

## **CHAPTER 4**

### **RISK VARIABLE IDENTIFICATION & CATEGORIZATION**

#### **4.0 Introduction**

A generalized list of risk variables which are affecting the project performance in terms of the cost and time were identified during the literature review process and were initially categorized as available. Since these risk variables as identified in the initial stages of the research process are generic in nature and are not completely applicable for the Construction of Substations in UAE, a specific list of risk variables are to be identified from the generalized list and to be subsequently categorized based on the stakeholders; for further utilized in the research.

#### **4.1 Risk Variables from Literature Review**

Various Risk Variables were identified initially from the Literature during their Reviews. These identified Risk variables (229 Risk Variables) were subsequently classified under various major categories (16 categories). These risk variables and their categorizations are based on various areas of construction projects including various regions and on global level. These Categorized Risk Variables with their quantification are shown in Appendix A1 and also summarized in the form of a Bar Chart as given in Figure 4.1, indicating the Categorization and the corresponding number of risk variables grouped against those categories.

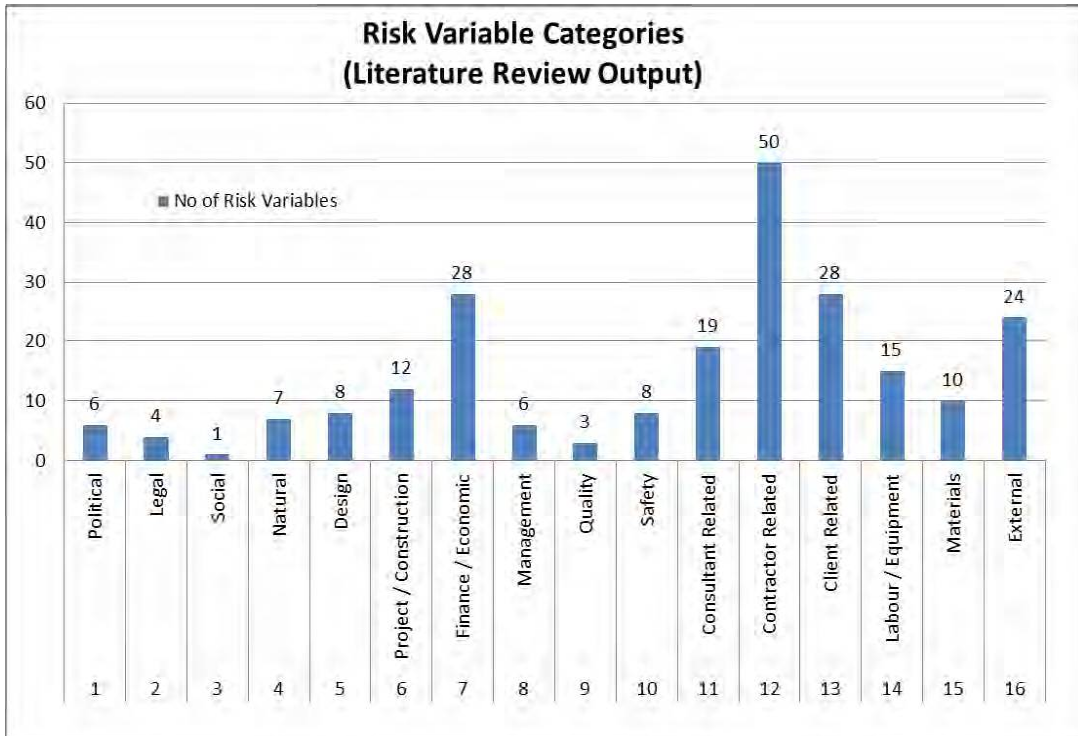


Fig. 4.1 – Summary Chart of Literature Review Categories & Risk Variables

#### 4.2 Identification & Validation of relevant Risk Variables

In order to have a meaningful set of risk variables including proper categorization of the same based on the Work Break-down Structure including various Stakeholders suitable for the Construction of Substation project in UAE, these initially identified risk variables from the Literature Review were taken up for the further analysis to conclude on the questionnaire for obtaining the responses from various respondents for the Objective 1.

The Activities involved in the construction of substations and their stakeholder wise grouping has been considered as the primary requirement for this study and was taken up for attaining needful opinions from various project professionals with expertise in the field of construction of substations in UAE.

