Abstract—this document presents the rejoinder report for the MSE thesis based on the comments from the thesis supervisor and the written reports submitted by the opponents. The purpose of this document is to address all the comments made by the above mentioned and illustrate the modifications made to the thesis report.

I. INTRODUCTION

In order to address the comments made by the thesis supervisor and the two opponents, the report is divided into three sections namely supervisor/examiner comments (S/E), opponent 1 (O1) and opponent 2 (O2). Each section addresses the comments made by them. The comments made by the opponents and the supervisor are mentioned in italics and our response to the comments is in normal text followed by letter “A”. After that the necessary corrective measures that we took are mentioned in underlined text. There were a lot of ambiguities in the reports sent by the opponents including language problems which made it difficult to understand the actual point of the opponents. However we have tried our best to address the comments adequately but we have not changed any text sent by the opponents so that we don’t change the meaning of what they wanted to convey.

Opponent 1: Syed Shahid Abbas
Opponent 2: Muhammad Assad Riaz

II. COMMENTS BY SUPERVISOR

S/E: You lack the analysis detail/sophistication/clarity currently for the report to reflect the higher grades; you need to detail it and ensure that everything you claim is supported by your data and that the connections are clear to the reader. Overall you need better traceability from the data->analysis-method->results. It is hard to see which things led to which result which makes it less convincing. You have a lot of results but the reader needs to be able to judge their weight and importance.

A: We agree that our report lacks the above mentioned characteristics. We believe problems of sophistication and clarity is due to our lack of experience with HMT format. It was always confusing to decide what to add and how much detail should be provided. There was a lot of addition to the first part of the report keeping in mind the details required for a master thesis. However, there was a lot of subtraction from the contents of the first part as well having the paper format in mind. The addition and subtraction of information disrupted the flow of the report and affected its readability. In order to improve the report according to the comments we have made the following changes to the report.

- We revised the entire report to improve the formatting, sentence structure and readability of the report
- A detailed research methodology diagram has been added to the Part I of the report section II A. research methodology. This diagram details the entire process of the thesis from the start till the end.
- For a better structure of Part I of the report we have reorganized its contents and added the extra information to Part II of the report. The parts moved are selection of participants it is now in appendix B in section B1.1.
- All the graphs of the report have been created again for clarity of results.
- Tables showing the type of study instruments used by each research question are also move to Part II of the report in appendix B data collection. B2.1
- An appendix A is added to Part II of the report consisting of Aims and objectives and the rational behind formulation of each research question. Research questions, rationale behind them
- The table of common and unique questions in the entire study instrument is moved to the part II of the report in appendix B.

III. COMMENTS BY OPPONENT 1

O1: The authors have divided thesis report into two parts. In part one, author tries to follow the style of published research papers. Although idea is good but authors have many flaws and drawbacks in part one including language and sentence structure problems leads to difficulty in readability and understandability of research topic.

A: The format followed for the report is the HMT format recently introduced to the master thesis students. We agree to the fact that it was difficult to understand what part of the report should go in which part and to what extent. This hopping between parts and continuously change of the layout resulted in readability and clarity issues related to the report specifically part one.

To address this issue we have revised the entire report and
have tried to eliminate these issues.

O1: In the second part, it gives a clear impression of written by someone else who not wrote part one. There is probability that both authors had divided section between each other. Because part two have proper flow of language as compare to part one. Overall analysis and discussion on collected data is only sufficient enough and required to improve and review the result sections.

A: The first issue stated in the comment is futile and does not suggest any improvements hence it is being ignored. However we have revised the discussion and results section in part 1 of the report.

The results section is separated that specially highlights the results of the study.

O1: Peer review is recommended for each section of final draft and opponent report writer of this report is assured that authors could catch many fundamental drawbacks by themselves if they had proper review.

A: The report was reviewed by both the authors. It has been proof read again.

O1: In the thesis report, research problem is clearly explained and meaningful. Aims, objectives are clear and research questions are also clear. However, it seems that the aims and objectives are partially met.

