error of Skewness		0.166
Range		1.333

Histogram for Budget allocation
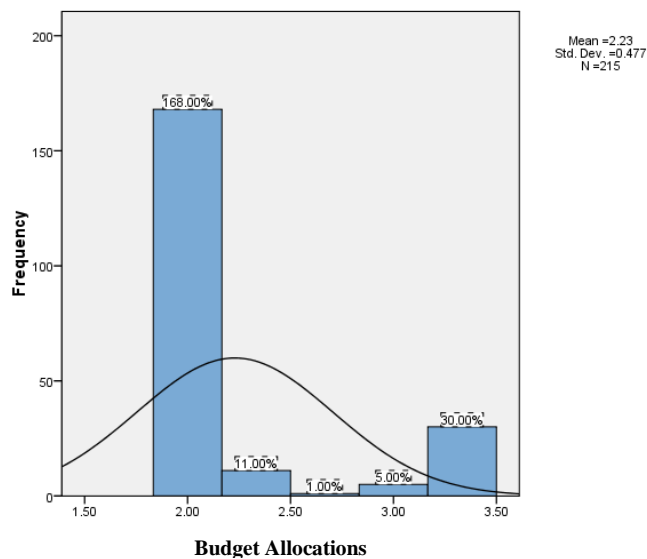
Figure 4. 10 - Histogram (Budget allocation compared)

4.4.6. Variable 6: support from top management and organizational culture (Descriptive Statistics)

The following descriptive statistics table shows the total distribution and means score of the 'support from top management and organizational culture" variable. Overall mean score of this variable stands at 2.870, with a median of 2.471 and mode of 3.018. Overall, the response for the 'support from top management and organizational culture' variable based on likert scale data falls between 'Neutral' and 'Agree' based on the mode of 3.018.

Table 4. 13 - Table of descriptive statistics (support from top management and org. culture compared)

Statistics		
Total management support and org. culture	**Management support and culture compared.**	
N	Valid	210
	Missing	0
Mean		2.363
Median		2.000
Mode		2.000
Std. Deviation		0.656
Variance		0.431
Skewness		2.421
Std. Error of Skewness		0.166
Range		2.500

Histogram for support from top management and organizational culture
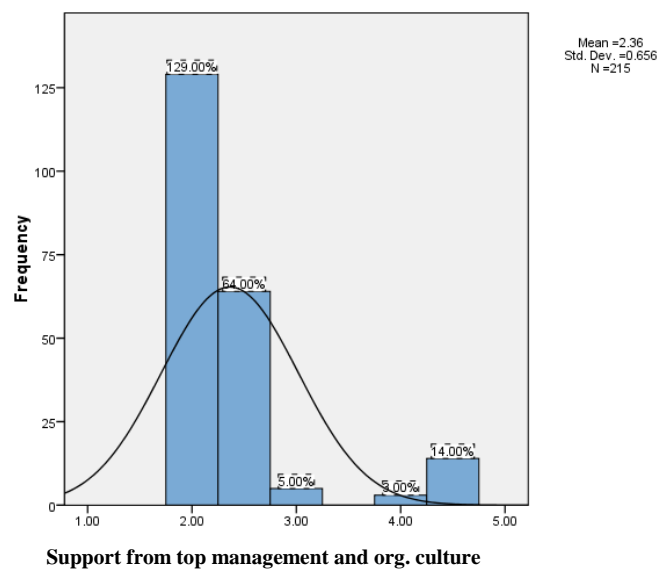
Figure 4. 11 – Histogram (support from top management and org. culture compared)

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4.4.7. Variable 7: General perspective about SQA profession compared to other occupations in software industry (Descriptive Statistics)

The following descriptive statistics table shows the total distribution and means score of the 'General perspective about SQA" variable. Overall mean score of this variable stands at 2.234, with a median of 2.471 and mode of 3.018. Overall, the response for the 'General perspective about SQA' variable based on likert scale data falls between 'Neutral' and 'Agree' based on the mode of 3.018.

Table 4. 14 – Table of descriptive statistics (General perspective about SQA compared)

Statistics		
Total general perspective	General perspective towards SQA compared	
N	Valid	210
	Missing	0
Mean		2.235
Median		2.500
Mode		1.500
Std. Deviation		0.710
Variance		0.504
Skewness		-0.002
Std. Error of Skewness		0.166
Range		1.500

Histogram for general perspective towards SQA
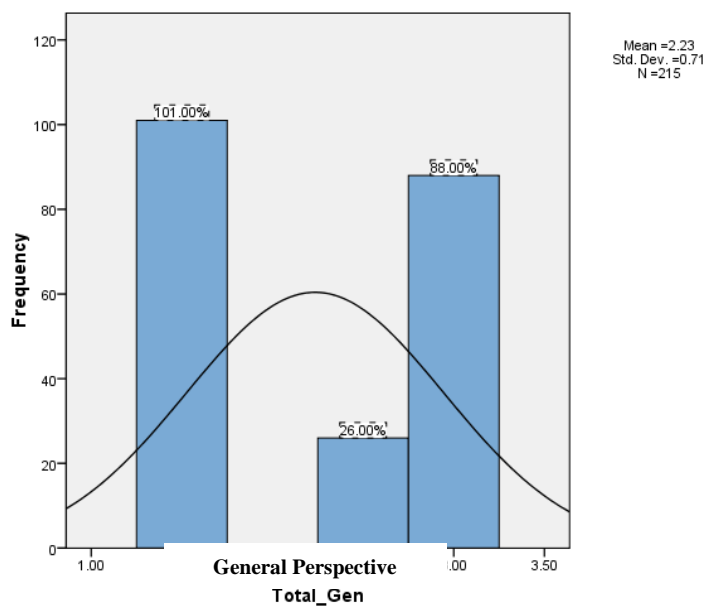
Figure 4. 12 - Histogram (General perspective about SQA compared)

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4.5. Hypothesis Testing

As for the conceptual framework, study has three broad hypotheses which influence job satisfaction of SQA professionals'. Those three are physiological, physical and environmental factors. Each three main hypothesis have sub hypotheses that specify and categorized into more meaningful variables to test those categories. Use of this sub hypotheses or hierarchy of hypothesis (HoH) is an acceptable and effective way according to Alejandro and Sabrina. (Alejandro G. Farji-Brener, 2014).

A hypothesis is a suggestion put forward as a clarification for the event of some watched wonder, stated either as a temporary guess to guide examination, called a working speculation, or acknowledged as profoundly likely in lieu of the built up certainties. An investigative speculation can turn into a hypothesis or at last a law of nature in the event that it is demonstrated by repeatable trials. Speculation testing is basic in measurements as a strategy for settling on choices utilizing information. At the end of the day, testing a theory is attempting to figure out whether the perception of some wonder is prone to have truly happened in light of measurements. As per the san Jose state college insights office, theory testing is a standout amongst the most vital ideas in measurements since it is the manner by which you choose if something truly happened, or if certain medicines have beneficial outcomes, or if bunches contrast from each other or on the off chance that one variable predicts another. To put it plainly, you need to demonstrate if the information is measurably critical and unrealistic to have happened by chance alone. Basically then, a speculation test is a trial of noteworthiness (Dubois, n.d.).

4.6. Formulation of Hypothesis

Out of the three main hypotheses, the hypothesis H1 proposes that the recognition, career growth opportunity and training and certification compared to other occupations in software industry psychological factors influence SQA employees job satisfaction. For the reason that H1 consists of three individual variables, H1 is sub hypothesized into three sub hypotheses. With the null hypotheses for each variable, H1 has six sub hypotheses under test.

$H1a_o$: Recognition compared to other occupations has no impact on the QA professionals' job satisfaction

$H1a$: Recognition compared to other occupations has an impact on the QA professionals' job satisfaction

H1b$_o$: Career Growth opportunity compared to other occupations has no impact on the QA professionals' job satisfaction

H1b: Career Growth opportunity compared to other occupations has an impact on the QA professionals' job satisfaction

H1c$_o$: Training and Certifications compared to other occupations have no impact on the QA professionals' job satisfaction.

H1c: Training and Certifications compared to other occupations have an impact on the QA professionals' job satisfaction.

Same as the above H1 and sub hypotheses, physical category has two variables and therefore with the null hypotheses, four hypotheses were under test for this study.

H2a$_o$: Salary compared to other occupations has no impact on the QA professionals' job satisfaction.

H2a: Salary compared to other occupations has an impact on the QA professionals' job satisfaction.

H2b$_o$: Budget allocation compared to other occupations has no impact on the QA professional's job satisfaction.

H2b: Budget allocation compared to other occupations has an impact on the QA professional's job satisfaction.

Going with the same as above, last category has two variables resulting four hypotheses with null hypotheses.

H3ao: support from top management and organizational culture compared to other occupations has no impact on the QA professional's job satisfaction.

H3a: support from top management and organizational culture compared to other occupations has an impact on the QA professional's job satisfaction.

H3bo: General perspective of SQA compared to other occupations has no impact on the QA professional's job satisfaction.

H3b: General perspective of S compared to other occupations has an impact on the QA professional's job satisfaction.

Following sections show the correlations between each sub hypotheses and job satisfaction of SQA professionals.

4.6.1. Correlation between Recognition compared to other occupations and job satisfaction

H1a$_o$: Recognition compared to other occupations has no impact on the QA professionals' job satisfaction

H1a: Recognition compared to other occupations has an impact on the QA professionals' job satisfaction

The table shows, the correlation between the job satisfaction and the Recognition. These variables have a positive but week relationship between the variables, and show a week outcome of .545.

Table 4. 15 - Correlation (Recognition compared)

		QA professionals job satisfaction
Recognition compared to other occupations in IT industry	Pearson Correlation	.545[**]
	Sig. (2-tailed)	0.000
	N	210

4.6.2. Correlations between Career Growth compared to other occupations and job satisfaction

H1b$_o$: Career Growth opportunity compared to other occupations has no impact on the QA professionals' job satisfaction

H1b: Career Growth opportunity compared to other occupations has an impact on the QA professionals' job satisfaction

The correlation between Career Growth and job satisfaction in the any industry is shown in the following table. This outcome is statistically significant at .719. And also the relationship

between Career Growth and job satisfaction fundamentally regulates a strong outcome. There is a strong correlation between Career Growth and job satisfaction, which means the outcome, is positively significant.

Table 4. 16 - Correlations (Career growth compared)

		QA professionals job satisfaction
Career growth compared to other occupations in IT industry	Pearson Correlation	.719[**]
	Sig. (2-tailed)	0.000
	N	210

4.6.3. Correlation between Training and Certifications compared to other occupations and job satisfaction

H1c$_o$: Training and Certifications compared to other occupations have no impact on the QA professionals' job satisfaction.

H1c: Training and Certifications compared to other occupations have an impact on the QA professionals' job satisfaction.

The following table demonstrates the correlation between Training and Certifications compared to other occupations and job satisfaction. Relationship between these two variables also strong at .779 this type of outcome mainly shows the important of the relationship with a good significant level.

Table 4. 17 - Correlations (Training and certifications compared)

		QA professionals job satisfaction
Training and Certifications compared to other occupations in IT industry	Pearson Correlation	.779[**]
	Sig. (2-tailed)	0.000
	N	210

4.6.4. Correlation between Salary compared to other occupations and job satisfaction

H2a$_o$: Salary compared to other occupations has no impact on the QA professionals' job satisfaction.

H2a: Salary compared to other occupations has an impact on the QA professionals' job satisfaction.

The following table demonstrates the correlation between Salary and compensations and job satisfaction. Relationship between these two variables also strong at .907 this type of outcome mainly shows the important of the relationship with a good significant level.

