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Appendices

Appendix A

Survey Questionnaire

Dear Sir/Madam

Questionnaire for dissertation on "Reduce design related rework in infrastructure projects in Maldives"

The aim of this survey is to obtain the perception of construction practitioners in Maldives about the causes of design changes which creates rework in infrastructure projects of Maldives. It is a research study undertaken by an MSC student towards fulfilling a Master's Degree within the Department Building Economics situated at the University of Moratuwa, Sri Lanka.

For the purposes of the survey, design refers to design drawing and specification that are used in construction project. Design changes is defined as *"any regular additions, omissions and adjustment to the design after the award of contract which effects original scope of the project, contract cost, contract schedule and quality of the project".*

Relate the answers that you provide to **infrastructure projects** that you have been involved with. It is very important that each question is read carefully and that all questions are answered. The survey should take about 5-10 minutes to complete.

The survey has been distributed to purposively selected construction organization/practitioners. You are assured that the information obtained from this survey will be kept strictly confidential and will be only used for research purposes. Data will not be made available to any third party or used in any published material.

Thank you
Yours faithfully,
Aminath Zidhna
Email: aminathzidna@gmail.com

SECTION A: PROFILE OF THE RESPONDENT

5 What is your professional background?

- ☐ Architect
- ☐ Consultant Engineer
- ☐ Project Manager
- ☐ Constructor
- ☐ Quantity Surveyor
- ☐ Others (please specify)

.....

6 How long have you worked in the construction industry?

- ☐ 0-5 Years
- ☐ 6-10 Years
- ☐ 11-15 Years
- ☐ 16-20 Years
- ☐ Over 21 Years

7 Which of the following types of infrastructure projects have you been involved with?

- ☐ Road
- ☐ Government office building
- ☐ Mosque
- ☐ School
- ☐ Quay wall
- ☐ Hospital/Medical Center
- ☐ Detention Centre
- ☐ Harbor
- ☐ Others (please specify)

.....

SECTION B: CAUSES OF DESIGN CHANGES

Please indicate the likelihood of occurrence of design changes of the following causes of design changes in infrastructure projects of Maldives.

Indicate your answers by ticking (✔) in the given scale

CAUSES OF DESIGN CHANGE

	Likelihood of occurrence of design changes				
	Very likely	Likely	Neutral	Not likely	Very unlikely
1. **Client-related**					
a. Changes to scope by client.	☐	☐	☐	☐	☐
b. Unclear initial design brief from client (e.g. unclear function of design).	☐	☐	☐	☐	☐
c. Change of design schedule due to financial problem of client.	☐	☐	☐	☐	☐
d. Low fee for design consultant.	☐	☐	☐	☐	☐
2. **Design consultant-related**					
a. Errors made in the design	☐	☐	☐	☐	☐
b. Omission made in the design	☐	☐	☐	☐	☐
c. Unskilled design consultant	☐	☐	☐	☐	☐
d. Less involvement of client and design consultant during design phase	☐	☐	☐	☐	☐
e. Inconsistent information on design drawings and specification (e.g. structural and architectural detail do not match)	☐	☐	☐	☐	☐

f.	Design consultant not familiar with the regulations and construction permits	☐	☐	☐	☐	☐
g.	Lack of knowledge of material availability in the market	☐	☐	☐	☐	☐
3.	**Constructor consultant-related**					
a.	Less involvement of constructor and design consultant during design phase	☐	☐	☐	☐	☐
b.	Constructor changing construction technique/method to improve constructability	☐	☐	☐	☐	☐
c.	Constructor changing construction techniques to increase constructor profitability	☐	☐	☐	☐	☐
d.	Constructor request to use available material	☐	☐	☐	☐	☐
e.	Unrealistic construction schedule	☐	☐	☐	☐	☐
4.	**Project management-related**					
a.	Insufficient checking and correct planning and contract documents (e.g. fail to review design documents with client, drawing and BOQ do not match)	☐	☐	☐	☐	☐
b.	Not able to collect sufficient information of site conditions (e.g. condition of underground)	☐	☐	☐	☐	☐
c.	Lack of communication among other parties involved in the construction project	☐	☐	☐	☐	☐
5.	**Subcontractor-related**					
a.	Design change (e.g. modification) initiated by a manufacture/subcontractor.	☐	☐	☐	☐	☐
b.	Material non-conformance to technical	☐	☐	☐	☐	☐

