

A supplementary document for the Article entitled:

Assessing the built environment's reflectivity, flexibility, resourcefulness, and rapidity resilience qualities against climate change impacts from the perspective of different stakeholders

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Sustainability 2023, 15, 5055. <https://doi.org/10.3390/su15065055>

This supplementary document includes the following:

1. *IRB Approval Letter.*
2. *Survey Questionnaire.*
3. *Data Analysis.*

**Qatar Biomedical Research Institute
Institutional Review Board
IRB Approval Letter**

Sami AlGhamdi
Principal Investigator
**HBKU College of Science &
Engineering**

IRB Protocol Reference
Number: QBRI-IRB-2023-34

Project Title: Assessing the Climate Change Resilience Qualities of the Urban Built Environment
from the Perspective of Different Sectors

Review Type: Exempt

QBRI-IRB Approval Date: April 17, 2022

QBRI-IRB Expiration Date: April 16, 2023

The QBRI Institutional Review Board (IRB) has reviewed your application submitted under the above referenced protocol QBRI-IRB-2023-34. It has been determined that your research proposal is eligible for exempt review status and has been approved effective April 17, 2022. According to the MoPH guidelines, regulations and policies for human subject research, this study falls under the following category :

2) Research involving the use of educational tests (cognitive, diagnostic, aptitude, achievement), survey procedures, interview procedures or observation of public behavior, unless: (i) information obtained is recorded in such a manner that human subjects can be identified; and (ii) any disclosure of the human subjects' responses outside the research could reasonably place the subjects at risk of criminal or civil liability or be damaging to the subjects' financial standing, employability, or reputation.

Please be reminded of the following:

- The research must be conducted according to the submitted and approved research protocol.
- Request for renewal, if required, should be submitted to the IRB at least 60 days prior to the expiry date to allow the IRB sufficient time to review and approve the request
- Any modifications to any aspect of the referenced study may render this approval invalid. All modifications must be submitted to the IRB office, and they can not be implemented until they are approved by the IRB office.

- It is imperative that any serious adverse events experienced during the course of this study by research subjects are immediately reported to the IRB office using the appropriate forms.
- It is the investigator's responsibility to ensure that the research team members have valid CITI certificates during the course of the approval. Research team members whose CITI certificate expires during the course of the project should stop working on the project until a new valid certificate is obtained and submitted to IRB office.

All approved documents for this study can be found in your submission file in Cayuse Human Ethics within the Attachments tab.

Wishing you all the success in conducting your research.

Dr. Khalid Al Ali
Chairperson

A handwritten signature in blue ink, appearing to read 'K. Alali'.

QBRI-IRB Office

Email: qbriirb@hbku.edu.qa

1. Cover Page

Dear Participant,

Mr. Mohammed Al-Humaiqani, a PhD Student of Sustainable Development, College of Science & Engineering, HBKU, is conducting a study that examines the reflectivity, flexibility, resourcefulness, and rapidity resilience qualities of the built environment systems to cope and adapt to the impacts of multiple climate change-related hazards. The study focuses on decision-makers, regulators, engineering and sustainability professionals, urban managers, climate change experts, citizens, residents, and university students who have been or are currently involved in any activity related to the built environment's resilience or aware of the importance of the resilience of urban systems against climate change impacts.

For your valuable time, the following questionnaire will require approximately 15 minutes to complete. There is no compensation for responding, nor are there any known risks. To ensure that all information will remain confidential, please do not write your name anywhere other than signing the consent form. If you choose to participate in this study, please answer all questions honestly.

Participation is strictly voluntary, and you may withdraw at any time. The data collected will provide useful information to develop later on a framework for measuring the preparedness of the built environment systems to cope and adapt to the impacts of multiple climate change-related hazards and establish a framework for better adaptation.

By completing and returning the questionnaire, you indicate your willingness to participate in this study. If you have questions, do not hesitate to contact the research team through the contact information below.

Thank you for taking the time to assist us in our educational endeavors.

Sincerely,

Mohammed M. Al-Humaiqani, PhD Student
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2. Consent Form

CONSENT TO ACT AS A PARTICIPANT IN A RESEARCH STUDY

TITLE: Assessing the built environment's reflectivity, flexibility and resourcefulness and rapidity resilience qualities against climate change impacts

IRB Approval Number and Date: QBRI-IRB-2023-34 on 17 April 2022

CONSENT FORM

1. Description

This study is designed to assess the preparedness of the built environment systems to cope (short-term) and adapt (long-term) to the multiple climate change-related hazards and their perception of future adaptation.

2. Risks

There are no risks associated with participating.

3. Right to Withdraw

I understand that I am free to withdraw from this study at any time. I also have the right to skip a question without completely withdrawing from the survey.