Table 4. 18 - Correlations (Salary compared)

		QA professionals job satisfaction
Salary compared to other occupations in IT industry	Pearson Correlation	.907**
	Sig. (2-tailed)	0.000
	N	210

4.6.5. Correlation between Budget allocations compared to other occupations in software industry and job satisfaction

H2b$_o$: Budget allocation compared to other occupations has no impact on the QA professional's job satisfaction.

H2b: Budget allocation compared to other occupations has an impact on the QA professional's job satisfaction.

The table shows, the correlation between the job satisfaction and the budget allocations compared to other occupations in software industry. These variables have a positive very week relationship between the variables, and show an outcome of .309. This shows that there is no relationship between Budget allocations compared to other occupations compared to other occupations in software industry has an impact on SQA professionals' job satisfaction.

Table 4. 19 - Correlation (Budget allocation compared)

		QA professionals job satisfaction
Budget allocations compared to other occupations in IT industry	Pearson Correlation	.309**
	Sig. (2-tailed)	0.000
	N	210

4.6.6. Correlation between support from top management and organizational culture compared to other occupations and job satisfaction

H3a$_o$: support from top management and organizational culture compared to other occupations has no impact on the QA professional's job satisfaction.

H3a: support from top management and organizational culture compared to other occupations has an impact on the QA professional's job satisfaction.

The table shows, the correlation between the job satisfaction and the support from top management and organizational culture. These variables have a positive very week relationship between the variables, and show an outcome of .394. This shows that there is no relationship between support from top management and organizational culture compared to other occupations in software industry has an impact on SQA professionals' job satisfaction.

Table 4. 20 - Correlation (support from top management and org. culture compared)

		QA professionals job satisfaction
Support from top management and org. culture compared to other occupations in IT industry	Pearson Correlation	.394**
	Sig. (2-tailed)	0.000
	N	210

4.6.7. Correlation between general perspective of SQA compared to other occupations and job satisfaction

H3b$_o$: General perspective of SQA compared to other occupations has no impact on the QA professional's job satisfaction.

H3b: General perspective of S compared to other occupations has an impact on the QA professional's job satisfaction.

The table shows, the correlation between the job satisfaction and the General perspective of QA. These variables have a positive significant relationship between the variables, and show a strong outcome of .839.

Table 4. 21 - Correlation (General perspective of QA compared)

		QA professionals job satisfaction
General perspective of SQA compared to other occupations	Pearson Correlation	.816[**]
	Sig. (2-tailed)	0.000
	N	210

4.7. Analysis of variance or 'ANOVA'

The ANOVA table is used to discuss the level of significance between the variables and test whether three or more groups (categories) are different (Mark Saunders, 2009). ANOVA analysis is use to determine if whether there is a statistically significant difference among the groups that are not related to sampling error. With the ANOVA analysis, independent variable is analyzed to determine a significant effect. If the number for significant value less than the critical value of alpha which is usually set at .05, then the effect is said to be significant. Any value less than this will result in significant effects, while any value greater than this value will result in non-significant effects. Therefore if the sig value is less than .05 for dependent and independent variable it is said to be influence of independent variable to dependent variable has a less probability to happen by chance such as sampling errors. When this is compared with F value, higher the F values lower the significant value.

4.7.1. The one way ANOVA analysis

Table 4. 22 - The 'one way ANOVA' analysis summary

ANOVA		Sum of Squares	df	Mean Square	F	Sig.
Total_Rec	Between Groups	69.855451	6	11.64258	49.7804	0.000
	Within Groups	48.88066	209	0.233879		
	Total	118.73611	215			
Total_CG	Between Groups	33.677336	6	5.612889	68.6023	0.000
	Within Groups	17.099927	209	0.081818		
	Total	50.777263	215			
Total_Training	Between Groups	98.077066	6	16.34618	156.299	0.000
	Within Groups	21.753166	208	0.104583		
	Total	119.83023	214			
Total_Sal	Between Groups	61.625797	6	10.27097	512.626	0.000
	Within Groups	4.167485	208	0.020036		
	Total	65.793282	214			
Total_Bud	Between Groups	35.483993	6	5.913999	93.2178	0.000
	Within Groups	13.19611	208	0.063443		
	Total	48.680103	214			
Total_MGT	Between Groups	40.356139	6	6.726023	26.9839	0.000
	Within Groups	51.846187	208	0.249261		
	Total	92.202326	214			
Total_Gen	Between Groups	88.265731	6	14.71096	155.936	0.000
	Within Groups	19.622642	208	0.09434		
	Total	107.88837	214			

4.7.2. Recognition (ANOVA analysis)

The ANOVA table shows a 0.000 for significant value for recognition compared to other occupations which is the independent variable. Therefore the sig. value is less than the threshold value which is 0.05. Dependent variable is job satisfaction of SQA professionals. Therefore null hypothesis is rejected which is "Job satisfaction of SQA professionals and recognition compared to other occupations in software industry" shows a strong correlation by chance.

4.7.3. Career Growth opportunity (ANOVA analysis)

The ANOVA table shows a 0.000 for significant value for career growth opportunity compared to other occupations which is the independent variable. The sig. value is less than

the threshold value which is 0.05. Dependent variable is job satisfaction of SQA professionals. Therefore null hypothesis is rejected which is "Job satisfaction of SQA professionals and career growth opportunity compared to other occupations in software industry" shows a strong correlation by chance.

4.7.4. Training and Certifications (ANOVA analysis)

The ANOVA table shows a 0.000 for significant value for training and certification compared to other occupations which is the independent variable. The sig. value is less than the threshold value which is 0.05. Dependent variable is job satisfaction of SQA professionals. Therefore null hypothesis is rejected which is "Job satisfaction of SQA professionals and training and certification compared to other occupations in software industry" shows a strong correlation by chance.

4.7.5. Salary (ANOVA analysis)

Null hypothesis is rejected which is "Job satisfaction of SQA professionals and salary compared to other occupations in software industry" shows a strong correlation by chance. The ANOVA table shows a 0.000 for significant value for salary compared to other occupations which is the independent variable. The sig. value is less than the threshold value which is 0.05. Dependent variable is job satisfaction of SQA professionals.

4.7.6. Budget allocations (ANOVA analysis)

During the correlation test there was no significant correlation between budget allocations and job satisfaction of SQA professionals so the null hypothesis was accepted. Null hypothesis for the ANOVA analysis can be rejected which is "Job satisfaction of SQA professionals and budget allocations compared to other occupations in software industry" shows a week correlation by chance. The ANOVA table shows a 0.000 for significant value for budget allocations compared to other occupations which is the independent variable. The sig. value is less than the threshold value which is 0.05. Dependent variable is job satisfaction of SQA professionals.

4.7.7. Support from top management and org. culture (ANOVA analysis)

During the correlation test there was no significant correlation between support from top management and organizational culture compared to other occupations in software industry and job satisfaction of SQA professionals so the null hypothesis was accepted. Null hypothesis for the ANOVA analysis can be rejected which is "Job satisfaction of SQA

professionals and support from top management and organizational culture compared to other occupations in software industry" shows a week correlation by chance. The ANOVA table shows a 0.000 for significant value for budget allocations compared to other occupations which is the independent variable. The sig. value is less than the.

4.7.8. General perspective of SQA (ANOVA analysis)

The Null hypothesis is rejected which is "Job satisfaction of SQA professionals and general perspective of SQA compared to other occupations in software industry" shows a strong correlation by chance. The ANOVA table shows a 0.000 for significant value for general perspective of SQA compared to other occupations which is the independent variable. The sig. value is less than the threshold value which is 0.05. Dependent variable is job satisfaction of SQA professionals.

4.8. Summary of hypothesis testing

Table 4. 23 - Test of homogeneity of variances summary

Test of Homogeneity of Variances				
	Levene Statistic	**df1**	**df2**	**Sig.**
Recognition	59.59762856	6	209	0.000
Career Growth	33.84658253	6	209	0.000
Training & Certifications	7.699128006	6	208	0.000
Salary	7.416380364	6	208	0.000
Budget Allocations	45.97256818	6	208	0.000
Management support and Org. Culture	95.90929761	6	208	0.000
General Perspective Towards QA	50.14595761	6	208	0.000

Levene test is also used to reject the null hypothesis of equal variance. Null hypothesis is the obtained differences in sample variances are unlikely to have occurred based on random sampling from a population with equal variances. Based on the above table of Levene test, significant value is less than 0.05. Therefore the null hypotheses for all the above variables can be rejected.

4.9. Summary of hypothesis testing

This research is based on correlations analysis and ANOVA analysis carry out the hypothesis testing effort. As the following hypothesis testing summary shows, data sample all alternative hypotheses were accepted. This shows how strong the variables are after the thorough

literature review and all these variables are highly important when it comes to job satisfaction of students. Further acceptance:

Table 4. 24 - Hypotheses tested table

No	Hypothesis	Accepted
H1a	Recognition compared to other occupations in software industry has an impact on job satisfaction because it has a positive impact. Note – Recognition compared to other occupations in software industry alternative hypothesis has been accepted and null hypothesis has been rejected, that means Recognition compared to other occupations in software industry have a significant relationship on job satisfaction.	Accepted
H1b	Career Growth opportunity compared to other occupations in software industry has an impact on job satisfaction because they are positively correlated. Note – Career Growth opportunity compared to other occupations in software industry alternative variable has been accepted and null hypothesis rejected. That means, this variable has an impact in job satisfaction and also Career Growth opportunity scored well in all the testing such as Cronbach's alpha, descriptive statistics correlation and ANOVA. Further Career Growth opportunity benefits have an impact on job satisfaction because it has a positive correlation.	Accepted

H1c	Training and certification compared to other occupations in software industry has an impact on job satisfaction because they are positively correlated. Note – Training and certification compared to other occupations in software industry alternative variable has been accepted and null hypothesis rejected. That means this variable has an impact in job satisfaction and also Training and certification scored well in all the testing such as Cronbach's alpha, descriptive statistics correlation and ANOVA. Further Training and certification benefits have an impact on job satisfaction because it has a positive correlation.	Accepted
H2a	Salary compared to other occupations in software industry has an impact on job satisfaction because they are positively correlated. Note - Salary compared to other occupations in software industry alternative variable has been accepted and null hypothesis rejected, that means salary compared to other occupations in software industry has an impact in job satisfaction and also Salary compared to other occupations in software industry scored well in all the testing such as Cronbach's alpha, descriptive statistics, correlation, further Salary and compensations has an impact on job satisfaction because it has a positive impact.	Accepted
H2b	Budget allocation compared to other occupations has no impact on job satisfaction because it has a positive but no correlation.	Rejected

	Note - Budget allocation compared to other occupations alternative hypothesis has been rejected and null hypothesis has been accepted, that means Budget allocation compared to other occupations has a no relationship on job satisfaction.	
H3a	Support from top management and organizational culture has no impact on job satisfaction because it has no correlation. Note - support from top management and organizational culture alternative hypothesis has been rejected and null hypothesis has been accepted, that means support from top management and organizational culture has no relationship on job satisfaction.	Rejected
H3b	General perspective of QA has an impact on job satisfaction because it has a positive impact. Note - General perspective of QA alternative hypothesis has been accepted and null hypothesis has been rejected, that means General perspective of QA has a significant relationship on job satisfaction.	Accepted

4.9.1. Hypothesis 1 (Recognition compared to other occupations in software industry)

Recognition compared to other occupations in software industry has an impact on job satisfaction as per the outcome. Correlation shows a significant relationship and in certain cases and in some context, positive impact gives a substantial amount of information on the behavior of the variable and vice versa. Many researches done for Recognition on job satisfaction and all the research showed that Recognition has an impact job satisfaction , and also all the researches on Recognition null hypothesis has been rejected and alternative hypothesis has been accepted. In this research recognition compared to other occupations in

software industry was tested and same as the other researches, null hypothesis has been rejected and alternative hypothesis has been accepted.