### 4.2.1 Approach for Risk Variable Grouping

There are different techniques utilized by experts for decision making to carry out the grouping activity. Few of them are as listed below:

- Delphi Technique
- Nominal Group Technique
- Brainstorming
- Focus Group
- Dialectical Inquiry
- Common Information Bias
- Diversity-based Infighting
- Risky Shift
- Devil’s Advocacy

As per Bowling (2002) there are three main methods for establishing and developing consensus which are (a) Delphi Method, (b) Consensus Development Panels and (c) Nominal Group Processes. After review of the available options and considering the recommendation as made by Bowling (2002), Nominal Group Technique (NGT) was selected for the above process of categorization. This was also supported by the comparison of Group Decision Making Processes (Potter M, Gordon S, Hamer P ; 2004) as appended below as Figure 4.2:

Attribute	Decision making process			
	Delphi	Focus Groups	Brainstorming	NGT
Face-to-face group meeting process	No	Yes	Yes	Yes
Generates a large number of ideas	Yes	Maybe	Maybe	Yes
Avoids focusing on a single train of thought	Yes	Yes	No	Yes
Encourages equal input from all participants	Yes	No	No	Yes
Highly structured process	Yes	Maybe	No	Yes
Meeting time usually 1-2 hours duration	No	Yes	Yes	Yes
Avoids 'quick' decision making	Yes	No	No	Yes
High degree of task completion	Yes	Maybe	No	Yes
Provision of immediate feedback	No	Maybe	Maybe	Yes
Measures the relative importance of ideas generated	Yes	No	No	Yes

Fig. 4.2 – Comparison of Group Decision Making Process (Source - Potter M, Gordon S, Hamer P ; 2004)

#### **4.2.2 Nominal Group Technique – Origin, Definition, Procedure and Advantages & Disadvantages**

Origin - The Nominal Group Technique (NGT) was originally developed as an Organizational Planning Tool by Andre Delbecq and Andrew H. Van de Ven in 1971 (Wikipedia online resource – [https://en.wikipedia.org/wiki/Nominal\\_group\\_techniques](https://en.wikipedia.org/wiki/Nominal_group_techniques))

Definition - The Nominal Group Technique (NGT) is a group process involving problem identification, solution generation and decision making; being a decision making tool in a group setting (Islam, R., 2010). It is also termed as a structured process to gather information from a group (Vi Hoang Dang, 2015). It is also stated that this technique is a structured variation of small group discussion methods (Journal of Extension). This technique can also be called as a structured form of Brain Storming or Brain Writing ([https://www.mycoated.com/Nominal\\_Group\\_Technique](https://www.mycoated.com/Nominal_Group_Technique) – Accessed on 12<sup>th</sup> June 2016) that encourages contribution from everyone (ASQ.org). NGT is a more-controlled variant of brainstorming used in problem solving sessions to encourage creative thinking, without group interaction at idea-generation stage (Business Dictionary). It is a structured process that seeks to draw quantitative estimates through a qualitative approach with individuals working independently to generate ideas (BSLE Conference – Oxford Brookes University, 16 May 2007; Diana Williams). NGT can be utilized as Consensus-Building tool (Terence R.Kline, 2013)

Procedure – A standard procedure for a Nominal Group Technique session consists of 5 stages. The details of these five stages are explained below:

i. Introduction and explanation:

The Facilitator welcomes the participants and explains to them the purpose and procedure of the meeting.

ii. Silent generation of ideas:

The Facilitator provides each participant with a sheet of paper with the question to be addressed and ask them to write down all ideas that come to mind when considering the question. During this period, the facilitator asks participants not to consult or discuss their ideas with others.

iii. Sharing ideas:

The Facilitator invites participants to share the ideas they have generated. He records each idea on a flip chart using the words spoken by the participant. The round robin process continues until all ideas have been presented. There is no debate about items at this stage and participants are encouraged to write down any new ideas that may arise from what others share. This process ensures all participants get an opportunity to make an equal contribution and provides a written record of all ideas generated by the group.

iv. Group discussion:

Participants are invited to seek verbal explanation or further details about any of the ideas that colleagues have produced that may not be clear to them. The facilitator's task is to ensure that each person is allowed to contribute and that discussion of all ideas is thorough without spending too long on a single idea. It is important to ensure that the process is as neutral as possible, avoiding judgment and criticism. The group may suggest new items for discussion and combine items into categories, but no ideas should be eliminated.

v. Voting and ranking:

This involves prioritizing the recorded ideas in relation to the original question. Following the voting and ranking process, immediate results in response to the question is available to participants so the meeting concludes having reached a specific outcome.