	specification (e.g. wrong material, poor quality)					
6.	**Third-party-related**					
a.	Request of changes (e.g. floor space, entrance) by the occupier	☐	☐	☐	☐	☐
b.	Complaints from neighbors	☐	☐	☐	☐	☐
7.	**Environment-related**					
a.	Unforeseen weather conditions (e.g. high probability of corrosion and erosion)	☐	☐	☐	☐	☐
b.	Unforeseen natural disaster (e.g. storm surge)	☐	☐	☐	☐	☐
8.	**Political and economic-related**					
a.	Unforeseen price fluctuation of materials and equipment.	☐	☐	☐	☐	☐
b.	Sudden changes in government policies and regulations	☐	☐	☐	☐	☐
c.	Change of market demand of the intended use of the building/structure.	☐	☐	☐	☐	☐

Thank you for your cooperation and assistance.

Appendix B

Interview Guideline

Section A: Interviewee personal information

1. What is your current position/title?
2. How many years you have been in that position/title?
3. How many years you have been in construction industry?
4. What are the other positions/titles worked before?
5. What are the types of infrastructure you were involved?

Section B: The purpose of the questions in this section was to get an overview of the interviewee respect to impact of design changes and practices that can be followed to reduce rework due to design changes.

1. What are the major impacts on construction projects in Maldives due to design changes?
2. Are there any current guidelines provided by the relevant authorities to reduce rework in constructions projects?
3. What are the practices employed by your organization to prevent or reduce design related rework in construction projects?

Section B: The questions in this section was based on to identify respondents' opinion on how the causes of design changes can be reduced.

Question 1: Client Related Causes

1. Client related causes was identified as the most likely causes of design related rework in infrastructure projects in Maldives. In your opinion, what maybe the reason for this?

Sub-questions

a. Changes to scope by client and changes to design schedule due to financial problems of client was identified as two most common under client related causes for design changes. How do you think these causes can be reduced?
b. How can causes like unclear initial design brief from client and low fee for design consultant can be reduced?

Question 2: Constructor Consultant Related Causes

2. Constructor related causes was identified as the second most likely causes of design related rework in infrastructure projects in Maldives. In your opinion what maybe the reason for this?

Sub-questions

a. Constructor request to use available material was identified as the most common cause under constructor related causes for design changes. How do u think this cause can be reduced?
b. How do u think unrealistic construction schedules and constructor request to change construction techniques to improve constructability or increase their profitability can be reduce?
c. How do u think cause like less involvement of constructor and design consultant during design phase can be reduced?

Question 3: Political and Economic Related Causes

3. Political and economic related causes was identified at third rank as a likely design related rework in infrastructure projects in Maldives. In your opinion what maybe the reason for this?

Sub-question

a. Sudden changes in government policies and regulations was identified as the most common cause under political and economic related causes for design changes. How do u think this cause can be reduced?
b. How do u think cause like unforeseen price fluctuation of materials and equipment can be reduced?

Question 4: Project Management Related Causes

4. Project management related causes was identified at fourth rank as a likely cause of design related rework in infrastructure projects in Maldives. In your opinion what maybe the reason for this?

Sub-questions

a. Communication among other parties involved in the construction project was identified as the most common cause under project management related causes for design changes. How do u think this cause can be reduced?
b. How do u think cause like insufficient information of site conditions and inaccuracy in design related documents can be reduced?

Question 5: Third-party Related Causes

5. Third-party related causes were identified at fifth rank as a likely cause of design related rework in infrastructure projects in Maldives. In your opinion what maybe the reason for this?

Sub-question

a. Request of changes by the occupier was identified as the most common cause under third party related causes for design changes. How do u think this cause can be reduced?
b. How do you think cause like complain from neighbors can be reduced?

