

# Developing Effective Online Assessment System for an Enterprise – Multidimensional Strategies for Success

Sanjit Kumar Ghosh, Alok Tiwary, Amit Tiwary, and Yogesh Kumar Bhatt

**Abstract**—Online assessments are rapidly creating a market space for measuring competency of employees in an enterprise. This unanimously blends with competency development programs. Such programs offer various certifications to assess multi facet skills of an employee. In a flat world, employee workforce is geographically spread in multiple development centers across the world. Designing a common online assessment platform for this workforce makes any competency development program very perplexing. This paper highlights potential adaptability, acquiescence related, location specific, systems and process centric challenges an enterprise can face while creating and running an online assessment system to measure the competency of employees. Anticipated modules and their features imperative to any enterprise online competency assessment system are proposed. Multidimensional strategies to mitigate various challenges are discussed. It also highlights the best practices that an enterprise should follow in order to have a balanced assessment platform. Adoption of recommended mitigation strategies lead to tangible measurable business benefits and had positive impact on customer satisfaction, issue resolution time, number of reported issues and escalations.

**Index Terms**—online assessment, competency development, question bank, authoring manager, assessment rule

## I. INTRODUCTION

It is challenging to maintain pace with constantly changing technology, but is a mandate for knowledge-based economy. A knowledge-based economy is directly based on the production, distribution and use of knowledge and information [1]. In order to cope up with rapidly changing technology, progressive and continuous training to existing employee is required. An employee needs to acquire various skills such as Technical, Process, Behavioral and Domain. In order to enable employee with these skills, an enterprise has to invest and plan in competency development programs. Such programs clearly state the level of competency required based on employee's role and area of responsibility. It also defines the timelines in order to acquire such skills. Penetration of competency development program and acquired skill is then measured through various assessment

mechanisms. Typically, due to geographical spread of employee work force, a generic platform for assessment is designed (commonly known as Assessment and Certification Center) and a dedicated team ensures that the assessment is conducted fairly and seamlessly across the globe.

## II. CHALLENGES

Since assessment operations are large and spread across the globe, there are myriad associated challenges that should to be resolved in order to have successful conduction of different assessments. These challenges are related to registrations, result processing, request handling, assessment engine problem and run time support. We can broadly classify the challenges for conducting assessments as follows:

- Generic adaptability and acquiescence related
- Location specific (offshore and onsite)
- Systems and process centric

Mostly for locations where an enterprise has a dedicated development center with all associated infrastructure and support from technical groups, there are very few challenges. However, for locations where employees are remotely located or deputed across the globe with no enterprise's offices and technical support team, challenges are multifold [2][3].

### A. Generic Adaptability and Acquiescence Challenges

1) *Philological Barrier*: One of the most common challenges in an enterprise is resistance towards any assessment. After taking multiple skill tests during recruitment process, majority of employees are reluctant to get assessed on the job. Any competency development program needs to have a clear objective and well-defined thought process to ensure this resistance does not compromise on the overall success of online assessments. This physiological barrier plays a very vital role.

2) *Flexibility*: In spite of a clearly stated plan for an employee to gradually undergo various training and associated assessment, system and process should provide sufficient flexibility so that employees can take assessment s based on one's ease and project schedule.

3) *Volume and Scale*: Numbers of exams are never same as number of employees. In any assessment plan, employee gets a chance to re-attempt and hence typically an employee will take 2-3 attempts for a given assessment. There is always a situation where few employees do not clear the assessment in stipulated attempts and they are given more chances with a gap so that they can prepare better for the subsequent attempts. This increases the number of assessments and poses scale related challenges. For example, if an enterprise has 20,000 employees and they all need to

Manuscript received March 16, 2011.

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undergo an assessment with maximum three attempts, a worst-case scenario will result in 60,000 assessments. Moreover, general tendency is to take the assessment towards the end of proposed timelines, as shown in figure 1. This results in a last minute rush and associated challenges.