4. Confidentiality & Right to Privacy

I understand that any information about me obtained from this research, including answers to questionnaires, will be kept confidential. It has been explained to me that my identity will not be revealed in any description or publication of this research. Therefore, I consent to publication for scientific and scholarly purposes.

5. Cost and Payment

I understand that there is no cost associated with participation in this study nor is there payment of any kind.

6. Signatures

Both parties: the researchers of this study, as well as the participants, are signing on the following:

- Researchers: As the representative of this study, researchers have clarified the purpose of this research study. All questions asked by the participant were answered.
- The Participant: I acknowledge that I have been informed by the undersigned of the purpose of this study, and I am aware of my right to print and retain copies of this consent. I also know that I can ask any questions to researchers at any time, either before or after the participation. I willingly agree to participate in this study.

* 1. Do you agree to participate in this study?

- ☐ Yes, I agree and would like to continue this questionnaire.
- ☐ I do not agree to participate. I would like to leave this page.

3. Thank you

We regret your inability to participate in this important study
for the future of the resilient built environment.

Thank you very much for trying.

4. Information about the participant

* 2. Participant's gender:

☐

Male

☐

Female

* 3. Participant's age in years:

☐

18-24

☐

45-54

☐

25-34

☐

55-64

☐

35-44

☐

65+

* 4. Participant's nationality:

☐

GCC Citizen

☐

European

☐

Middle Eastern, Arabic non-GCC

☐

North American

☐

Middle Eastern, non-Arabic

☐

South American

☐

Asian, non-Middle Eastern, nor Arabic

☐

Oceanian

☐

North African, Arabic, non-Middle Eastern

☐

Other

☐

African, non-Middle Eastern, nor Arabic

* 5. Participant's occupation:

☐

Undergraduate Student or Equivalent

☐

Employee

☐

Graduate Student (MSc and Above) or
Equivalent

☐

Unemployed

☐

Researcher/Scholar/Scientist

☐

Self-employed

☐

Academic (lecturer, teaching assistant,
professor, ..etc)

☐

Retired

☐

Engineer or equivalent

* 6. Participant's highest achieved level of education:

☐

High school graduate or less

☐

Master's degree or equivalent

☐

Bachelor's degree or equivalent

☐

PhD degree or above

* 7. Which field are you working in?

☐

Civil Engineering

☐

Industrial Engineering

☐

Mechanical Engineering

☐

Architecture

☐

Electrical Engineering

☐

Other Engineering Disciplines

☐

Chemical Engineering

☐

Non-Engineering

☐

Environmental / Ecological Engineering

* 8. Years of Experience of the participant in the field of work.

- | | |
|-----------------------------------|-----------------------------------|
| <input type="radio"/> 0-5 years | <input type="radio"/> 21-25 years |
| <input type="radio"/> 6-10 years | <input type="radio"/> 26-30 years |
| <input type="radio"/> 11-15 years | <input type="radio"/> 30+ years |
| <input type="radio"/> 16-20 years | |

* 9. In which part of the world your experience was built? (Select all that applies)

- | | |
|--|--|
| <input type="checkbox"/> Middle East and North Africa (MENA) | <input type="checkbox"/> South America & Caribbean |
| <input type="checkbox"/> Asia | <input type="checkbox"/> Australia and New Zealand |
| <input type="checkbox"/> Europe | <input type="checkbox"/> Africa |
| <input type="checkbox"/> North America | |
| <input type="checkbox"/> Other (please specify) | |

* 10. In which sector/entity are you currently working?

- | | |
|--|--|
| <input type="radio"/> Executive: Regulatory Body and Government-owned Entity | <input type="radio"/> Educational, Academic institution, Research Center, ...etc |
| <input type="radio"/> Construction Industry (owner, developer, real estate, contracting, project management, consultancy, ...etc.) | <input type="radio"/> Private Non-Engineering Sector |
| <input type="radio"/> Non-governmental organization (NGO) | <input type="radio"/> Society Development |
| <input type="radio"/> Engineering-Based Non-Profit Organization (NPO) | <input type="radio"/> Other |
| <input type="radio"/> Non-Engineering-Based Non-Profit Organization (NPO) | |

* 11. **Note 1:**

All the Questions below are related to the county/area you work/live in.

- ☐ Noted

* 12. **Note 2:**

The questions are not only about the efforts made by the relevant authorities, regulatory bodies, construction industry, academia, NGOs, NPOs,...etc., but also include your department/company. So please answer accordingly.

- ☐ Noted

5. G.1:
1.0 Leveraging Reflectivity (Rf)

Entities, organizations, institutions, and the public need to react to disturbances. They also need to share their views, feedback, and what they learned from previous experiences and leverage them to inform future decision-making.

6. G.1:

1.1 Learning from the Past

* 13. How does your department/institution progress in **promoting good practice** in the built environment on the community level, and advancing future measures to minimize the impacts of climate change disturbance events?