A: The study comprehensively meets the aims of the objectives of the study. To support our claim we would suggest the opponent to read the aims and objectives and the research questions again. There is a clearly mentioned aim, that comprises of certain objectives and to meet those objectives we have designed the research questions. However to make it more evident we have added the rationale for each research question in the part II of the report in Appendix A. These rationale were conversed with the case company and the supervisor prior to the beginning of the study but were not added in the report before. Apart from that expected outcomes of the study were also discussed and finalized in the proposal but were not mentioned in the report. But now we have added the expected outcomes briefly as mentioned in the approved proposal.

O1: The authors of this thesis had good opportunity to collect more data from industry as this thesis has only one company case studies. Authors mention that there are ~20 Testers working at Sogeti AB. They have conducted semi structured interviews from only 6 out of 20 testers. However, they have not mentioned the details of sample selection criteria. This can be threat to the validity of results.

A: The details of the sample selection were mentioned in the report in Part I section II C under the heading “selection of participants”. The text clearly shows the criteria for selection that was the type of participants: testers and customers, having perspectives: ET supportive and skeptical and finally initial training of ET for all the testers was the selection criteria for the participants. However the selection of the participants within the organization was made by the case company its self. We only stated our requirements. The selection of participant for the survey is also clearly mentioned in the same section. The amount of detail was added keeping in mind the paper format. But it seems some of the readers might find the information insufficient therefore the section “Selection of Participants” now moved to the Part II of the report in Appendix B Data collection with a improved structure.

We disagree with the comment regarding the selection of number of participants at Sogeti. It appears that opponents are suggesting that we did not avail the chance at its best and we deliberately chose to interview only 6 testers. We on the other hand consider ourselves rather fortunate that we could interview even 6 testers. It is a bit hard to get a hold of people for such meetings. Secondly we had a criteria and not every tester at Sogeti fulfilled it. The validity threat regarding one company has already been discussed in Part I Heading V validity evaluation section.

O1: Authors mention in Part 2 under heading of Data collection on page 17, Customers interviews from 3 out of 4 have also validity threat when authors send interviews questionnaire through e-mails and not mention any particular tools and detail about online semi structured interviews. Authors had only one direct contact with one customer. Thesis report also not mentions the customer details, for example how much they have knowledge about ET or about software development.

A: The report clearly mentions the medium of communication that was email. The reason of doing so was that after months of waiting for the interviews to be scheduled only one customer of Sogeti agreed for an interview. Other participants were reachable through emails only. Regarding the details of the customers, Sogeti did not consent to reveal any kind of information regarding their customers. However, this specific point regarding the customers is added to the selection of participants section in Appendix B data collection.

O1: Authors conduct survey as an alternative of data collection. Sample size population 25 for survey also has validity threat. This is highly recommended that must be at least 40 to 50 persons for survey. Mention survey population size is insufficient. 7 out of 26 references are web based

A: We disagree with the views of the opponent. Because we did not come across any study that suggests that the current sample size is inadequate for our research. We have repeatedly mentioned that it is a relatively new approach in academia as well as in the industry therefore very little scientific material is available for referring. The opponent is suggested to read Part II Appendix “A literature survey section survey methodology”.

O1: In connection of research question 1: What is Exploratory Testing? Authors only mention few paragraphs that usually written in Background/Introduction section of
thesis report. After reading this part, one question arise why authors mention this separate research question or what is your contribution of authors for this research question?

A: The prime motive of this research question was to reach all the available study material related to ET in order to conduct the literature review. Secondly, as constantly mentioned the ET lacks research and is not very well known, the motive of having this section was to provide an extensive summary of the approach to the readers of the report. So that after reading the literature review section of part I and specially part II of the report the reader develops a thorough understanding of the phenomenon. As far as our contribution is concerned it lies in the efforts in bringing together most of the literature regarding ET and providing a new definition of exploratory testing based on our understanding.

**O1:** Graphical Presentation of research results shows inconsistency in selection of colors and there is no proper values mentioned for Y-Axis in almost all graphs. Heading of tables for research results are not standards, for example in Table 4 heading “N of O” instead of Occurrence/ Number of Occurrences. This is highly recommended that Graphs should be clear and consistent in all references and table heading should be proper according to standards.

A: There was no inconsistency of colors found. Had there been no values along Y-axis graphs would have not been drawn. Most of the Y-axis values were textual not numeric. The term “N of O” was explicitly explained prior to its use to avoid any ambiguity. However, all the graphs in the study have been redrawn. Because the previous graphs were of bad quality and occupied a lot of space. They were taken from survey monkey; the medium used to conduct survey. Inappropriate table headings have been altered accordingly. “N of O” is changed at all instances.