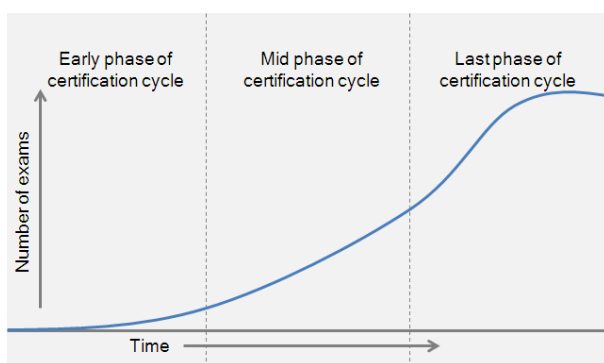


Figure 1. Increase in number of exams with time

### B. Location Specific – Offshore and Onsite Challenges

Offshore development centers are more populated and have large employee base, onsite locations have only deputed work force that is comparatively smaller in number but big enough to pose various challenges for operations to be smooth.

1) *Offshore Issues:* Generally, a large organization has around 70-80% of their population at offshore development center. Therefore, high capacity and dedicated facility becomes a key here.

2) *Onsite Related Issues:* There are various problems at onsite locations primarily due to the geographical spread of employees. Since these employees are not positioned at the development center where all the facility such as certification center exists, figuring out a mechanism for fair conduction of exams and technical support to employees becomes a key challenge.

### C. Systems and Process Centric Challenges

For successful conduction of any exam with minimum issues, there must be a good online examination system. Most of the problems arise due to poorly designed online examination systems. Some of the well-known problems related to systems are:

1) *Lack of well-structured online examination system:* Online examination system should be well structured and user friendly. It should cover all the basic modules for conducting organized examination.

2) *Incompatible question type and non-availability of question editor:* Inability to support different types of questions such as multiple choices, multiple response, fill in the blank, essay type, match the following type, audio based question, image based question and case study is a big challenge. Unavailability of IDE (question editor interface) poses lot of challenges in authoring and managing questions.

3) *Security of assessment platform:* All assessments are proctored. However, with technological enhancement, candidates can malpractice during the exam through various ways. It is utmost important to have built in security features in the system to take care of high impact security vulnerabilities. Examination system should provide secure

way of displaying question paper to candidate where a candidate cannot compromise question paper by any means.

4) *Question upload and format related issues:* Inadequate question formats due to lack of standards and inability of question editor to handle multiple formats, causes major issues related to question display and storage.

5) *Difficulty in question contribution:* Various Subject Matter Experts generate and review the question bank. Lack of well-defined workflow in the system can complicate authoring and review process.

6) *Display issues:* Display issues such as missing special characters in code snippets, improper alignment of code and formatting leads to ambiguity.

7) *Slow response of examination system:* During peak-time and critical hours, the performance and throughput of online examination system can be on the lower side. This can jeopardize the success of assessments by inflicting delays in result processing and evaluation mechanism.

8) *Question Bank Ageing:* Ageing is a phenomenon in the space of assessment that indicates the usage of question is extremely high and it demands the need to revisit the question bank in order to keep it refreshed. In other words, refreshment index of question bank should be kept high in order to maintain the similar level of the question bank across participants.

9) *Question Bank Sizing:* Sizing the question bank optimally has always been a wild goose chase. It is extremely difficult to figure out a precise statistically confided formula to obtain the ideal size of the question bank. However, factors such as frequency of usage, number of candidates and social networking aspects plays a vital role to figure out the recommended question bank size.

## III. MITIGATING CHALLENGES

### A. Mitigating Generic Adaptability and Acquiescence Challenges

1) *Resistance for Assessment:* Successful attempts and efforts should be appropriately rewarded. Competency development should be driven as a gain to employee in terms of technical competency, technical skills, process and domain knowledge and well-defined career path along with productivity enhancement for the organization.

2) *Flexibility:* System should be designed in such a way that it provides flexibility to employees to register as per their convenience considering both physiological and project pressure.