4.9.2. Hypothesis 2 (Career growth opportunity compared to other occupations in software industry)

Career Growth has an impact on job satisfaction because they are positively correlated and also it is clear that QA professionals has a trust on the career due to this factor there will be a positive impact, and therefore some positive variables always push to the positive directions all the time. In certain cases, there may be some certain interplay and may bring to clear the total impact. Therefore, Career Growth is important. This research done for Career Growth compared to other occupations in software industry with job satisfaction showed that Career Growth has an impact on job satisfaction and alternative hypothesis has been accepted and null hypothesis has been rejected, so this variable also has a substantial contribution to job satisfaction.

4.9.3. Hypothesis 3 (Training and certifications occupations in software industry)

Training and certifications compared to other occupations in software industry has an impact on job satisfaction because represents a greater degree of correlation between the variables. Training and certifications is a very important factor when it comes to the job satisfaction. Training and certifications compared to other occupations in software industry was measured in this research study. Alternative, hypothesis has been accepted and null hypothesis has been rejected for the hypothesis testing done for the mentioned factors.

4.9.4. Hypothesis 4 (Salary compared to other occupations in software industry)

Salary compared to other occupations in software industry has an impact on job satisfaction because they are positively correlated, represents a greater degree of correlation between the variables. Salary is a very important variable because it shows how important the perspective of QA professionals towards the salary compared to other occupations in software industry. Many researches done for Salary for job satisfaction and all the research showed that Salary and compensations has an impact on job satisfaction. All the researches on Salary and compensations alternative, hypothesis has been accepted and null hypothesis has been rejected, so this variable has a substantial contribution to job satisfaction researches. Whereas this research is focused on salary of SQA professionals compared to other occupations in software industry. Here also alternative, hypothesis has been accepted and null hypothesis has been rejected.

4.9.5. Hypothesis 5 (Budget allocations compared to other occupations in software industry)

Budget allocation is a strong factor of job satisfaction for any occupation. Budget allocation compared to other occupations in software industry was tested in this study. Budget allocations compared to other occupations in software industry has a week correlation or can consider as there is no correlation between job satisfaction of SQA professionals with regards to budget allocations compared to other occupations such as SE, BA and networking. In this hypothesis testing alternative, hypothesis has been rejected and null hypothesis has been accepted. Therefore there is no relationship between budget allocations and job satisfaction of SQA professionals.

4.9.6. Hypothesis 6 (support from top management and organizational culture compared to other occupations in software industry)

Support from top management and organizational culture has no impact on job satisfaction as per the outcome. Correlation shows a week relationship. Many researches done for support from top management and organizational culture on job satisfaction and all the research showed that support from top management and organizational culture has an impact job satisfaction , and also all the researches on support from top management and organizational culture null hypothesis has been rejected and alternative hypothesis has been accepted. But in here, support from top management and organizational culture compared to other occupations in software industry was hypothesized. In this hypothesis testing alternative, hypothesis has been rejected and null hypothesis has been accepted. Therefore there is no relationship between support from top management and organizational culture with job satisfaction of SQA professionals.

4.9.7. Hypothesis 7 (General perspective of SQA compared to other occupations in software industry)

General perspective of SQA affects job satisfaction according to the result. Correlation demonstrates a noteworthy relationship and in specific cases and in some unique circumstance, positive effect gives a generous measure of data on the conduct of the variable and the other way around. Many inquire accomplished for General perspective view of SQA on job satisfaction and all the exploration demonstrated that General perspective of SQA has an effect job satisfaction. Here also alternative, hypothesis has been accepted and null hypothesis has been rejected.

4.9.8. Summary of hypothesis testing.

In summary, data analysis and its outcomes of correlations, hypothesis testing had a positive impact towards five out of seven variables. Started with Cronbach's alpha and chapter continues with other various elements of the hypothesis testing and its process. The weightage of this analysis shows how these variables are going through several processes and generate the outcome in a statistical perspective. Finally, the variables are analyzed to find the correlation and regression, which was tested and came to a final conclusion of null or alternative to be accepted. Gathered data was also analyzed to find correlations and variance. Finally hypotheses were tested to find the answer for the research question. As the final outcome, five factors have an impact of job satisfaction of SQA professionals with compared to other professions in software industry such as SE, BA and PM.

4.9.9. Additional findings.

Other than the hypothesis testing, data analysis was carried out to find any interesting relationships or findings with demographic information collected along with the other research questions. Following tables and graphs summarized the additional findings, conclusions and where further research can be done with a different topic related to SQA as well as other occupations.

Considering everything, how satisfied are you with your job? Question was asked to measure the overall satisfaction from the participants. 62% of the respondents were dissatisfied with their job. But out of female respondents, 26% were answered as they are satisfied with their job and only 5% of males were responded as satisfied. Therefore male SQA professionals are more dissatisfied than the female SQA professionals.
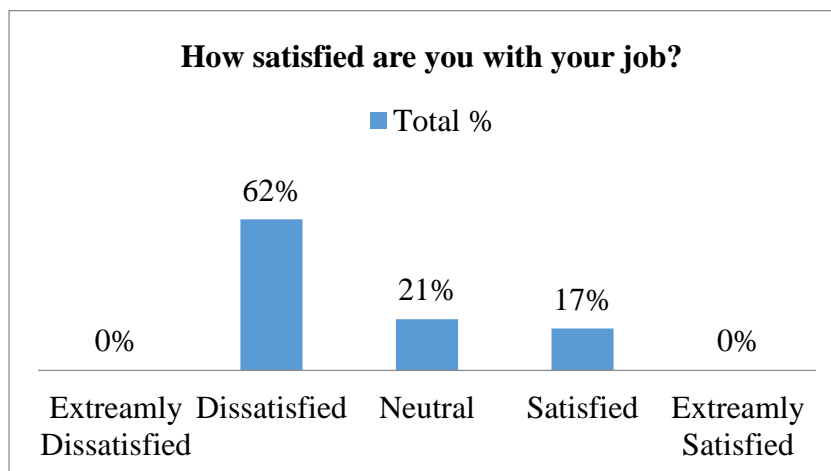

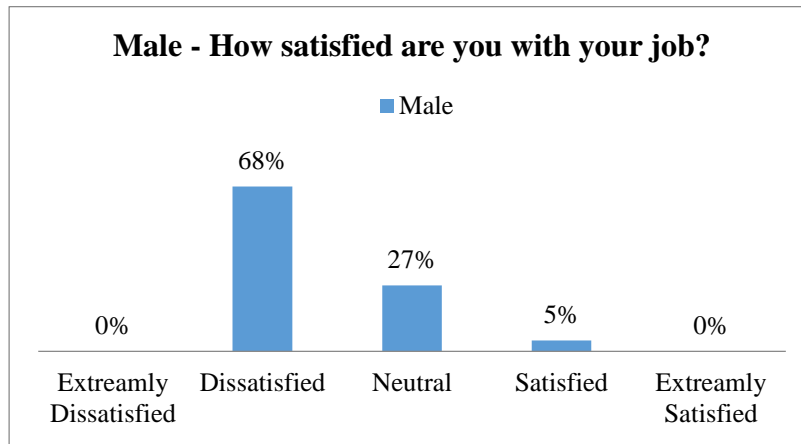Figure 4. 13 - How satisfied are you with your job (Summary)

Figure 4. 14 - Male - How satisfied are you with your job? (Summary)
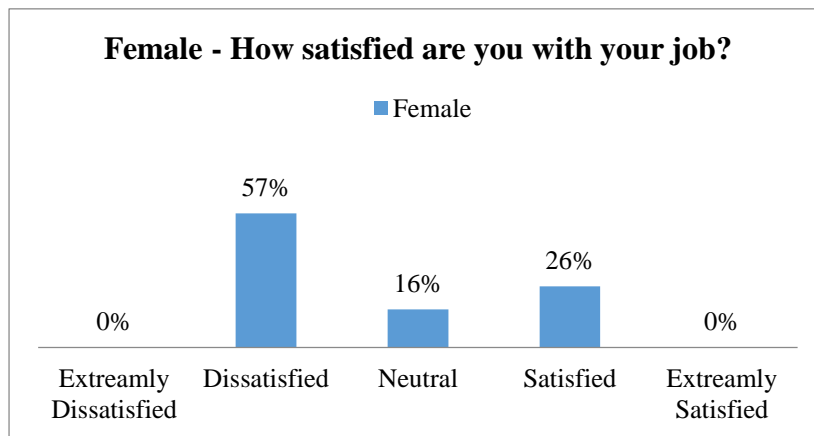

Figure 4. 15 - Female - How satisfied are you with your job (Summary)

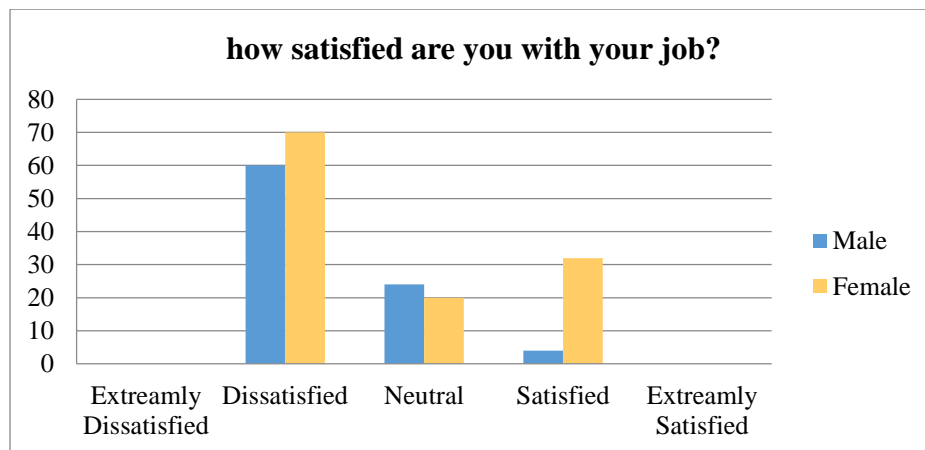**SQA professionals job satisfaction - Comparison based on gender**

Figure 4. 16 - How satisfied are with your job (Gender of comparison)

According to the responses, there are no extremely satisfied or extremely dissatisfied responses from the SQA professionals. All the responses were in satisfied, neutral (neither satisfied nor dissatisfied) and dissatisfied stages without going to extreme level.