**O1:** Authors cover the research area. According to author’s statement there is insufficient literature available for this topic. But they have not mentioned any published article/paper reference that validates author’s statement. Authors not used any systematic or literature review for research area. They only mention some database names.

A: We totally disagree with the comment as proper referencing has repeatedly made when ever this claim is used. For instance Part I, section Introduction. “One of the major reasons of ET not being realized - although practiced - is lack of scientific research. Therefore, ET seems to be a victim of a number of misconceptions [1] [7].” The opponent is suggested to read report part II, Appendix B Literature survey, section Survey methodology again which details the methodology of the review and the motive of conducting in that manner. The report clearly states the use of publications as well.

**O1:** There is insufficient reference list. On one point authors are consistent that is repetition. Authors also repeat the list of references. First they mention in part one and then they again in part two.

A: The purpose of having references at two instances was not by any means repetition. It was according to the HMT format which requires the part I of the report to be a paper and the paper has its own set of references. The second part also had text which required referencing. Therefore references were mentioned in Part II as well. References in both parts of the report are also seen in one of the HMT format thesis to be used as an example at the course homepage. Opponent is suggested to visit the course homepage for details regarding HMT format.

**O1:** 7 out of 26 references are web based.

A: Repetition of comment. This has already been answered.

**O1:** There is no proper order in through out the Thesis report. This proper order creates the difficulty to see the references numbers from the list. There is no consistency in writing of references formatting. Authors not follow any particular standard.

A: We do not agree to the comment regarding the ordering of and formatting of the references. The orders of the references have been consistent throughout the report. But we are not quite sure what the opponent means by ordering. The formatting of the referencing has been consistent and follows the format. However there are types of references which have their own format such as a web reference has a different format than reference of a book so on so forth. The format structured followed by us for each type is as following.

Publication, book reference and web references respectively:

[1] Author(s) name(s), “title of the publication”, published in, page number, year, (link to the article if available), last visited date

[2] Author(s) name(s), “Name of the book”, publisher, year

[3] Author(s) name(s), “title”, source, last visited date, link

**O1:** On page 16 there is no proper reference mentioned “Some good examples of types of software/services that could benefit from the ET approach can be facebook, LinkedIn, Twitter, Wordpress and Joomla etc.” then how authors come to know?

A: The opponent is suggested the read the above mentioned with reference to the context where it has been mentioned. Moreover this is not a claim it is a view point developed during the study. Which we believe does not require referencing, at least to the above mentioned case.

**O1:** Authors divide the thesis report into two parts. Part one consist of about 20 pages including almost all headings. In this part there is major problem in flow of language. There is no rhythms and consistency in sentence structures. There is lot of redundancy of words. In most of the sentences wordiness is common along with inconsistency in paragraphs. Reader feels many difficulties to understand the concept of authors. Often reader feels bore and cannot concentrate on reading martial. There are some interesting examples from first 20 pages. Authors need to fix these problems through out the thesis report.

A: We agree with the opponent regarding the readability issue of the first part of the report. As mentioned earlier formulating the thesis in HMT was new for us and we did do
well in that. There was a lot of addition to the first part of the report with respect to the details required for a master thesis. However, there was a lot of subtraction from the contents of the first part as well. Having in mind that it is to be a paper as well. The addition and subtraction of information disrupted the flow of the report and affected the reports readability. We have tried solving the problems with flow of the report and readability as well, by improving the entire report. We have improved the sentence structuring and removed the redundancy of the words.

O1: Some interesting statistics: Authors of this report uses words "WE" & "OUR", 64 and 44 times respectively with in first 20 pages. This is highly recommended authors use word “AUTHORS” as alternative of “WE”. This change will increase the readability.

A: We do not agree with this comment of the opponent as replacing the word “Authors” with we & our, would sound as if we are presenting third persons work. For instance, “the authors used the method of descriptive case study for their investigation”. Apart from this it was interesting for us as well to know that opponent could put up such a suggestion.

O1: No proper flow of sentences. Reader feels difficult to understand the authors point of view.

A: Redundant comment. The issue is already addressed.