3) *Volume and Scale:* There should be an effort towards distributing the load for a given certification cycle. Early bird entries and attempts should be rewarded so that candidates are encouraged to take assessments in the beginning of cycle, rather than consolidating towards the closure of the deadline. Sufficient capacity planning should be done well in advance and seats should be released/reserved based on predicted increasing load towards the end of cycle.

### B. Mitigating Location Specific –Offshore and Onsite Challenges

1) *Offshore Issues:* Large organizations have different delivery centers across offshore locations. Company can use

its own infrastructure for dedicated exam center with the presence of dedicated proctor. This will reduce the cost of overall examination, as neither proctor nor candidate requires traveling outside. Since development centers are connected through corporate intranet and speed and consistency of corporate network is always better, therefore conducting exam over corporate intranet will reduce the challenges arising due to network bandwidth.

2) *Onsite Related Issues*: Due to geographic spread of employees, conducting exam at onsite location becomes complicated and challenging. Maintaining the sanctity and fairness of exam is imperative. One can follow Vendor Based Model or Proctor Based internet/intranet Model.

*Vendor-Based Model*: In this model, exam can be conducted through hired vendor, which has assessment centers worldwide or at least at those places where most of the onsite candidates are located. These test centers should provide secure and proctored environment to conduct the assessment in order to negate unfair means. Systems, networking, scheduling of exam and logistic is taken care by the vendor. The corporate assessment team handles uploading question bank and creating assessment. Secure way of conducting exam in dedicated centers with minimal requirement of internal exam support is one the key benefits of this model. However, the cost factor is very high. Figure 2 illustrates a SWOT (strengths, weaknesses, opportunities, threats) analysis of vendor-based model [2].

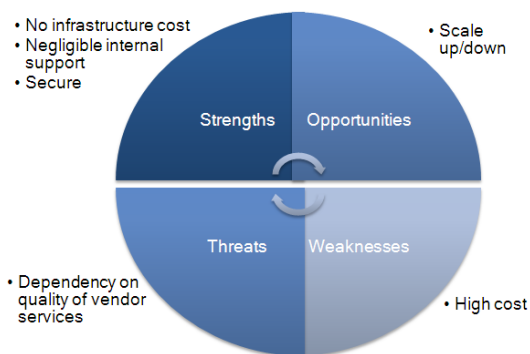


Figure 2. SWOT Analysis of vendor-based model

*Strengths* - Vendor based model is primarily good for large-scale operations where heavy infrastructure is needed. The biggest strength of this model is we do not have to spend towards infrastructure cost. In addition, once the vendor is verified against various security standards, one need not worry about the sanctity of assessments. The advantage continues by having a need of zero or no support required internally as the entire activity is outsourced to the vendor.

*Opportunities* - Since the strength of the vendors are already evaluated in past before giving the business, an appropriate negotiated contract with the vendor will clearly help in scaling up or scaling down the business. Contract written and more favorable towards the customer will ensure scaling up or scaling down can happen with minimal effort from the customer's end. However many a time contracts do run with a minimum business clause and in such a case scale down should be treated as a threat in SWOT analysis.

*Threats* - Typically, one would evaluate multiple vendors but choose one to deliver. Mostly the objective is to choose a single best vendor to provide the quality services. However,

this becomes a threat to the entire operations as it eventually indicates keeping all eggs in a single basket. For any large-scale operations, it becomes a big single point of failure. If the selected vendor fails to deliver even partially it affects the overall service level of the customer. Adaptability, tolerance, scalability of the vendor becomes a key factor to come out of such risks and if vendor does not have these capabilities, this remains a serious threat. Ideally, in the vendor selection procedure, one should carefully evaluate on above criteria. As an example, if in specific geography of a country, vendor has one test center and there are large volumes of assessments expected in duration. It is found that the test center is closed due to certain unavoidable reason. Now how capable the vendor will be to figure out another alternative test center without much influencing the ongoing show, decides the strength of the vendor, however it remains the threat if vendor is not evaluated on this parameter.