Another question was asked to get the information about changing the career path. "My plan is to change career path to a field such as Project management in future/ or already changed after few years of working as a QA." 38% of the respondents answered that they don't have a plan to change their career path. This question was analyzed along with the gender. 35% of the male and 40% of the females had answered that they don't have a plan to change career path. This indicates that intention of changing the career path of SQA professionals has no significant relationship with gender. But when it is analyzed with the years of experience, it clearly shows that higher the experience respondents have already changed their career path or they have an intention to change the career path.
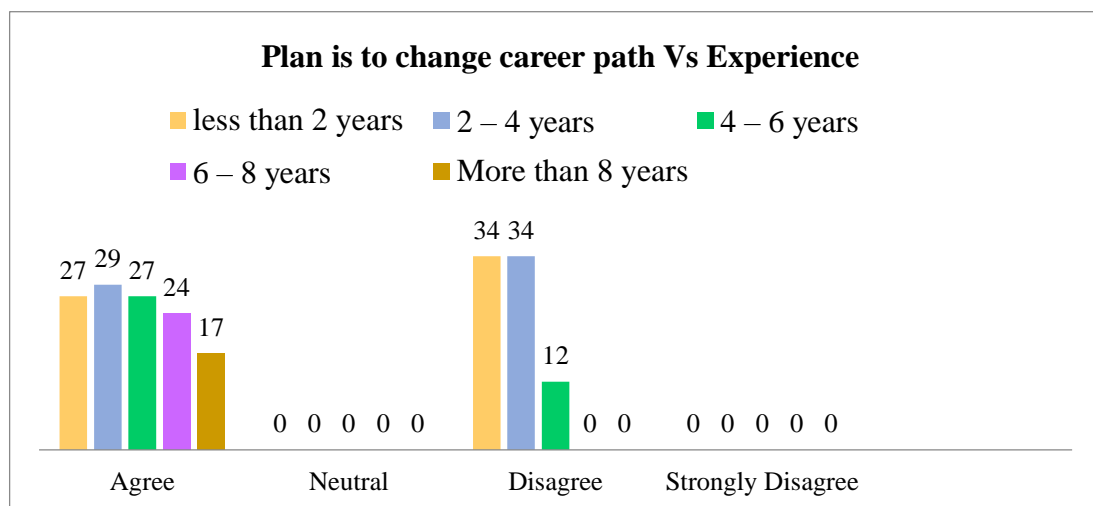
Figure 4. 17 - Plan is to change career path Vs. Experience (Summary Graph)

Figure 4. 18 - Plan to change career path Vs. Gender

Above charts show that planning to change career path or already change of career based on gender. From the above bar charts, while majority agrees to the question it seems that more females are agreeing as well as disagreeing. For a better comparison following pie charts were used.
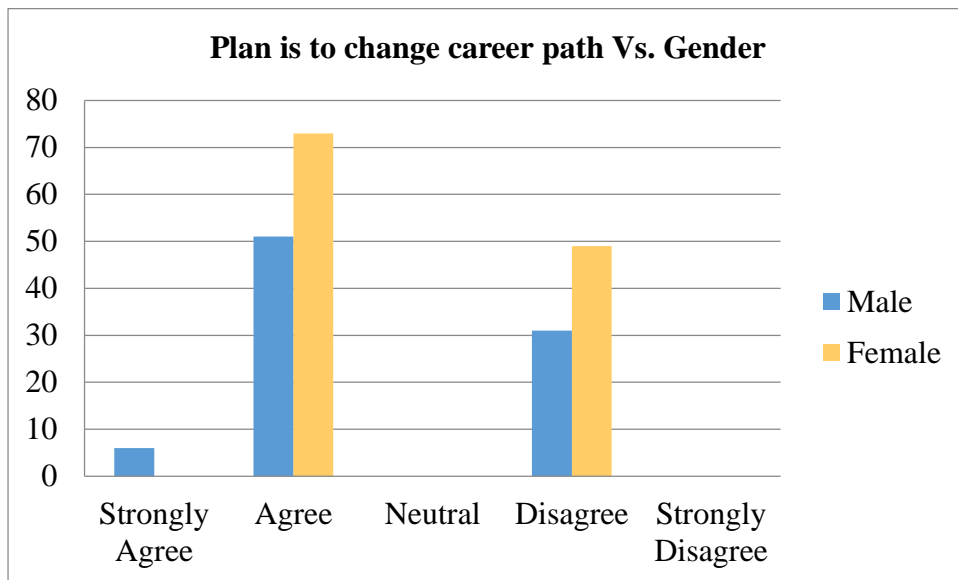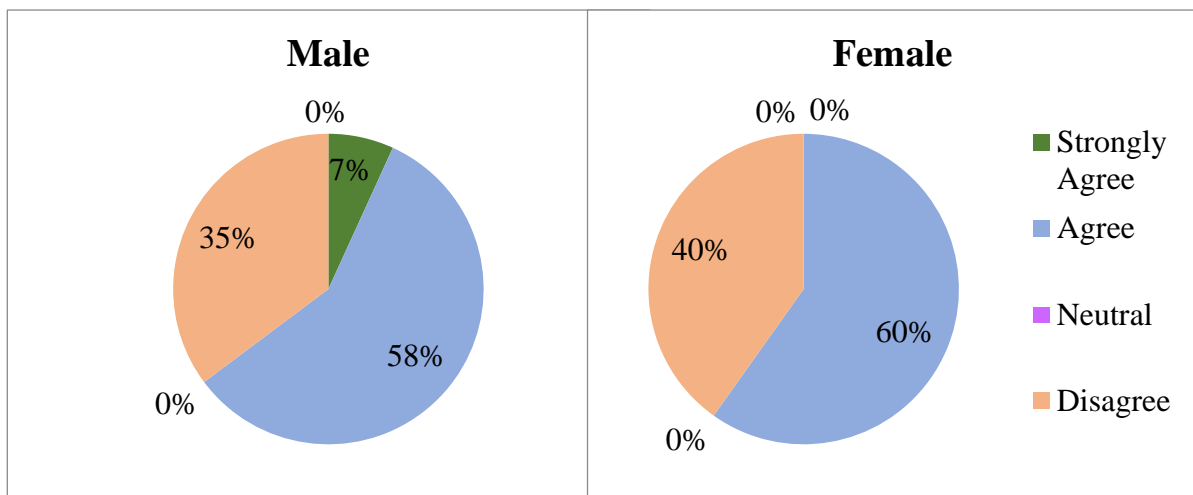

Figure 4. 19 - Plan to change career path Vs. Gender comparison

Table 4. 25 - Plan is to change career path Vs. Experience (Summary Table)

My plan is to change career path to a field such as Project management in future/ or already changed after few years of working as a QA. ?	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
less than 2 years	0	23	0	38	0
2 – 4 years	0	28	0	35	0
4 – 6 years	6	27	0	12	0
6 – 8 years	0	24	0	0	0
More than 8 years	0	17	0	0	0
Sum	6	119	0	85	0

Other than the relationship between changing the career path and years of experience, size of the organization and changing the career path seems to have a relationship too. For the same question, following chart shows data gathered from respondents.
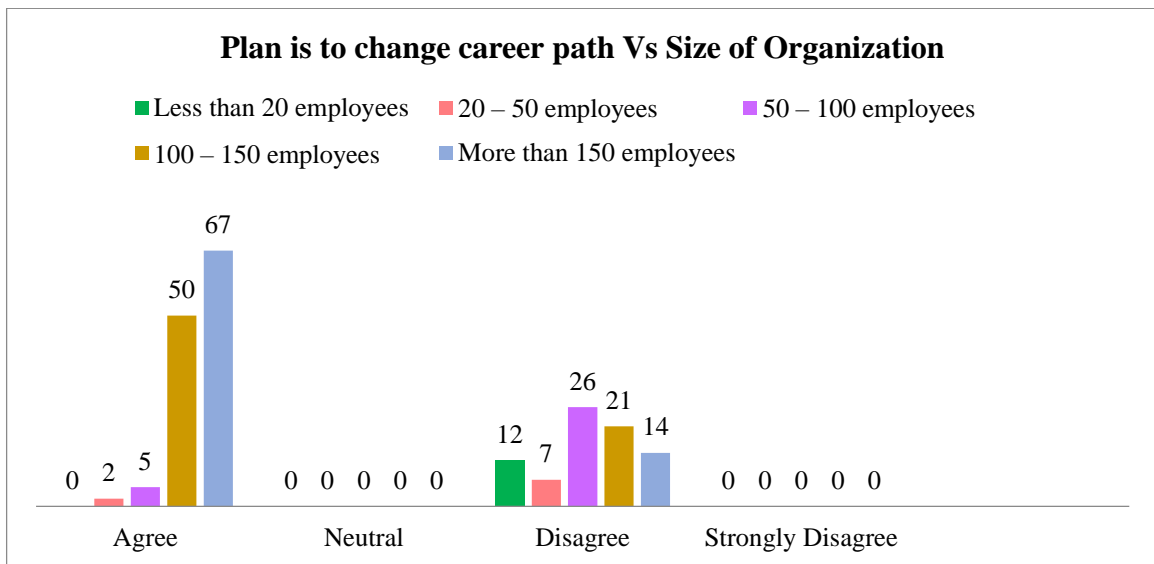
Figure 4. 20 - Plan is to change career path Vs. Size of Organization (Summary Graph)

This shows that higher the organization size, SQA professionals have intention to change their career path or have already changed their career path. When the size of the organization is around 100 employees, we can consider it as a well-established company in the context of IT organizations. Therefore these companies should have a proper hierarchy and managerial levels as well as managers with experience. This can also confirm by looking at the companies

that questionnaire was distributed. We can assume that employees in relatively large companies have more opportunities to change career paths to areas such as project management or managerial levels. We can assume that SQA employees in relatively large companies see and have more opportunity to change career paths than the employees in small companies. But we cannot come to a conclusion that it is only SQA professionals. Therefore this needs to be analyzed with other occupations such as SE, BA and networking for the IT sector as well as can expand to any industry as well.

Another concern may that SQA employees with more experience are already working in well established companies.

Table 4. 26 - Change of career path Vs. Size of organization (Summary table)

My plan is to change career path to a field such as Project management in future/ or already changed after few years of working as a QA. ?	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Less than 20 employees	0	0	0	12	0
20 – 50 employees	6	2	0	7	0
50 – 100 employees	0	5	0	26	0
100 – 150 employees	0	50	0	21	0
More than 150 employees	0	67	0	14	0
Sum	**6**	**124**	**0**	**80**	**0**

Another finding from the research was that employees who have answered as recognition compared to other occupations in IT industry is low for SQAs are the employees who have experience more than 4 years. Majority of the respondents who have less experience than 4 years has responded as they disagree with the question "In my organization, QA Professionals have less recognition compared to SE/ PM/ BA and networking etc.
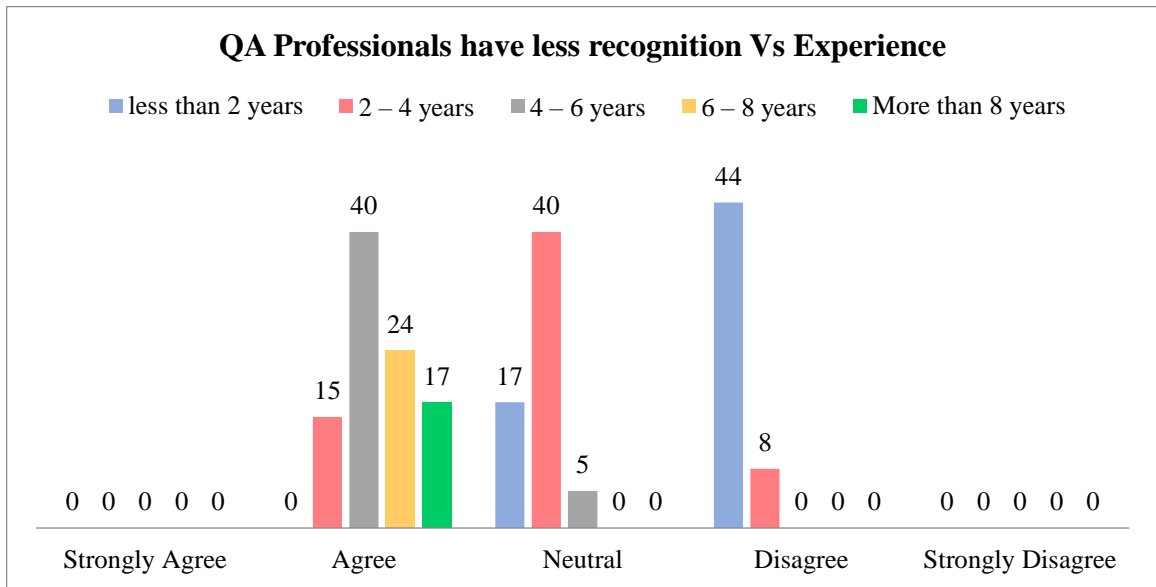
Figure 4. 21 - QA Professionals have less recognition Vs. Experience (Summary Graph)