Advantages and Disadvantages - The following are few of the advantages and disadvantages of Nominal Group Technique:

Advantages

- Opportunity for all participants to contribute ideas thereby minimizing the domination of the process by more confident or outspoken individuals.
- The generation of a greater number of ideas than other techniques.
- The generation of more creative ideas than other techniques.
- The ease of interpreting the results because of idea generation, voting / ranking, and evaluation are done in a session itself.
- A greater sense of accomplishment for members due to availability of the results at the end of the session itself.
- The comparatively efficient use of time than other techniques.

Disadvantages

Apart from the advantages, the disadvantages or limitations are to be recognized while utilizing Nominal Group Technique which includes:

- The limited number of topics and issues that are covered (generally being a single-topic sessions).
- The limitation of idea generation to the meeting session itself without an opportunity to provide additional ideas during their available opportunity.
- The lack of anonymity, sometimes may limit participant willingness to express their views.
- The rigidity for all group members to be capable of and comfortable with, expressing their ideas in writing and then communicating them verbally to the group.
- The time commitment required from participants, and the necessity for them to attend a specific location at a given time, which may limit participant numbers.

- The lack of generalizability of the results to the wider population due to the specific characteristics of the participants (both in terms of who is nominated to attend, and who agrees to participate).
- The limited nature of the data (i.e. in terms of number of respondents) often requires a follow-up survey or other quantitative methodology prior to making final decisions about an issue.

#### **4.2.3 Nominal Group Technique – Participants**

A review on the recommendation by NGT experts was done to determine the number of participants to be utilized for the session. Delbecq AL, Van De Ven AH (1971) suggest that NGT groups should be made up of no more than 5-9 participants. Carney et al (1996) noted that from their pilot project findings, that a minimum of six participants were required, in order to engender a sense of ‘safety’ within the group, illustrating this point by outlining that one of the pilot groups in the study had only contained five members and it was perceived that this could be felt as ‘mildly threatening’ (Lennon R, Glasper A, Carpenter D; 2012, Vi Hoang Dang; 2015). Consequently, six participants are considered and nominated as Nominal Group member for the NGT session with four from Contractor side, one from Consultant & one from Client side; all having vast experience in the construction of Substation in UAE.

#### **4.2.4 Nominal Group Session – Opening Session: Scope, Characteristics & Rules**

The NGT session commenced with a briefing of the study undertaken presently with the objectives of the research and the requirement of identification of the Risk variables for taking up the Objective 1 of the research which reflects the relevant Risk Variables for the construction of Substation in UAE. Along with the scope of the session, the procedure for the NGT session was briefed to all the participants. Apart from the utilization of the Nominal Group Technique; in order

to eliminate the few of its disadvantages; the following characteristics of decision-making are considered and detailed to the group members:

- Objectives are established first for the grouping process.
- Objectives are classified and placed in order of importance
- Possibility of developing alternative actions to be identified
- The identified alternatives are to be evaluated against all the core objective
- The alternative that is able to achieve all the core objective to be considered being the tentative decision
- This tentative decision is to be evaluated thereafter for more possible consequences
- In a situation featuring conflict among the group members, role-playing is considered for predicting decisions to be made by involved members.

The following rules are being agreed for the session:

- There should be no criticism about anybody's ideas
- There should be no evaluation about anybody's ideas
- There is Anonymity of Input
- To generate ideas as much as possible
- Modifying the ideas and / or combining various ideas

#### **4.2.5 Nominal Group Session – Silent Phase: Identification of Relevant Risk Variables from Overall List of Risk Variables taken from Literature Review**

The Table-4.1 listing out the Risk Variables taken from the Literature Review was handed over to the NGT members. Considering that there are 229 Nos. of Risk Variables to be analyzed, a time period of 90 minutes was provided, even though the same being very long.



Since the Risk Variables were categorized while issuing to the members, the review process was easier and resulted in getting the feedback from the members much faster than the estimated time.

The members provided their response with their validation on the requirement of the Risk Variable to be considered for the study in the form of Y (Yes) & N (No) against each Risk Variable in the Appendix A1 handed over to them.