*Weaknesses* - Vendor based model has its strength and weaknesses. One of the biggest weakness of this model is part of your revenue will now go to a vendor to service your requirement. Since for large geographically spread operations, you may want to involve single or multiple vendor, costing may differ from country to country and that could lead to complexities. Invoice and associated billing verification will never be easy due to the same. If one goes for multiple vendors to have multiple options, complexities increases even further.

*Proctor-Based internet/intranet Model*: This is alternative to vendor-based model and is comparatively less expensive, but requires internal dedicated support team to schedule and support exam. Proctor should be a senior employee and has to take the responsibility to conduct the exam fairly. Required password or other details are shared with proctor only. In turn, proctor will share this information with the candidate at the time of assessment. Based on the availability of corporate network, candidate can take exam over intranet; this is always recommended because network speed in intranet is anytime better than internet. This model is cost effective. However, a chance of unfair means are relatively higher and the deputed proctor shoulders entire responsibility of the same. Figure 3 illustrates a SWOT (strengths, weaknesses, opportunities, threats) analysis of proctor-based model.



Figure 3. SWOT Analysis of proctor based model

*Strength* - This model provides a low cost solution and easy to setup/implement. It also provides better control in the hand of customer/owner from the scheduling timetable. It is a flexible model and can run purely based on customer's requirements. If used with the state of the art technology

available in the market today such as “Camera Based Remote Surveillance”, it can overcome its challenge of conducting exams fairly. Such secure remote proctoring methods are becoming very popular in the market today and it allows single point of contacts to act as proctors virtually sitting anywhere in the world to conduct the exams remotely for the candidates placed anywhere.

**Opportunities** - There are plenty of opportunities to improve upon this model and bring in secure remote proctoring method. Since proctors and candidate will be remote, usage of technology can make it more secure.

**Threats** - The biggest threat in this model is to use unfair means in the assessment. This could lead to loss of confidential data, questions, IP and in turn organizational values.

**Weakness** - Since the model has remote proctoring, the biggest weakness of this model is participant and proctor can team up and indulge in malpractice. There are very few methods to assess the involvement of each party and conclude if the exam is conducted fairly. This very well defeats the purpose of conducting the assessment.

Ideally, it is very difficult to get vendors who can cover all employee locations across geographies. In that case, one can choose blended model as illustrated in figure 4. Wherever there is a vendor’s assessment center, candidate should take assessments from the same; at other locations, assessment can be conducted via internal proctor model [2].



Figure 4. Blended Model to conduct exams at different geographic locations

**C. Mitigating Systems and Process Centric Challenges**

For successful conduction of any exam with minimum issues, there must be a good online examination system. Most of the problems arise due to poorly designed online examination systems. Some of the well-known problems related to systems are:

1) **Lack of well-structured online examination system:** In order to conduct the assessment successfully we need to choose a good examination system. There are many online examination systems available in market such as Prometric’s IBT [4], Questionmark’s Perception [5] and Devsquare’s Athena Online Examination System [6]. Any online examination system must have at least five modules as shown in figure 5 [7].

Online Examination System must have Administrator console. Administrator console should provide features such as Authoring, Scheduling, Reporting, Results, and Role management and application interface for integration with other internal system.

Application Interface provides a vital functionality to connect various internal systems with the assessment engine. For example, registration can happen outside the assessment engine and appropriate API can be invoked using an intermediate program to schedule the assessment. Similarly, result extract could be done automatically through API

invocation for appropriate communication and storage of results.