Question 6: Subcontractor Related Causes

6. Subcontractor related causes was identified at sixth rank as a likely cause of design related rework in infrastructure projects in Maldives. In your opinion what maybe the reason for this?

Sub-question

c. Material non-conformance to technical specification was identified as the most common cause under subcontractor related causes for design changes. How do u think this cause can be reduced?

a. How do you think cause like request of design changes by subcontractor can be reduced?

Question 7: Design Consultant Related Causes

7. Design consultant related causes was identified at seventh rank as a likely cause of design related rework in infrastructure projects in Maldives. In your opinion what maybe the reason for this?

Sub-question

a. Errors made in design was identified as the most common cause under design consultant related causes for design changes. How do u think this cause can be reduced?

b. How do you think causes like omission made in design and communication gap between client and design consultant during design phase can be reduced?

c. How do you think causes like inconsistency of information on design drawings and technical design specifications can be reduced?

Question 8: Environment Related Causes

8. Environment related causes was identified as the least likely cause of design related rework in infrastructure projects in Maldives. In your opinion, what maybe the reason for this?

Sub-question

a. Unforeseen weather condition was identified as the most common cause under environment consultant related causes for design changes. How do u think this cause can be reduced?

Question 9: Causes identified as very unlikely to causes design changes
9. Lack of knowledge of material availability in the market, design consultant not familiar with the regulations and construction permits and unforeseen natural disaster was identified as very less likely causes of design changes. In your opinion, what maybe the reason for this?

Appendix C

Respondents Score Sheet

Respondent/ Causes	1a	1b	1c	1d	2a	2b	2c	2d	2e	2f	2g	3a	3b	3c	3d	3e	4a	4b	4c	5a	5b	6a	6b	7a	7b	8a	8b
1	4	3	3	4	3	4	3	4	2	2	3	4	3	4	4	5	4	4	4	3	4	4	4	5	4	5	4
2	5	5	5	3	4	4	2	2	4	2	2	4	4	5	5	4	4	4	4	4	4	4	4	4	4	4	4
3	4	3	3	4	4	4	2	2	4	2	3	4	4	5	5	4	4	4	4	4	4	3	3	5	4	4	3
4	5	4	3	4	5	5	2	4	5	3	2	4	3	3	4	3	5	5	5	3	5	4	4	4	1	4	3
5	5	4	5	3	4	4	2	2	4	3	4	4	3	2	4	5	4	5	4	3	4	4	4	5	3	5	4
6	5	4	4	5	3	3	3	2	2	2	2	3	4	3	4	4	3	3	4	3	3	3	3	4	3	4	3
7	4	3	3	2	4	3	3	2	4	4	3	4	4	4	4	3	3	4	3	3	2	3	3	4	3	4	3
8	4	3	3	2	4	3	2	2	4	2	3	2	2	3	4	3	3	4	4	3	4	4	3	4	2	4	4
9	5	5	4	4	4	4	4	3	3	3	3	5	3	4	5	5	5	5	5	3	4	4	3	5	3	4	5
10	3	3	5	4	3	3	2	2	2	1	1	2	3	2	3	3	3	1	4	3	3	5	3	4	2	4	5
11	5	5	5	3	5	5	4	5	4	4	5	4	3	5	5	5	4	5	5	3	5	5	5	4	2	4	3
12	4	2	3	5	4	3	3	3	2	2	2	4	4	3	3	2	2	3	3	4	3	2	5	4	2	2	4
13	5	3	3	5	4	4	3	3	3	2	5	4	5	3	3	2	3	3	3	4	3	2	5	4	2	2	4
14	4	3	4	4	3	3	4	4	4	3	3	2	2	2	2	2	2	3	4	3	3	4	3	3	3	3	3
15	4	3	4	2	2	3	4	4	3	2	4	4	4	4	4	5	3	4	4	4	4	4	4	3	2	4	4
16	5	1	4	2	3	4	2	2	2	2	2	2	3	3	3	2	2	2	2	2	2	3	3	3	3	4	4
17	5	5	5	3	4	4	2	2	4	2	2	4	4	5	5	4	5	4	4	4	4	4	4	4	2	4	4
18	5	3	5	2	5	5	5	4	5	5	4	4	5	4	4	5	4	5	4	3	5	5	4	4	3	5	5
19	4	3	5	4	4	4	4	5	4	3	2	5	5	4	5	5	3	4	4	5	3	5	3	4	2	3	4
20	4	2	4	2	4	4	4	4	4	5	4	4	4	4	4	5	5	5	4	5	3	3	4	4	1	4	5
21	4	4	2	4	4	4	4	4	4	2	2	4	4	4	4	5	5	5	4	5	5	4	4	4	1	4	4
22	4	3	5	4	4	4	4	5	3	3	3	5	5	4	5	5	3	4	4	5	3	5	2	4	2	3	4
23	5	4	4	2	3	3	4	4	3	2	2	4	4	3	4	3	5	4	4	4	3	4	4	4	3	3	4
24	5	5	4	3	3	2	2	5	4	1	1	2	3	4	5	3	5	4	5	4	4	4	1	1	1	1	5
25	3	4	5	1	5	2	2	4	1	1	2	4	4	5	4	2	2	2	4	4	2	4	5	2	2	4	5
26	3	4	4	3	4	4	3	4	3	5	5	2	4	4	4	5	5	4	5	5	4	5	3	4	4	5	2
27	4	5	5	5	5	5	4	5	2	4	2	4	4	3	4	5	3	4	4	3	2	5	3	5	2	5	3
28	4	4	4	4	5	5	3	4	2	2	3	4	5	5	2	5	3	2	2	1	5	5	2	4	1	4	4
29	4	4	5	3	5	5	4	4	3	5	3	4	4	5	2	5	3	2	4	3	4	4	4	4	2	3	4
30	5	5	5	5	5	5	5	3	4	5	2	5	4	3	3	5	2	3	2	1	5	4	1	4	2	3	3