Based on these details, the responses are again put into the tabulation with the details of Y & N and the summation of the Y & N against each Risk Variable. This Output is given as part of Appendix A5 (Column name with Res-1, Res-2, Res-3, Res-4, Res-5 & Res-6)

#### **4.2.6 Nominal Group Session – Sharing Phase: Identification of Relevant Groups of Work Break-down Structure for distributing the identified Risk Variables**

Upon completion of the silent phase for generation of ideas by identifying the relevant Risk Variables by the NGT members and its tabulation, the sharing of ideas phase was initiated.

Initially, members were requested to share their views on the Work Breakdown Structure (WBS) to be followed for the present study. Consequently, various ideas were tabled by the NGT members and are duly shared between them. Based on the views of the members expressed, a typical WBS was formulated considering their ideas and sharing the same among them to result with four groups (three being technical function and one being support function) corresponding to the various stakeholders of the project; with cumulative of 20 categories; as shown below in Figure 4.3:

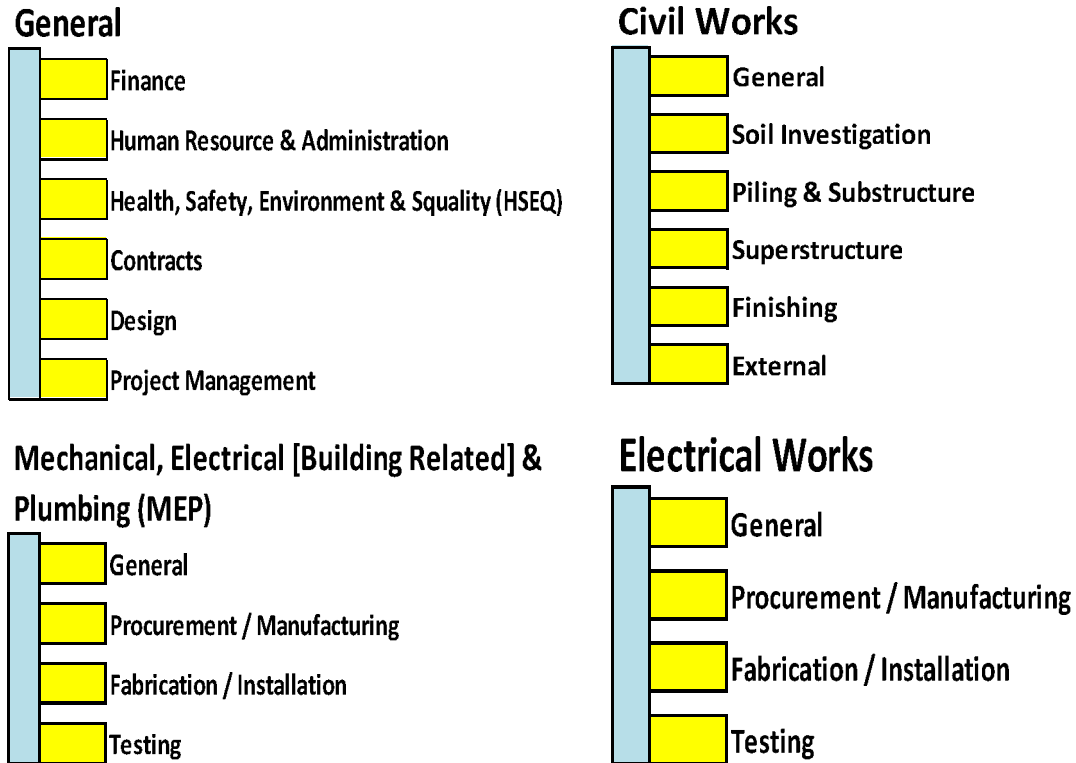


Fig. 4.3 – WBS wise stakeholder wise Risk Variable Categories

In view of the agreement to the above WBS, it was also recommended by the NGT members to group the relevant Risk Variables to the individual WBS category for formulation of the questionnaire by means of Discussion, Voting and Ranking of relevant Risk Variables matching with the Group / Category.

**4.2.7 Nominal Group Session – Group Discussion: Allocation of the relevant Risk Variables Identified to Relevant Categories of Work Break-down Structure**

The output of the silent phase and sharing phase in the form of the Table with the identified relevant Risk Variables and the WBS Categorization was handed over to the NGT members. The Group Discussion session was scheduled for next day with a time frame of 120 Minutes to allocate the Risk Variables to various WBS Categories as desired by various members based on the discussion but was

Rating & Voting session will authorize the content sequence for the Questionnaire – 1.