Figure 5. Imperative modules of an online examination system

Authoring module can be used to create new question bank and assessment for any test. Authoring can be in offline or online mode. In offline mode, course owner can author questions in the local system and after verification; those questions can be published in the server. In online mode, an intermediate server has to be used to store the questions. After confirmation from owner, question bank executive can publish the questions from intermediate server onto test bed. Once questions are uploaded in the server, next step is to create the assessment for each certification, for which owner needs to decide the assessment rule. This assessment rule is the core of every assessment and can be used to tweak complexity and distribution of questions in an assessment. There can be various subtopics in an assessment where questions can be tagged as simple, medium or complex based on complexity of the question. Assessment rule guides the assessment engine to pick requisite number of questions from different subtopics. Figure 6 illustrates a sample assessment rule. This assessment rule is for topic “UNIX Application Development”. This topic has two subtopics namely “File Subsystem” and “Process Subsystem”. These subtopics have a pool of questions. E.g. File Subsystem has 60 simple, 30 medium and 10 complex questions respectively. Assessment rule instructs the assessment engine to pick 15 simple, 10 medium and 5 complex questions for File Subsystem. For Process Subsystem, engine will pick 10 simple, 7 medium and 3 complex questions respectively. Overall, assessment of UNIX Application Development would have 25 simple, 17 medium and 8 complex questions from various subtopics. One can use genetic algorithms for creating more efficient test sheet generating approaches for large question bank [8].

Topic Name	Subtopic Name	Complexity	Questions in Bank	Assessment Rule
UNIX Application Development	File Subsystem	Simple	60	15
		Medium	30	10
		Complex	10	5
	Process Subsystem	Simple	30	10
		Medium	15	7
		Complex	5	3

Figure 6. A sample assessment rule

Scheduling module is responsible for scheduling exam for specific or group of participants. Basic parameters required for scheduling an exam include e-mail, start date/time, end date/time, and number of attempts. Scheduling module may require other parameters which will control the basic properties of examination e.g. exam launch environment (secure or non-secure), applicability of second level of password which will be entered by proctor, known as proctor password.

Reporting module can generate different types of reports that will be used to analyze the performance of candidates. One of the reasons why online examination system gets popularity over traditional paper pencil test is its efficiency and promptness of generating various reliable reports for a particular candidate, certification, topic etc. In this module of online examination system one can generate different types of report that is used for analyzing performance of candidate or overall certification effectiveness. Some of the crucial reports that must be integrated with online examination system are detailed below.

- *Candidate Test Score Report:* This report is a most basic type of report, but it is most frequently used. This report describes the test score with date and time of exam, certification name, IP address of machine from where the participant took exam, start time and end time of exam, etc. Ideally one should download this report for a particular employee or specified time period, which will show a list of employees with their score details. One should be able to export the report in spreadsheet format for later use.

- *Answer Script View Report:* This report is exhaustive than candidate test score report. Apart from all metadata that are part of candidate test score report, it contains details of all questions presented during test, list of distractors, correct answer and answer selected by examinee while taking exam. This report is extremely useful in case of reevaluation. Instead of searching the question in large bank, the owner can easily check the answer script of a particular candidate to find out if there is any question option is erroneous, ambiguous or out of scope. One should be able to generate this kind of report based on any of the parameters like employee number, date of exam and certification code or name. Security is a major concern in handling this type of report. Since this report contains set of presented questions with all associated details of the question along with answer, any security breach would result in set of presented questions going to public. Robust authorization control should be integrated to enhance security of this report. Further, the report should be viewed in secure mode i.e. no one should be allowed to cut-copy-paste data from this report. Search can be enabled.

- *Question Outcome Report:* To keep question bank always updated and efficient for proper judgment of candidate's competency, owner must always refresh question by analyzing question bank. This report should help owner to analyze questions in the bank and visualize the impact of each question on performance of examinees. This report should give question wise detail analysis report for whole question bank. From this report one should understand how many times a question got presented to candidates and how

many times the question was answered correctly or incorrectly. This report may contain different statistical parameters like standard deviation, mean etc to predict the possibility of question being answered correctly. With this report owner can identify the complexity level of any question, which can be a useful for revamp question paper. For example. If a question is answered correctly by majority of candidates then the question is too easy and its difficulty level should be increased. Similarly, if a question remains unanswered or is answered incorrectly by majority of candidates then the question is of higher order complexity its difficulty can be reduced.

- *Section/Topic Report:* Today, majority of assessments are composed of various subtopics or sections. This report presents statistics of candidate's performance in each section/topic of assessment. Based on this data one can easily understand the strength and weaknesses of a candidate. Once the topics where the performance is not upto the mark is identified, manager can prepare a customized training plan for competency development of employee in reported grey section.