O1: On page 5 under heading Data collection. “Rests of the 3 testers were interview using questions for ET skeptical testers as an instrument. 1 of the 4 customers was interview using interview questions for ET supportive customers.”

A: It seems that the opponent was in a rush to make a comment because the sentence mentioned above is apart of a complete sentence. We did not understand the motive behind this.

O1: “The data from the common questions among all the instruments was manually grouped together to separate the common and unique data occurrences. Data collected from the survey was to analyze the data collected from Sogeti and draw inference and conclusions of results.”

A: We don’t find anything strange with the above paragraph.

O1: There were no interviews specific to any research question alone.”

A: The opponent needs to read the things in the context. Within context this sentence is okay.

O1: On page 6 Jumping from one prospective to another create the difficulty for reader. Previous paragraph discuss survey and again description about interviews. Instead of here authors could mention more information about interview before starting the paragraph about survey.

A: We agree with the comment and the changes in the sections “research methodology” and “data collection” in Part 1 of the report have been made.

O1: Very strange sentence on page 6 part 1” Knowing the purposes of using ET at Sogeti was important and so were the purposes of not using ET."

A: Opponent would not find it strange if read in context. However there are numerous ways to structure a sentence.

O1: On page 13 what is the meaning of here “So here we can see that there are some common pros and cons mentioned by the testers and the customers.”

A: Comment made out of context. Opponent is suggested to learn to read things in their context.

O1: On page 13 bad example of incomplete sentence “So is with the rapid feedback”.

A: Another comment made out of context

O1: On page 14 example of redundancy of article the” On the second the place is the accountability factor of ET”.

A: Typographical error, now corrected.

O1: On page 14 improper table headings “N of O”.

A: repetition of comment issue already addressed.

O1: On page 14 example of difficult to understand “The rationale behind could be the fact that when you decide to do risk based testing it is easy to decide upon the test mission in ET. Hence, testing is more focused in eliminating all the entitled risk of the system. This could also be stated as focused testing. The testers and customers were also asked about the manner they used ET.”

A: Reasons for such difficulties has been explained and fixed as mentioned earlier.

O1: On page 15” But the motive of listing these techniques was to present the data according to the industry usage and the above mentioned were repeatedly stated by the survey participants.”

A: Sentence read out of context again.

O1: On page 16 example of redundancy and inconsistency “when docs and /or requirements are vague or are

A: We agree with the redundancy and inconsistency issues in the report but mentioning out of context and incomplete sentences over and over again would not help in improving the research neither the formatting. However the sentence mentioned here is again incomplete and out of context so it is obvious it will not make sense if mentioned as above which is not the case in the report.

O1: On page 5 heading Data Collection “testers at Sogeti. 3 of the 6 testers were interviewed using”

A: Incomplete and out of context sentence mentioned again. Whereas the original sentence is “We performed 6 interviews with the testers at Sogeti. 3 of the 6 testers were
interviewed using questions for ET supportive testers as an instrument.” We still do not understand the motive of opponent in mentioning incomplete sentences deliberately and repeatedly.

O1: Weak Analysis, inconsistency in references numbers.
A: Need to elaborate the comment weak Analysis as opponent in the entire report has only been discussing about the formatting and issues related to structuring the language. Comment regarding the inconsistency in reference numbers is not correct and have been addressed earlier.

O1: Authors have clear but limited effort. There is need of more effort for master level thesis. At least authors have peer review of their own text.
A: We can only say that we appreciate the time spent by the opponent in reading our report. The comments from opponent really helped us in fixing the structure and format related problems of our thesis. However, we think the opposition report should have been more focused on improving the thesis in terms of research not just formatting. comments by opponent 2

O2: Authors have clearly defined the problem in the introduction section of thesis report. But it is hard to identify relationship of problem definition and software engineering in this work. As authors mentioned in report and also in presentation. Exploratory testing is playing with the system “i.e. it is an ad-hoc way of testing system. But in software engineering, focus is on using systematic methods to solve problems. Exploratory testing can be good for certain situations but its not wise to use on system which has high priority of safety and security.
A: We believe that the opponent has misconstrued the information provided in the report and the presentation. Because one of the motive of conducting this research was to show that ET is not ad hoc and neither is exercised in this manner in the industry. We suggest the opponent to read the literature review Appendix in Part II of the report and the entire Part I of the report. But initially read just the introduction would help.