The Group Discussion session started with the suggestion from the members to identify the similar Risk Variable and group them into a single Risk Variable as a first step, so that the number of Risk Variable to be assigned to the Categorize are minimized but the contents are not lost due to this grouping. This was suggested considering that the number of Risk Variables will be huge without grouping and obtaining the response from the various respondents upon formulation of the Questionnaire and subsequent procession of the responses will be wearisome. This being a valid suggestion by all the members and with their agreement, the needful grouping of the similar Risk Variables into a single Risk Variable by giving a clear Terminology for the grouped Risk Variable was carried out as first step. This grouping of the Risk Variables was done with the suggestions by the NGT members and was clearly indicated in the Finalized Appendix A5 with colour highlight in Brown on the Risk Variables and the suggested Terminology for the Risk Variable as grouped & its grouping details in the “Remarks” column of Appendix A5.

While the first step was in progress, it has been suggested by the NGT members that some Risk Variables which were noted as “Required” are not an appropriate one to be considered for the present study and hence shall not be categorized. These Risk Variables were identified and marked in RED for easy identification during the final output of the NGT session.

It was pointed out by the NGT members that some of the specific Risk Variables which are relevant to the Construction of Substations in UAE – the present study are not covered. Hence the NGT members suggested including few of them to the Overall List of Risk Variables to be grouped into various WBS categories. These Risk Variables account for a total of 19 Numbers and are shown in the Appendix A5 separately.

After completion of the above two steps of grouping and adding additional Risk Variables to the overall list, further discussions were made to assign them to the relevant WBS categories. A Matrix was prepared with the Risk Variables listed in the Rows and the 20 numbers of WBS categories listed out in the Column side. Each Risk Variable was taken up for discussion and is assigned to the relevant categories. This process was carried out until all the identified relevant Risk Variables are assigned against the relevant categories. It shall be noted that many risk variables are allocated against different categories and their response from the specific stakeholder who are experts in those categories of activities, being their perception, are more relevant for this study.

Apart from the above, a simple “Help Text” was also discussed and was included in the Risk Variable Terminology, wherever feasible, so that the respondent can clearly understand the Question and can provide a valid response. These are common for the same risk variables distributed against various categories, but are having different perception of those stakeholders addressing their relevant categories.

#### **4.2.8 Nominal Group Session – Voting & Ranking: Transferring of Categorized Risk Variables into a Questionnaire**

Upon completion of the assignment of the Risk Variables to the relevant WBS categories, the NGT members are requested to Rank the Risk Variables so as to present them in a proper order in the Questionnaire to be formulated.

The ranking of the Risk Variables were made by the NGT members and accordingly the sequencing of the Risk Variables in each Categories of the Questionnaire was listed out.

### 4.3 Questionnaire-1 for WBS Categories with allocated Risk Variables

Based on the conclusion of the Nominal Group Technique session conducted and detailed in the earlier sessions, the Questionnaire – 1 was formulated with a total of 185 Risk Variables grouped and ranked against the 20 numbers of WBS Categories, also referred here as Activity-wise Stakeholder-wise Categories, for the construction of Substations in UAE.

These Categorized Risk Variables for the Questionnaire-1 in the form of a NTG Session Output is shown in the Appendix A5 and also summarized in the form of a Bar Chart as given in Figure 4.4.