- *Feedback Report:* Before an assessment is created, the subject matter experts take due care of learning outcome and objectives and accordingly prepare questions to test the same. However, it is a healthy practice to take regular feedback from candidates about the quality of exam. Candidates can report about difficulty level of question, scope, how well framed the question is, is it out of scope, is it erroneous or ambiguous, etc. Candidates can be requested to take survey of not only question quality but also about infrastructure, ambience, launch of exam, server response, user interface and various other parameters of interest. Feedback report generally encompasses feedback of participant about quality of questions whereas survey report encapsulated feedback with respect to other parameters. The feedback report is regularly shared with subject matter experts so that they can be well aware about pulse of candidates and if required they can take corrective action to ensure effectiveness of question bank.

Assessment team must archive the resource intensive report securely. This process can be accomplished during off peak hours. Taking timely database backups are must in an online examination system to ensure data availability. This procedure should be executed only during off-peak time in order to minimize the performance impact on the ongoing assessments.

Result Management module takes care of storing candidate's response to assessment questions in database, calculates final score and captures various metadata like start time and end time of exam, total time spend by user in taking exam, IP address of the machine from where the participant took exam. Server load and other parameters like network bandwidth and total size of assessment questions largely influence the design of result management module. There are different mechanisms to record user response to questions, in a secondary media or database. Adopting improper mechanism may lead to inaccurate test score results and compromise the overall integrity and reliability of assessment

system. One of the commonly used techniques is *submission save* where response of candidate to assessment questions is recorded after the final submit. The associated risk is high in this mode as throughout the assessment, no user response is getting stored and in case of connectivity failure, user may not get score towards the end. Retaking the assessment is only option left, in case of failure. There is another popular technique called *save-as-you-go*. This technique ensures that user selection is recorded throughout while taking the assessment. Response-record operation can be time drive or click based. If it is time driven, user selection will be stored after a stipulated time interval, however if its click based, then user responses will be stored only after click on save or associated event such as navigation to next page of assessment. Result Management module must use amalgamation of both techniques to ensure accuracy of test score and improve reliability and load balancing.

Role Management module is used to create different roles and assign responsibilities to each role. E.g. we can create a role called reporter, by which assignee can download only reports. Similarly, we can create a role called Author who can only add questions and create assessments.

2) *Incompatible question type and non availability of editor:* Authoring manager should be compatible with wide variety of question type. To allow interoperability between diverse systems, the questions should be design using IMS Question and Test Interoperability specification (QTI) [9]. Some of the popular question types are as follows:

- *Multiple choice question (MCQ):* where participant can choose one correct option out of four options. Options are presented as a radio button.
- *Multiple response question (MR type):* This type is similar to the MCQ, but only difference is candidate can choose more than one option. Here options are presented as checkbox.
- *Fill in the blanks:* Blanks are presented as input text box where candidate can enter the appropriate answer.
- *Essay type question:* In this type of question, answers are lengthy. Evaluation of this type of question cannot be done automatically by assessment tool and requires manual intervention.
- *Match the following:* Here participants need to match two columns which are corresponding to each other. This is done by drag and drop property.
- *Case study or comprehension based question:* Here questions are displayed according to the corresponding case study. A case study is displayed followed by few randomly fetched questions from a large bank.
- *Image/Audio based question:* Here, the audio or image is embedded as a part of the question. Upload and processing of image/audio based question is time consuming and demands caution.

3) *Security of assessment platform:* Questions can be presented to candidate in either secure or non-secure mode.

- *Non secure Mode:* In this environment, candidate can view the question paper and copy paste whole/part of any question. All services like communicator, e-mail and internet will continue to work during exam. That is why candidate can copy questions and save it, or send it to other candidate. This

mode of exam is not recommended for taking any examination. For surveys, opinion polls and informal tests, this is effective. Generally, this mode does not require installation of any external client software. Internet browser is sufficient to take exam.