Even though research couldn't find a strong correlation between total budget allocations for QA department and job satisfaction of SQA employees following bar chart shows that majority of respondent agree with the question "Effort estimations of QAs are challenged compared to the estimations for development and requirement gathering"
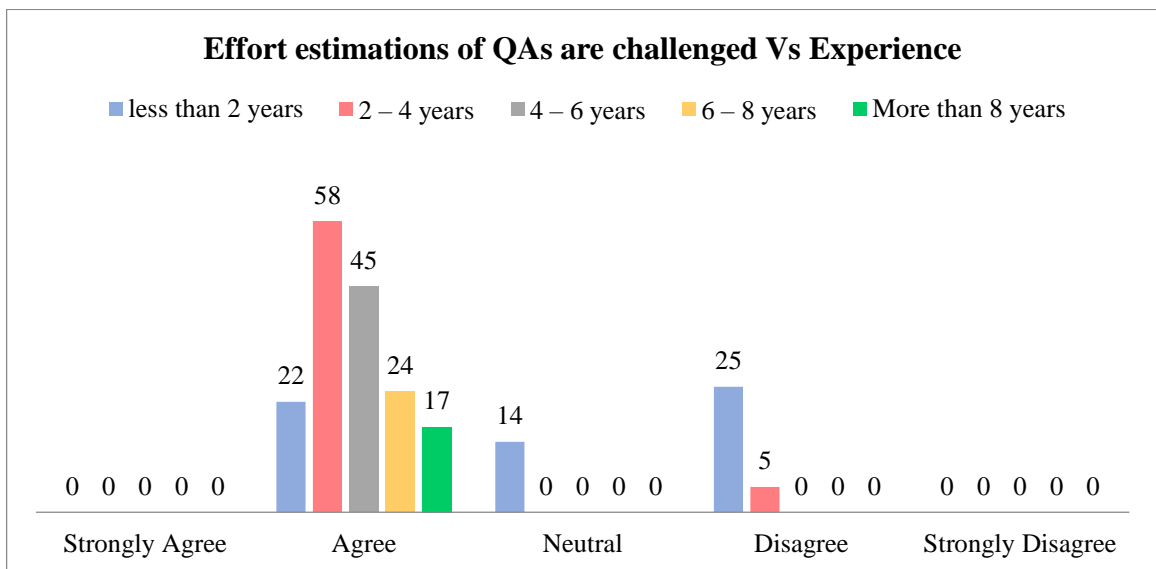
Figure 4. 22 - Effort estimations of QAs are challenged Vs. Experience (Summary Graph)

As a percentage, 79% from the overall responses agree with the above question. Following pie chart shows the percentages of answers.
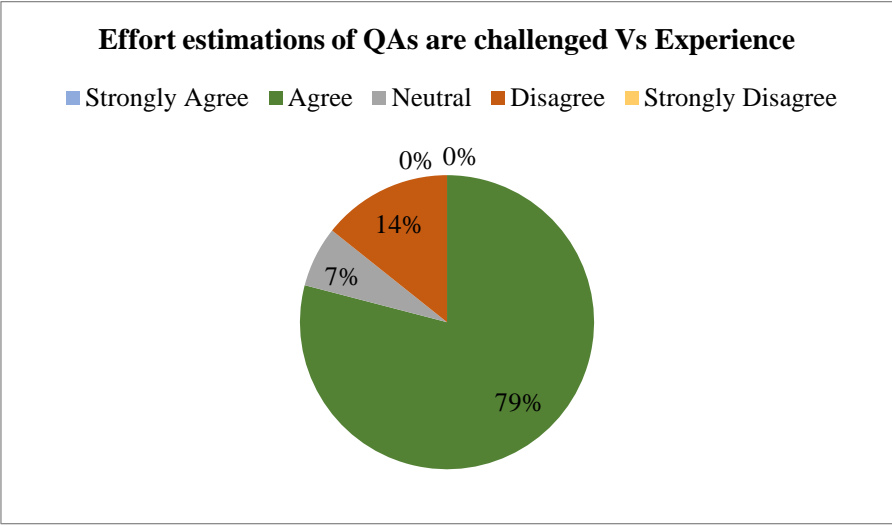
Figure 4. 23 - Effort estimations of QAs are challenged Vs. Experience (Summary Graph)

In the questionnaire following question was asked to identify the priority given by IT graduates for selecting SQA stream as their career path. "When I was looking for a job after graduation, QA was NOT my first priority". 47% agreed with the statement while 41% disagreed and 12% has a nether agree or disagree. We can come to a conclusion that around half of the SQA professionals who are currently working in QA field actually was looking for a different career path or gave priority for finding a different career path but ended up as SQA professionals. Further analysis was done with the same question. Following graph shows how respondents answer to the same question versus years of experience in IT industry.
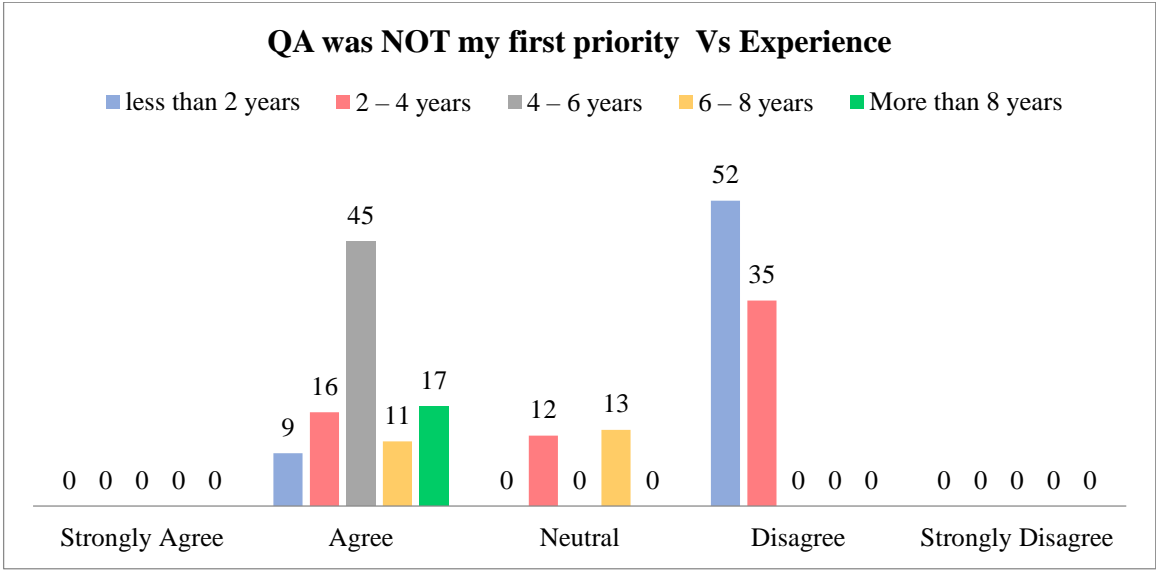
Figure 4. 24 - QA was NOT my first priority Vs. Experience (Summary Graph)

As we can see, experience less than 4 years SQA professionals are mostly disagreeing with the above statement. We can assume that less experience means those respondents are new graduates compared to other respondents. Therefore we can come to a conclusion that recently IT graduates are considering QA as a career path and give priority and seek for QA jobs. This is a good trend to continue. As Perera mentioned in his research, IT graduates do not consider quality assurance as a good career path in Sri Lanka. As a result good graduates do not come to quality assurance jobs (Perera, 2013). But after three to four years, there is an indication that IT graduates are actually considering QA as a career path. But good graduates or bad graduate factors is not considered for this research.

Following chart is to analyze the same question "QA was NOT my first priority Vs. Gender" as a percentage vise, there is no significant difference fount concluding that it was not also based on gender but as a general, 47% of graduates are not considering QA as their first priority for a career path. Figure 4.25 clearly shows the overall percentages and figure 4.26 and 4.27 shows the gender vise analysis.
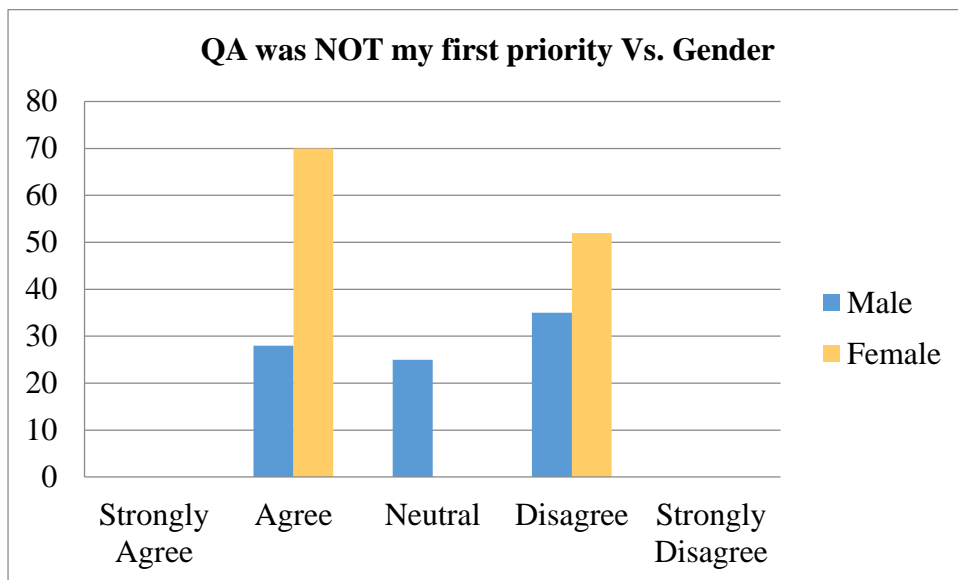
Figure 4. 25 - QA was NOT my first priority Vs. Gender comparison
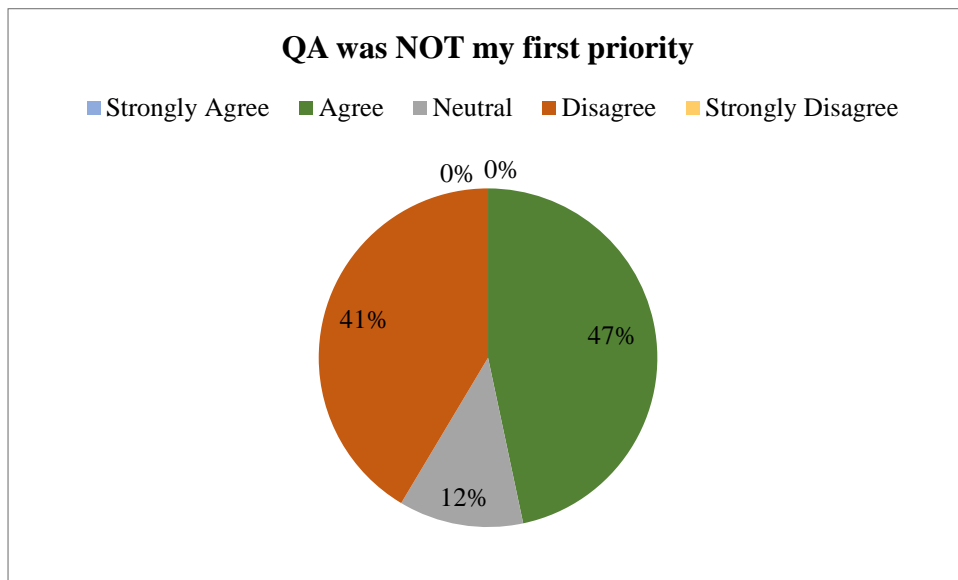
Figure 4. 26 - QA was NOT my first priority
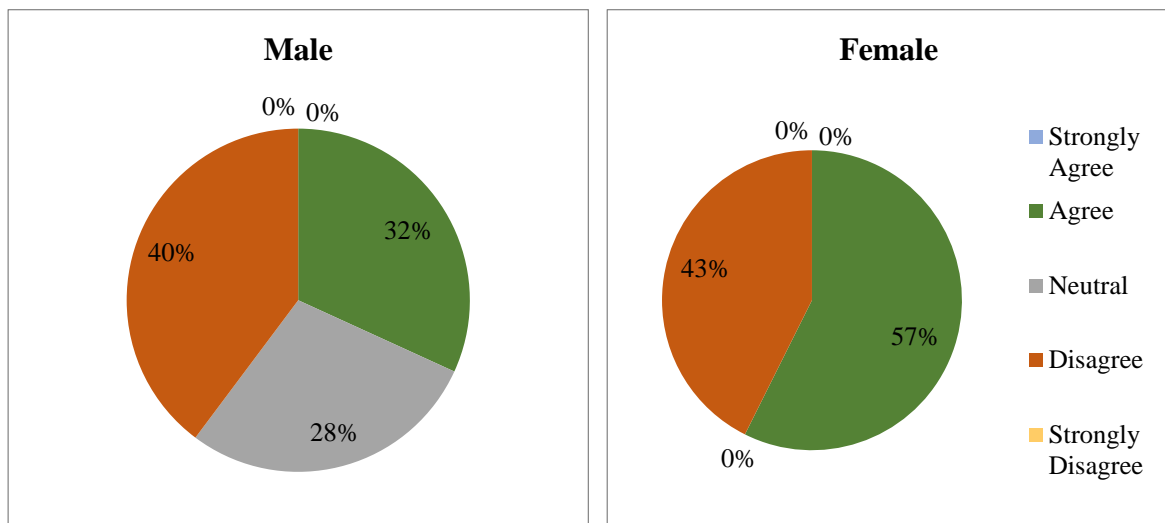
Figure 4. 27 - QA was NOT my first priority Vs. Gender comparison