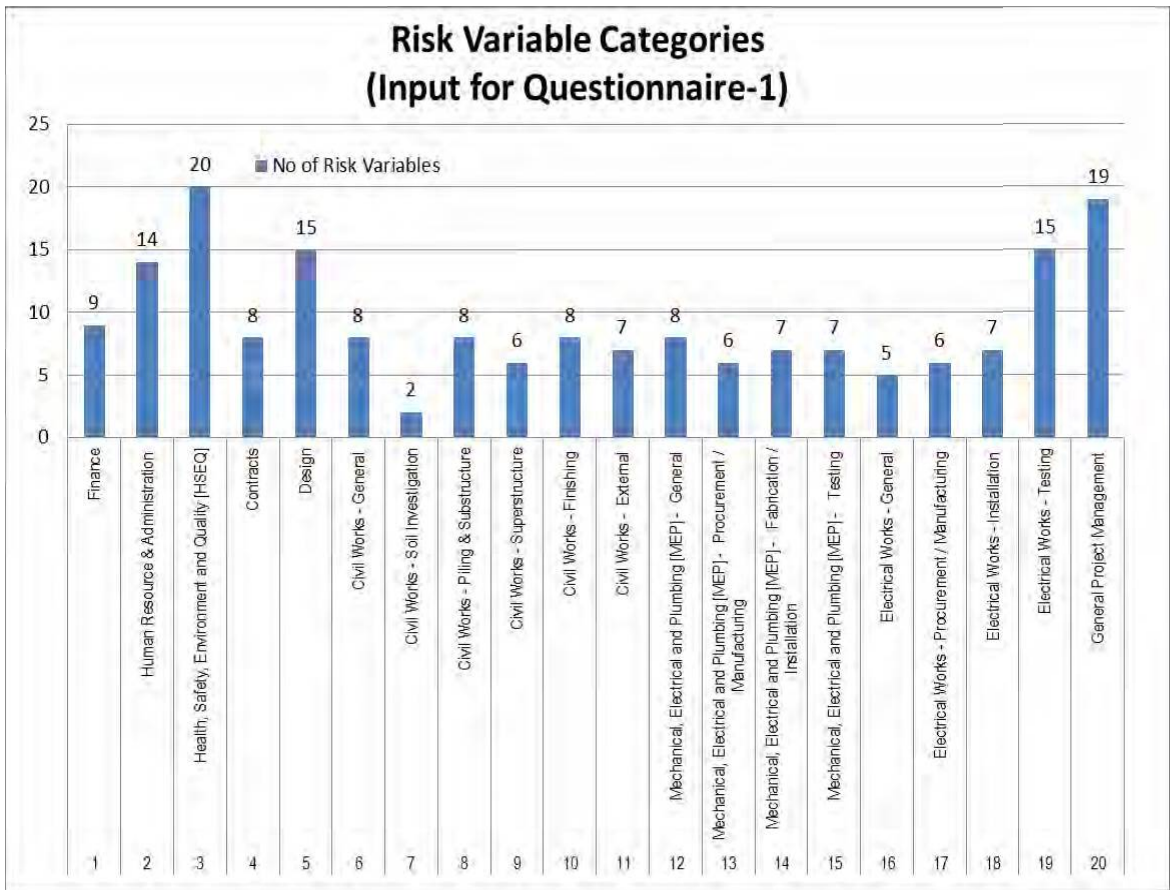


Figure 4.4 - Summary Chart of NGT session Categories & Risk Variables taken up as input for Questionnaire # 1

#### **4.4 Chapter Summary**

The Initial list of Risk Variables (229 Nos. grouped in 16 Categories) as obtained from the Literature Review was taken as the basis for formation of Questionnaire # 1 reflecting the relevant Risk Variables along with the Work Breakdown Structure Categorization corresponding to the relevant stakeholders for Construction of Substations in UAE; while the Nominal Group Technique was utilized for such grouping of the Risk Variables, with more improvisations made during the NGT sessions by means of suggestions and discussions by the experienced professionals in the field of Construction of Substations in UAE.

Initial discussions were made on the Activity wise breaking down of the Construction of Substation project with the major Work Breakdown Structure reflecting the relevant stakeholders. Suggestions as made were taken up resulting into General, Civil Works, Mechanical / Electrical [Building Related] & Plumbing (MEP) Works & Electrical Works, with sub-categories within them; resulting in 20 categories viz. Project Management, Electrical (4 categories), Civil (6 categories), MEP (4 categories), Design, Finance, Human Resource & Administration, HSEQ, and Contracts, replicating the comprehensive requirements of Substation Construction Project.

Based on the outcome of categorization made above, the Risk variable considered as 'Required' from the initial step was taken up for discussion, individually and were allocated to the 20 categories as identified earlier; while few of the Risk Variables from the initial list were discarded after discussion and new Risk Variables which are relevant for the present study were included along with categorization. Improvements in the form of grouping of various Risk Variables into one Meaningful Risk Variable along with suggestion and subsequent agreement on the terminology of such grouped Risk Variables was also performed by the members.

Furthermore, the sequencing of the Risk Variables in each of their categories was ranked accordingly and the final version of the Risk Variables for each of the 20 Nos. of categories was formulated by the NGT session members, paving out the way for formulation of the Questionnaire 1 for Objective 1.

The resultant output as shown in the Appendix A5 was utilized in subsequent section while formulation of Questionnaire for Objective-1 was taken up.

This chapter outlines the basis for this research by identifying and categorizing the Risk Variables; utilized for further investigation and subsequent exploration as per the objective set out earlier.

#### 4.5 Reference

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