- *Secure Mode:* In this environment candidates can view the question but they cannot copy. Further, all services via which candidate may resort to unfair means like communicator, mail, cut-copy-paste, screen-shot, any kind of P2P software, word processor and spreadsheet will be forcibly closed just before questions are presented. This is popularly known as secure browsing. This requires installation of some client side software, that is generally small in size.

4) *Question upload and format related issues:* Owners should share the question bank in some well defined standard format. Some of the popular formats are text, XML, and QML. It is recommended to use a question authoring tool where owner can preview/modify the questions.

5) *Difficulty in question contribution:* There can be two models to contribute the question to the assessment team, in one model owner will author the question in the local system by using offline mode of authoring manager. In another model by using online mode of authoring tool, there can be a workflow where subject matter expert can author questions in Authoring tool; even SME can delegate some of the authoring activity to co owner of question bank. But they need to upload the questions in some intermediate production server. Thereafter, question bank team will deploy the questions with rule for assessment from intermediate server to production server.

6) *Difficulty in question bank migration:* Question bank with assessment rule should be encapsulated into a single encrypted compressed file. This would ensure that assessment rules are not lost during migration.

7) *Display issues:* Authoring tools must have preview or tryout option. Using this option, authors can preview and test each question for technical correctness, formatting, indentation, alignment and display issues. It is advisable to take few rounds of pilot test on test bed and production server before the launch of assessment.

8) *Slow response of examination system:* Slow response is a common phenomena during peak hours. It is good idea to have multiple exam servers with proper load balancing mechanism between them. Load balancing can be done manually, where we can distribute the load manually amongst assessment servers based on the number of examination, while scheduling. Better option is to use automated network load balancer and monitoring scripts.

#### IV. TANGIBLE BUSINESS BENEFITS

The core benefit of an online assessment system is to check the knowledge level of the candidate. An assessment is an instrument to evaluate the overall skill improvement of the candidate based on training or on the job experience. It is extremely critical to continuously use and monitor to define a trend in the skill improvement of the candidate. This instrument if used well can do wonders for any enterprise.

Adhering to the solutions proposed for the challenges of

conducting online assessments can lead to significant gains to an enterprise. One of the biggest advantages to achieve a secure online examination system in an enterprise is that it reduces the overall effort towards developing various items commonly known as questions. Any system compromised on security parameters will result in item leakage and in turn will increase the overall effort and cost of replacing the same in the Question Bank. However ageing and replacement of questions in a secure platform is gradual and hence effort and related cost associated to it is low.

Correct choice of online examination system with proper implementation strategy will help any organization in multiple ways. Some of the measurable benefits include overall cost reduction, decrease in turnaround time to respond and resolve queries, decrease in total number of reported defects and escalation. Finally, all these factors influence the overall employee satisfaction.

Blended approach used to conduct the online assessments will not only result in ensuring secure environment and fair means of conducting the exam but also the sanctity of question artifacts. Competency achieved by employees during the process provides significant gains to the enterprise in terms of acquired knowledge and its dissemination at the work place to accomplish optimal productivity.

Adoption of recommended guidelines resulted in reduction of issue turnaround time by 58% (from 24 hours to 10.07 hours) [2]. Figure 7 provides details of a survey conducted across candidates who took online exams. 57% candidates were extremely satisfied with Assessment Group services. Only 3% candidates rated services below satisfactory. Overall, 89% candidates rated services above satisfactory.

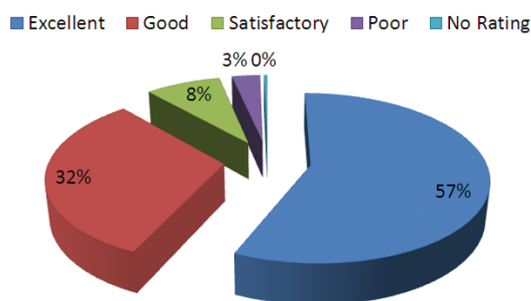


Figure 7. Feedback after mitigating challenges

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