Reason behind above trend which is employees less than four years' experience saying that their first priority for a career is QA could be that in recent years, QA has been included in undergraduate syllabus whereas in earlier years, QA was not included in most undergraduate degree programs. Therefore the special skill sets required by a QA professional may not be identified by the students. Cannot come to a conclusion that having QA as a subject in undergraduate program is the definite and only reason but we can build an assumption. Further research is required for come to a conclusion. Despite reasons, this trend is a favorable trend for future of QA and indirectly affect favorable to the software industry.

5. CHAPTER FIVE – FINDINGS AND CONCLUSIONS

5.1. Introduction

This research has given encounters into job satisfaction in relation to SQA professionals. QA professionals agree that working up an appreciation of recognition, career growth opportunities, training and certifications, salary and general perspectives towards SQA would enhance the satisfaction. The inspiration driving of this research will show how the respondents are affected by variables of recognition, career growth opportunities, training and certifications, salary, and perspectives towards job satisfaction. All these variables are compared to other occupations in software industry.

These variables can be considered as fundamental factors for an organizations as well as a career path to ensure that its satisfaction is kept in the brains of SQA professionals and will not keep them from changing to various jobs. The research showed that it was not kept and secures recognition, career growth opportunities, training and certifications, salary, and perspectives towards SQA at a satisfactory level in most of the companies as well as a job role or community.

From the examination of this research, it was exhibited that out of seven variables tested there are five variables that were appropriate to the Sri Lankan environment which are, the recognition, career growth opportunity, training and certifications, salary and perspectives towards SQA compared to the other occupations in software industry. The general disclosures of this audit moreover exhibit that SQA professional's recognition, career growth opportunities, training and certifications, salary and perspectives towards SQA compared to other occupations in software industry has negatively affected job satisfaction of SQA professionals.

This research also shows that new IT graduates choose SQA as their career path than four years ago. Because employees who has experience less than 4 years has responded that SQA was their first choice of career path whereas more experienced employees respond as SQA was not their first priority for a career path.

It was also noted that 26% of female employees has responded that they are satisfied with their job but only 5% of males says that they are satisfied. This give a hint of that female employees are more satisfied with SQA than males. But when calculated together, 62% of the respondents are not satisfied with their job.

Years of experience as well as the size of the organization also have some impact on the responses. More the experience more SQA professionals are planning to change or already changed career path. Higher the organization size more SQA professionals are planning to change or already changed career path.

5.2. Findings

The study review the effect of recognition, career growth opportunities, training and certifications, salary, budget allocations, support from top management and organizational culture and perspectives toward SQA compared to other occupations in software industry versus job satisfaction by concentrating on SQA professional's service area of Sri Lanka.

The outcomes demonstrate a positive effect of on job satisfaction for five variables out of seven tested. Research concluded in that recognition, career growth opportunities, training and certifications, salary and perspectives positively affects job satisfaction of SQA professionals. Yet gender and years of experience has effect on the responses as well. This review demonstrates a noteworthy outcome that a decent recognition compared to other occupations in software industry impacts the job satisfaction. Tests were gathered from the SQA professionals of tried through correlation investigation and ANOVA analysis in SPSS also analysis was carried out with demographic information collected. The consequences of study demonstrate the effect of recognition, career growth opportunities, training and certifications, salary, and perspectives of SQA profession. The test size of population was 352 and responses recovered were 210. The discoveries of the review demonstrate a positive noteworthy effect.

When it comes to recognition researcher has expected a much positive outcome because researcher was confident in this variable, this confident came up with the pilot study and researchers personal experience towards the recognition compared to other occupations and job satisfaction. Further, the recognition compared to other occupations and job satisfaction, correlation outcome would be 0.545. Researcher also expected better strong outcome from this variable but this correlation is also enough to come to a conclusion.

When it comes to career growth opportunity compared to researcher has expected a moderate positive outcome because researcher had a moderate confident in this, but with the pilot study this outcome showed a positive outcome that gained some confident on this variable, further,

the career growth and job satisfaction, correlation outcome was .719. Researcher also expected same kind of outcome from this variable.

When it comes to training and certifications compared to other occupations and job satisfaction of SQA professionals, researcher expected another strong correlation. As first this variable was added based on personal experience and discussions had with SQA colleagues. Pilot survey also confirmed this variable is correlated with Job satisfaction of SQA profession. Correlation outcome was 0.779 as expected.

When it comes to salary compared to other occupations, researcher has expected a strong positive outcome because researcher is also much confident on the effect of the variable, with the pilot study also this showed a strong positive outcome as researcher expected. Further, the salary and job satisfaction, correlation outcome was .907. This was the strongest correlation among tested variables. Researcher also expected same kind of outcome from this variable.

Budget allocations compared to other occupations was another variable that researcher want to investigate. Same as the other variables, it was based on personal experience pilot survey showed a week correlation but enough to continue further analysis. As the outcome of the research, it came as a week correlation. Value of the correlation analysis was 0.309. Therefore this variable was rejected as it shows a lesser correlation for SQA professionals' job satisfaction.

When it comes to support from top management and organizational culture researcher expected a least outcome for this variable, because author had least confident for this variable. Further, the support from top management and organizational culture and job satisfaction, correlation outcome was .394. as expected. Researcher expected a least outcome from this variable, and rejected that there is lesser correlation compared to other variables and job satisfaction of SQA professionals.

5.3. Implications and Recommendations

Recognition, career growth opportunities, training and certifications, salary and general perspective towards SQA profession compared to other occupations have influenced SQA professionals' job satisfaction. Gender, experience, and organization size also have some impact on the independent variables that has an impact on satisfaction. Subsequent to doing the investigation from the information gathered it can be presumed job satisfaction is firmly

influenced by the past involvement that helps them to choose whether employees were satisfied or not.

For an example, if the experience is great with current organization they will work for long period. In this way the recognition, career growth opportunity, training and certifications, salary and general perspective towards SQA profession is particularly influenced by great or awful experience of the QA professionals.

The employees having great experience get persuaded to similar organization and subsequently it make them loyal to the organization. But in this research, more experienced professionals are more dissatisfied with the confirmed five variables which are recognition, career growth opportunity, training and certifications, salary and perspective towards SQA profession compared to other occupations in software industry.

Further-more budget allocations compared to other occupations have less impact on job satisfaction. 58% of the respondents have agreed that "Effort estimations of QAs are challenged compared to the estimations for development and requirement gathering". But this has no considerable impact on job satisfaction.

Also top management support and organizational culture compared to other occupations has less correlation compared to other variables. This implies that SQA professionals are not concerned much about top management support and organizational culture compared to other occupations in software industry and very less impact towards SQA professionals job satisfaction.

To improve and maintain SQA professionals' job satisfaction, recognition given to QA should be increased. Organizations and management should have to focus on this factor because if this trend continues, more employees may change their career paths as well as trend of good graduates not considering SQA as a good career path may continue resulting poor quality products and more costs in QA departments of organizations.

Software organizations should give more opportunities for career growth for SQA professionals. Because not having enough career growth opportunities have a major impact on satisfaction of SQA employees. This might be the reason that more experience employees are considering about career path.

Not enough training and certification opportunities also have to be addressed this is more related to SQA community than the individual organizations. As the organization, management can provide more internal and external training opportunities and encourage SQA professionals to do more existing certifications and give those certifications in the SQA profession.

Salary gaps should be addressed because this variable had the highest correlation with job satisfaction. This will also help to attack more good graduates to SQA steam. Same people from same university with same academic qualifications are treated differently in salary wise based on the selected career path in same organization seems to have this major dissatisfaction.

Finally perspective towards SQA profession should be change gradually. This can be started from the university level. Most of the universities have specializings for occupations such as SE and networking but SQA is rarely taught as a specialization or even as a subject.

Plus point that highlighted from the study was that new graduates were seeking and considering SQA as a career path. It is favorable to notice this trend for the future of SQA profession.

5.4. Conclusions

Based on the personal experience and pilot survey, this study was carried out to find out factors affecting job satisfaction of SQA professionals. These factors are assessed compared to the other occupations such as SE, PM, BA and Networking in software industry.

Following factors compared to other occupations in software industry has a strong relationship with job satisfaction of SQA professional. Low Recognition, not adequate career growth opportunities, not enough training and certifications, salary compared to other occupations and unfavorable perspective towards SQA in software industry are those factors.

Even though budget allocations such as effort estimations and resource allocations as well as support from top management and organization culture was tested, those two factors were not showing a correlation with SQA professionals job satisfaction. This implies that SQA professionals accept those factors and do not show dissatisfaction about budget allocations and support from top management and culture compared to other occupations. Following is the final conceptual framework derived from the research study.

Independent Variables   **Dependent variable**
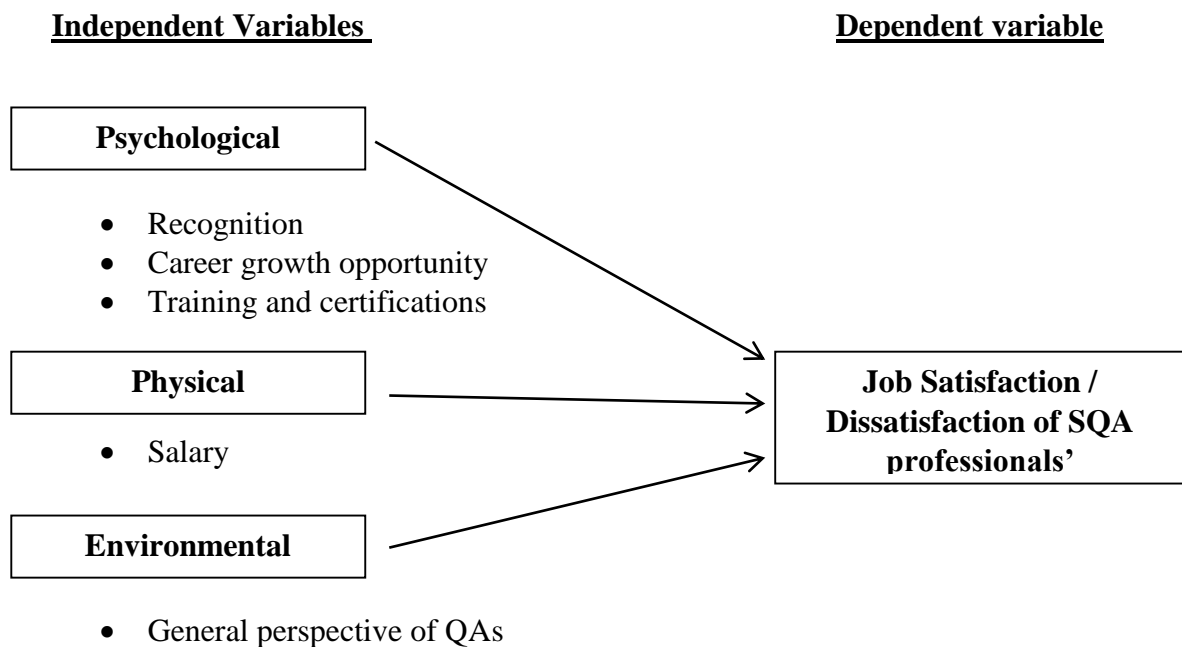

Figure 5. 1 - Final conceptual framework

Other than the hypothesis testing following factor were identified with the collected data for the research.