O2: The selection of research question is appropriate for the problem definition. But it would be better if author also include the rational and motivation for each research question in thesis Appendix D.2.
A: We agree with the opponent’s suggestion and have added the rationale of each research question in part II of the report in Appendix A in section A.2 of the updated report.

O2: In Appendix A.1 authors mentioned research methodology, they argued that there is not established research conducted in exploratory testing. Therefore they didn’t used systematic review. But it would be appropriate to use systematic review in situation to dig deep into the problem domain.

A: We believe that the opponent has misconstrued the information again. The report states that no formal techniques like systematic review was used to conducted the review of the available literature. This is due to fact that there is no established scientific research available for exploratory testing. However, the literatures review in itself was conducted very systematically as mentioned in section B.1 in the appendix B in part II of the report.

O2: In authors used precise and technical language. There are few grammatical errors. The report formatting is very poor. Authors try to fix the formatting issues at last movement but still it need revision. The tables in the report should be either on top or on the bottom. The research paper is easy to follow. But the appendices need to be review for better understanding.
A: We agree to the comment regarding the formatting of the entire report therefore issues related to formatting are addressed in the entire updated report.

O2: In appendix B. authors described the selection instrument. This section lacks the selection criteria for tester, skeptical testers and customers. In appendix E the interview question are included there lack of. How these questions have been formulated and motivation for these questions. What were the considerations for formulating these questions. Some of the questions are ambiguous. E.g. if we try to related the question with the results it is hard to find how authors related this information with actual results and analysis. The data collection at appendix B.2 states that some testers and customer were select. There should be a motivation how theses testers and customers were selected.
A: The selection criteria of the participant was explicitly mentioned in Part I in section III. C selection of the participants. However the selection of participant section is moved to the part II Appendix C section C1.1 in the updated report with more clarity. The construction of the questions of the interviews and survey is explicitly mentioned in section B1.1 that is “Construction of the study instruments” in the previous report. This section discussed the construction of each study instrument and the consideration taken into account while constructing the study instrument. However in the updated report this section is in appendix C section C1.2. To show the traceability of our work from method=>data =>Analysis=>results we have added a detailed research methodology diagram in part I of the report in section II study design part. A. This diagram and the description regarding the diagram illustrate the thesis process. For each research question we have constructed a table that shows the types of study instrument and the specific questions in that study instrument used to answer the research question. These tables were initially included in part I of the report but in the updated report the tables are in part II appendix C Data collection section C.2.4.

O2: During the interviews tap recorder was used. Which is
normally not recommend for extraction information from interviewees

A: The tape is not a recommended method but it is widely used by researchers when conducting interviews in the industry as it is hard to contact them after the interviews. However the recorder was used with the consent of the interviewee.

O2: This report lacks the description of validity threats.
A: We have discussed the validity evaluation of the entire study in part I of the report in section V validity evaluation.

O2: In this work authors left out construct validity by stating it is not relevant in this case. But according to Wohlin [2] is concerned with relationship between theory and observation. And in this case as author mentioned in aim and objective of the thesis why ET is not adopted by industry. Therefore it is suitable to include construct validity in the work.
A: We disagree with the comment that there is a need to include construct validity. According to Wohlin [1] “construct validity concerns generalizing the results of the experiments to the theory behind the experiments”. However there are no experiments involved in this study therefore this study does not require construct validity.

O2: The scale used between case study and survey should same for comparison.
A: The scale used for the comparison of pros and cons of survey and interviews was same. However the tool used for the graphs automatically scaled the maximum value of X axis from 100 to the highest weight assigned to a choice mentioned in Y axis. The updated version of the report has all new graphs that are clearly understandable.

IV. CONCLUSION

In this report we have tried to address all the issues reported by the supervisor and the two opponents of our thesis. We have tried hard to resolve the readability, formatting and language structuring issues so that the thesis report is sophisticated and clear.

V. ACKNOWLEDGEMENT

We would like to acknowledge our supervisor Dr. Robert Feldt for his time and valuable feedback throughout our study. We would also like to thank our thesis examiner Tony Gorschek for his patience and reviews. Last but not the least we really appreciate our thesis opponents for their time, feedback and comments.