31	3	2	2	2	2	2	2	2	2	2	2	3	3	3	3	3	2	2	2	2	2	2	2	3	3	2	2
32	4	2	4	4	2	2	2	1	2	1	2	2	4	4	4	2	4	3	2	2	2	4	2	2	2	2	3
Total	137	113	129	107	123	119	99	106	102	87	88	116	120	119	124	124	113	116	120	108	113	125	107	122	76	116	121	
Count (N)	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	
Not answered	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	
Total	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	
No. of 5	13	7	12	5	8	7	2	5	2	5	3	4	5	7	8	15	8	7	5	5	6	8	4	5	0	5	6	
No. of 4	15	9	11	11	14	13	11	12	13	3	4	19	16	12	15	4	7	13	19	9	11	16	11	20	4	16	15	
No. of 3	4	11	7	7	7	8	7	4	7	6	9	2	9	10	6	7	11	6	3	13	9	5	11	4	9	6	9	
No. of 2	0	4	2	8	3	4	12	10	9	14	14	7	2	3	3	6	6	5	5	3	6	3	4	2	14	4	2	
No. of 1	0	1	0	1	0	0	0	1	1	4	2	0	0	0	0	0	0	1	0	2	0	0	2	1	5	1	0	
Total	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	32	
% of 5	41	22	38	16	25	22	6	16	6	16	9	13	16	22	25	47	25	22	16	16	19	25	13	16	0	16	19	
% of 4	47	28	34	34	44	41	34	38	41	9	13	59	50	38	47	13	22	41	59	28	34	50	34	63	13	50	47	
% of 3	13	34	22	22	22	25	22	13	22	19	28	6	28	31	19	22	34	19	9	41	28	16	34	13	28	19	28	
% of 2	0	13	6	25	9	13	38	31	28	44	44	22	6	9	9	19	19	16	16	9	19	9	13	6	44	13	6	
% of 1	0	3	0	3	0	0	0	3	3	13	6	0	0	0	0	0	0	3	0	6	0	0	6	3	16	3	0	
Total	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	100	