No SQA employees are extremely satisfied or extremely dissatisfied but 68% of the employees are dissatisfied. Out of SQA employees who are satisfied only 5% of the males are satisfied while 26% of females are satisfied. Therefore more female SQA employees are satisfied with the current jobs.

More experienced SQA professionals have an intention to change career path or have already changed career path. Whereas less experienced SQA professionals are not considering changing career path.

Larger the organization size, more SQA employees have or having intentions of changing career path.

Higher the experience, more SQA professionals feels that they don't have recognition inside the company.

Even though there is no correlation with budget allocations compared to other occupations in software industry to job satisfaction of SQA professionals, more respondents have agreed with effort estimations of QAs are challenged.

New graduates are considering QA as a career path with compared to the old graduates who graduated more than four years ago. This is favorable for the future of QA stream.

5.5. Limitations

Main limitation was all the software development companies were not included for data gathering. There are number of small and medium size (less than 50 employees) companies that were not able to distribute the research questionnaire. Some respondents may not be 100% honest as well as reluctant to answer for some questions honestly. Some respondents have worked for more than one company and some have only work for one company regardless of the experience. They may have only one perception and answered whereas a professional who has work for more than one company has different perspective and exposure. This may also have impacted differently for answers. Not all the factors affect job satisfaction of SQA professionals may not have tested. The factors under test were identified as the main factors from the literature study.

5.6. Recommendations

One objective of the research is to identify main factors affecting job satisfaction of SQA professionals that helps managers and SQA community to increase job satisfaction of SQA professionals. Therefor main recommendations can be listed as follows.

- Software organization and responsible manager should consider about giving more recognition to SQA professionals within the company.
- As a career, SQA should get more recognition from the undergraduate level.
- Organizations should consider about giving more career growth opportunities to SQA professionals.
- As a SQA community, more recognized trainings and certifications should be developed. Introducing specialization at the undergraduate level might be an initiation.
- Salaries of SQA professionals should keep competitive with the salaries of other professions in software industry. Giving specialized skills from the undergraduate level as well as specialized certifications can have an effect on this.
- Perspective towards SQA should be changed in the software industry.

As a plus point immerge from the study is that, new graduates are considering SQA as a good career path. Most probable reason could be that undergraduate programs offering SQA as a

subject in recent past. Continuing this is important for SQA profession and indirectly enhances software industry as well.

5.7. Future work

As an immerging profession with new aspects such as automation, and nun-functional testing such as performance and user experience, above identified five factors may not be the only factors contributing to job satisfaction of SQA profession. Finding out "why" is again important for these identified factors. As an example, why software organizations don't give recognition to SQA profession, why perspective towards SQA profession is not positive as well as why don't SQA profession don't have enough recognized training and certification should be identified. As found out during literature survey, SQA is among top ten happiest jobs in America from 2008 (CareerBliss, CareerBliss Happiest and Unhappiest Jobs in America, 2016). Identifying what are the factors that CareerBills is measuring is and comparing those with the factors found in this study can help improve job satisfaction of SQA professionals in all over the world.

Evaluating how these factors affect productivity of individuals and software companies is another aspect to consider.

Having specialization area for QA from the undergraduate level and measuring their perspective, motivation, productivity and satisfaction is also a future research area. Comparison between new graduates (less than five years' experience) and old graduates (more than five years' experience) is another area for future research.

Another limitation was technical and manual QA has not treated differently in this analysis. In some organizations, both technical aspects such as automation and performance testing as well as manual testing is done by same people whereas in some organizations, those are handled by different people under QA department. Therefore job satisfaction may affect differently for technical and manual QAs differently.

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7. APPENDIX 1 – QUESTIONIOR (PILOT SURVEY)

1. Gender
   a. Male
   b. Female

2. Years of experience in IT industry
   a. less than 2 years
   b. 2 – 4 years
   c. 4 – 6 years
   d. 6 – 8 years
   e. More than 8 years

3. Size of the organization currently employed
   a. Less than 20 employees
   b. 20 – 50 employees
   c. 50 – 100 employees
   d. 100 – 150 employees
   e. More than 150 employees

4. Job title exact or equivalent
   a. Trainee QA engineer or equivalent
   b. QA engineer or equivalent
   c. Senior QA engineer or equivalent
   d. QA lead or equivalent
   e. QA manager/ architect or higher

Please rate your overall satisfaction as a quality assurance professional

- Strongly Agree
- Agree
- Neutral
- Disagree
- Strongly Disagree

Please rate how strongly you agree or disagree with the following statement:

Psychological –

Recognition compared to other occupations in software industry

1. In my organization, QA Professionals have less recognition compared to SE/ PM/ BA and networking etc…

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

2. QA professionals are rewarded for their work from internal recognition programs (rewards, bonuses, promotions) same as the other professionals such as SE/ PM/ BA etc.

   Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

3. QA professionals have less industry recognition, compared to other IT professions such as SE/ PM/ BA etc.

   Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Career growth and future opportunities compared to other occupations in software industry

1. I have career growth opportunities to continue my career as a QA professional till I retire (in Sri Lankan IT industry).

   Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

2. When you climb up the ladder, as in to QA architect (mostly after Senior QA Lead) it is quite difficult to find another opportunity within the company or outside the company.

   Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

3. My company provide exposure to all QA aspects such as automation, performance, non-functional testing, manual testing and different types of projects

   Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

4. My company is providing career growth opportunities with clear carrier map and follows it for QAs, same as the other professionals like SE/PM/BA etc.

   Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Lack of training, certifications and competencies compared to other occupations in software industry

1. There are well recognized professional certifications (MVP, MCSD, MCSE, CISCO, CHE, etc...) for QA professionals in the software industry to specialize in different areas

   Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

2. IT companies provide necessary training opportunities for QA professionals same as the other professionals like SE/PM/BA etc… with the intention of the career growth

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

3. Training opportunities and exposure that I have gained as a QA professional, were beneficial for me to play the next level promotion/ change my career at another company

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Physical –

Salary and compensation given compared to other occupations in software industry

1. Organization(s) I work(ed) keep salary ranges of QA professionals to industry standards

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

2. Our company is maintaining a reasonable salary scale for QA professionals, compared to the other professionals within the company (QAs have less salary scale compared to SE)

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

3. My salary is determined based on factors such as qualifications, certifications, experience and skills not based on profession such as QAs are paid less than SEs.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Budget allocations such as (Time, resource and cost) compared to other occupations in software industry

1. My project team allocate and approve reasonable time (effort) schedule for QA tasks.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

2. Effort estimations of QAs are challenged compared to the estimations for development and requirement gathering

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

3. My project team has sufficient number of QAs with required skill level

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

4. My company has sufficient number of QA professionals with the required qualifications and experience to allocate for the ongoing projects

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

5. I often have/had to work long hours to meet the deadlines, since the DEV team doesn't release the QA builds as of the estimated time schedule

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

6. Software Organizations are reluctant to allocate necessary cost for QA department (QA professionals)

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Environmental

Lack of understanding and value for QA task by other project members specially management and leads

1. My company and project team(s) I work(ed) identified the value addition of the QA for the project is equal to SE/ PM/BA

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

2. Project team and stakeholders appreciate QA effort and I am satisfied with recognition given to QA team compared to other teams(SE/ PM/BA)

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

3. Suggestions made at testers point of view are accepted for further investigations other than the raised bugs after testing the system against the requirements

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

4. QA estimations and scope are often cut down by the management to meet the deadline.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

Industry opinions and beliefs about QA compared to other occupations in software industry

1. When I was looking for a job after graduation, QA was my first priority/ or I only applied for QA vacancies.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

2. When I was searching for job opportunities, most of the experienced industry professionals/relatives recommended SE/BA/ and PM Job roles prior to QA.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

3. Recognition for QA as a profession is less, compared to other professionals such as SE/BA/PM/Networking within the IT industry.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

4. My plan is to change career path to a field such as Project management in future/ or already changed after few years of working as a QA.

Strongly Agree   Agree   Neutral   Disagree   Strongly Disagree

8. APPENDIX 2 – FINAL ONLINEQUESTIONIOR

1. Gender
   a. Male
   b. Female

2. Years of experience in IT industry
   a. less than 2 years
   b. 2 – 4 years
   c. 4 – 6 years
   d. 6 – 8 years
   e. More than 8 years

3. Size of the organization currently employed
   a. Less than 20 employees
   b. 20 – 50 employees
   c. 50 – 100 employees
   d. 100 – 150 employees
   e. More than 150 employees

4. Job title exact or equivalent
   a. Trainee QA engineer or equivalent
   b. QA engineer or equivalent
   c. Senior QA engineer or equivalent
   d. QA lead or equivalent
   e. QA manager/ architect or higher

Please rate your overall satisfaction as a quality assurance professional

1. Strongly agree
2. Agree
3. Neither agree nor disagree
4. Disagree
5. Strongly disagree

Please rate how strongly you agree or disagree with the following statement:

Psychological –

Recognition compared to other occupations in software industry

4. In my organization, QA Professionals have less recognition compared to SE/ PM/ BA and networking etc…

5. QA professionals are rewarded for their work from internal recognition programs (rewards, bonuses, promotions) less than other professionals such as SE/ PM/ BA etc.
6. QA professionals have less industry recognition, compared to other IT professions such as SE/ PM/ BA etc.

Career growth and future opportunities compared to other occupations in software industry

5. I feel that I don't have career growth opportunities to continue my career as a QA professional till I retire (in Sri Lankan IT industry).

6. When you climb up the ladder, as in to QA architect (mostly after Senior QA Lead) it is quite difficult to find another opportunity within the company or outside the company

7. My company does not provide career growth opportunities for QA professionals with clear carrier path with compared to other professionals like SE/PM/BA etc.

Lack of training, certifications and competencies compared to other occupations in software industry

4. QA profession does not have well recognized professional certifications (MVP, MCSD, MCSE, CISCO, CHE, etc...) in the software industry to specialize in different areas with compared to other professionals like SE/PM/BA etc.

5. IT companies do not provide necessary training opportunities for QA professionals same as the other professionals like SE/PM/BA etc… with the intention of the career growth

Physical –

Salary and compensation given compared to other occupations in software industry

4. Organization(s) I work(ed) keep salary ranges of QA professionals to industry standards

5. Our company is maintaining a reasonable salary scale for QA professionals, compared to the other professionals within the company (QAs have less salary scale compared to SE)

6. My salary is NOT determined based on factors such as qualifications, certifications, experience and skills not based on profession such as QAs are paid less than SEs.

Budget allocations such as (Time, resource and cost) compared to other occupations in software industry

7. Effort estimations of QAs are challenged compared to the estimations for development and requirement gathering

8. I often have/had to work long hours to meet the deadlines, since the DEV team doesn't release the QA builds as of the estimated time schedule

9. Software Organizations are reluctant to allocate necessary cost for QA department (QA professionals)

Environmental

Lack of understanding and value for QA task by other project members specially management and leads

5. My company and project team(s) I work(ed) Do NOT identified the value addition of the QA for the project is equal to SE/ PM/BA

6. QA estimations and scope are often cut down by the management to meet the deadline.

Industry opinions and beliefs about QA compared to other occupations in software industry

5. When I was looking for a job after graduation, QA was NOT my first priority/ or I only applied for QA vacancies.

6. When I was searching for job opportunities, most of the experienced industry professionals/relatives recommended SE/BA/ and PM Job roles prior to QA.

Job Satisfaction

1. My plan is to change career path to a field such as Project management in future/ or already changed after few years of working as a QA. ?

2. I am NOT satisfied with opportunities to get a better job within or outside the company?

3. Considering everything, how satisfied are you with your job?
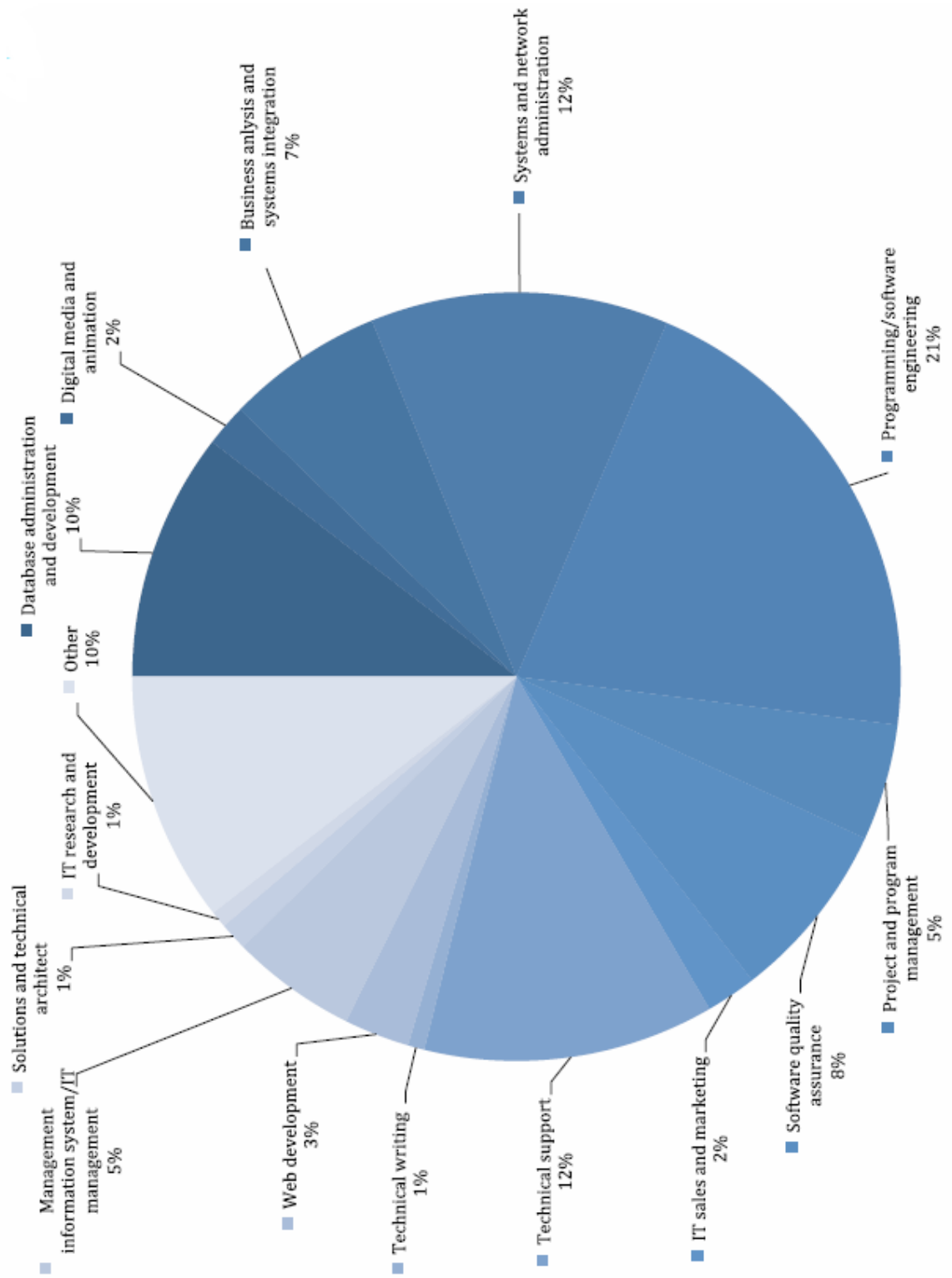
9. APPENDIX 3 - RESEARCH MODEL
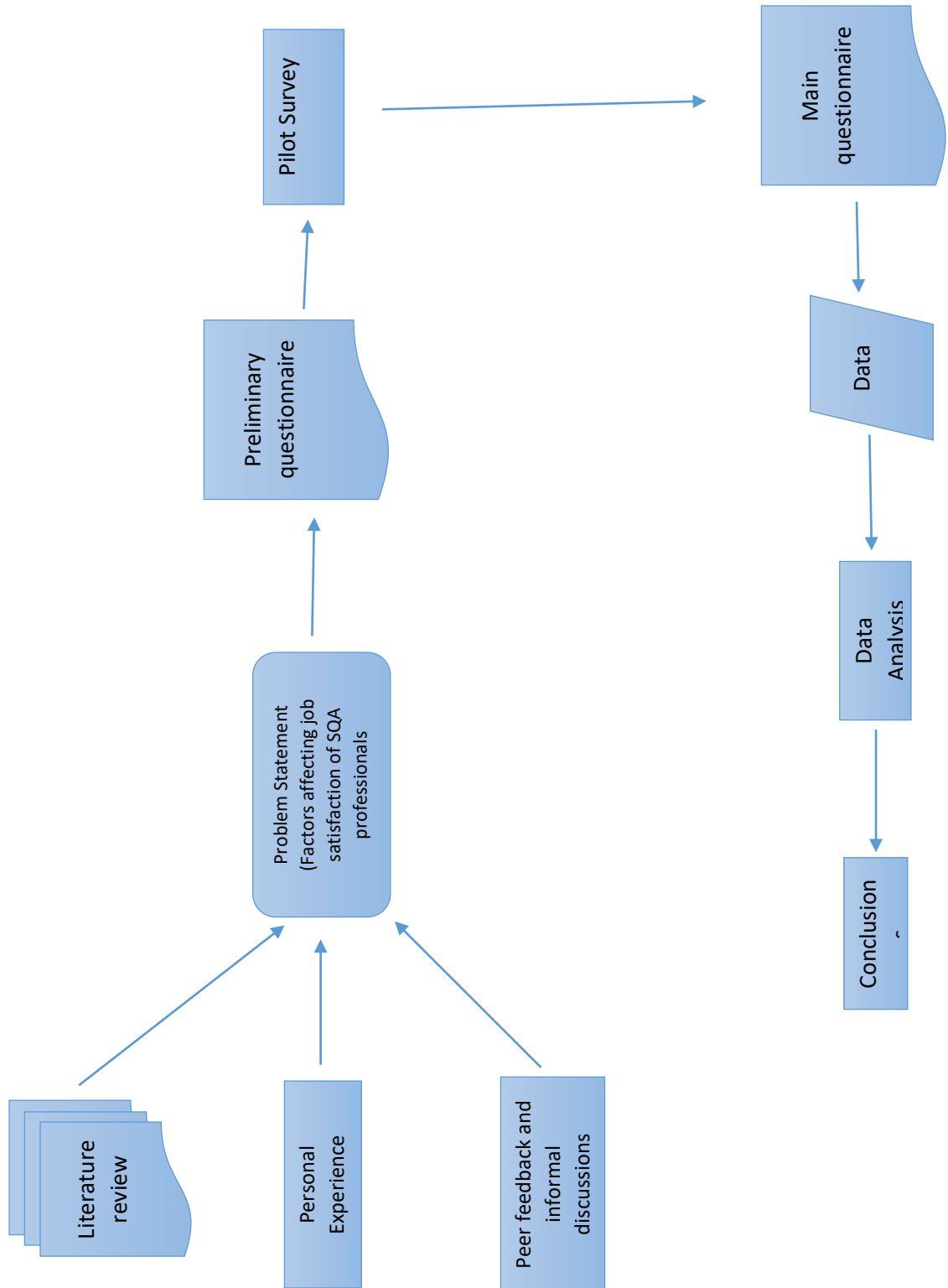
Research Model

10. APPENDIX 4 – GROWTH OF ICT WORKFORCE
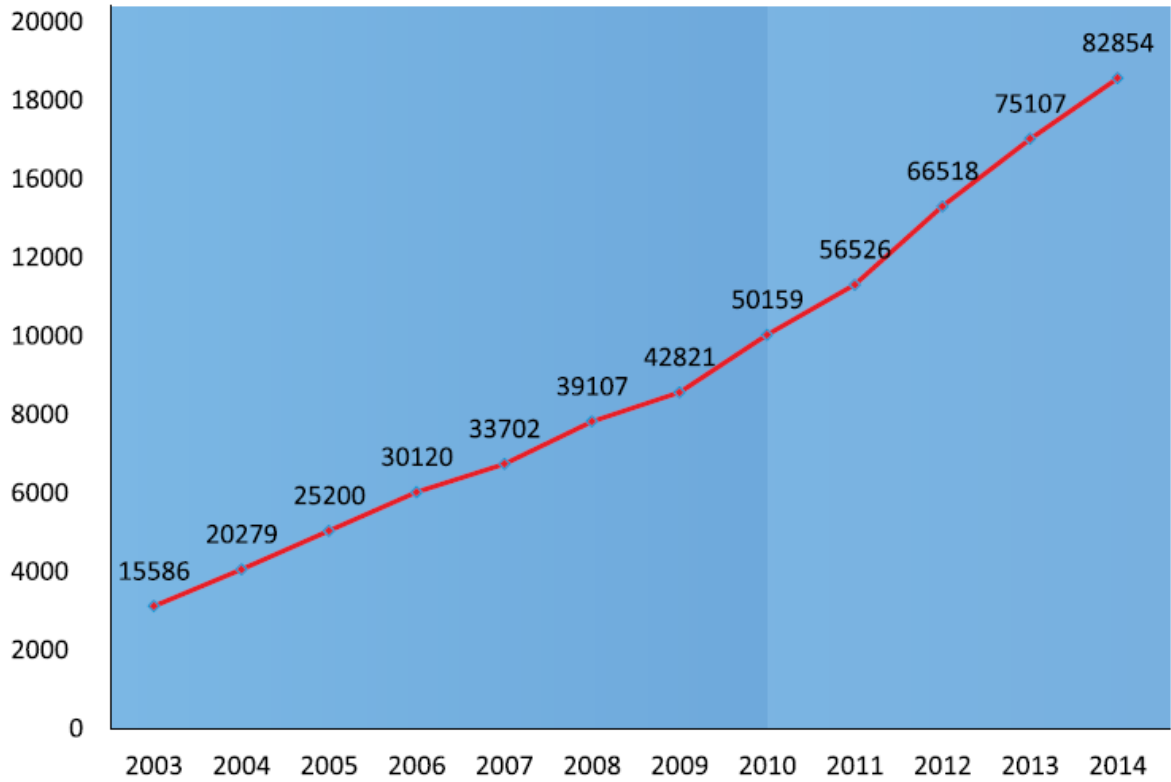
Growth of ICT Workforce

11. APPENDIX 6 – PROFILE OF ICT WORKFORCE BY JOB CATEGORIES

Profile of ICT workforce by job categories