- | | |
|------------------------------------|--|
| <input type="radio"/> No progress | <input type="radio"/> Good Progress |
| <input type="radio"/> Low progress | <input type="radio"/> Excellent progress |
| <input type="radio"/> Moderate | |

* 14. Is **climate change learning philosophy** (communication, knowledge sharing, and experiences) part of the jurisdiction of your department/institution or at its core business?

- | | |
|---------------------------|-------------------------------|
| <input type="radio"/> Yes | <input type="radio"/> Somehow |
| <input type="radio"/> No | <input type="radio"/> Unsure |

* 15. How do you rate the relevant local governmental authorities in terms of **learning lessons, gathering information, building knowledge** during disruptive events, **analyzing, and developing plans** to save lives, and protect the built environment systems from any potential future disasters?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

7. G.1:

1.2 Active Participation of Professional Stakeholders and Experienced Actors

* 16. Which of the following applies to the construction industry's sectors concerning climate change impacts? (Select all that applies)

- ☐ Developing necessary regulations and standards and managing for change
- ☐ Integrating climate into existing planning
- ☐ Considering conservation goals and management strategies
- ☐ All
- ☐ Adopting forward-looking, climate-informed goals
- ☐ Linking adaptation actions to climate impacts
- ☐ Other (please specify)
-
- ☐ None of the above

* 17. How do you rate the performance of regulatory authorities and relevant governmental bodies in your county/area in considering the following?

	Poor	Fair	Average	Good	Excellent
Public awareness and attitudes to help reduce disaster risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improving management efforts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing mortality and economic losses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing the necessary plans for implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 18. What is the level of **coordination** between the governmental authorities, institutions, and the private and construction sectors, regarding the different climate change concerns and built environment resilience priorities?

- ☐ Never
- ☐ Often
- ☐ Rarely
- ☐ Always
- ☐ Sometimes

8. G.1:
1.3 Planing for Future

* 19. Is **integrated development planning** (strategy and plans) developed, and regularly updated by the relevant departments?

- ☐ Never ☐ Often
☐ Rarely ☐ Always
☐ Sometimes

* 20. Do you believe that the relevant local government authorities and other relevant organizations have the **capacity to plan** for anticipated or unknown climate change disasters?

- ☐ Yes ☐ Unsure
☐ No

* 21. Does your city have a **holistic cross-sectoral vision, strategy, or plan** consolidated with appropriate data and delivered through policy, standards, regulations, and codes?

- ☐ Yes ☐ No

* 22. Do governmental regulatory authorities **facilitate the decision-making process** before climate change disasters hit the built environment systems?

- ☐ Never ☐ Often
☐ Rarely ☐ Always
☐ Sometimes

9. G.1:
1.4 Preparation for Disasters

* 23. What is the level of importance of **getting the community engaged** to generate some level of preparedness against climate change disasters from the point of view of your institution?

- | | |
|--|--|
| <input type="radio"/> Low important | <input type="radio"/> Moderately important |
| <input type="radio"/> Slightly important | <input type="radio"/> Very important |
| <input type="radio"/> Neutral | |

24. How often do **community engagement techniques** (such as benchmarking research, context, and skill levels) effectively generate some level of preparedness for the built environment systems against climate change hazards?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

* 25. How often have **planning regulations** been enforced addressing the potential climate change stresses and shocks that the built environment systems might face?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

10. G.1:
1.5 Decision-Making Facilitating

* 26. How do you rate the use of the **previous climatic experiences** by governmental authorities and leverage them to inform future decision-making?

- | | |
|--|--------------------------------------|
| <input type="radio"/> Insufficient | <input type="radio"/> Effective |
| <input type="radio"/> Weak | <input type="radio"/> Very effective |
| <input type="radio"/> Need improvement | |

* 27. Has your department/institution **engaged NGOs, NPOs, Academia, and construction companies** in any policy-making decision techniques to increase the preparedness of the built environment against climate change disasters?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

* 28. Do decision-makers **integrate uncertainty and flexibility explicitly into the decision-making process** to enhance the preparedness of the built environment systems against climate change disasters, reduce capital expenditure, and improve investment value?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

11. G.1:

1.6 Reflective Environment Systems

* 29. The reflective environment consists of systems that accept the change and uncertainty inherited from the past or generated over time. According to this presumption, how do you value the below-built environmental systems?

	Poor	Fair	Average	Good	Excellent
Shelter systems (i.e., buildings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Life Support Systems (i.e., energy & water supply systems,... etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Movement Systems (i.e., transportation infrastructure (roads, bridges, ... etc.))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Space Systems (i.e., the utility for park & recreation purposes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 30. How often have the following practices been adopted by your department/institution?

	Never	Rarely	Sometimes	Often	Always
Seeking permanent solutions based on the current status of the built environment systems.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Modifying standards, norms, and regulations based on collected information.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Emerging evidence from climate change stress and shocks experienced.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

12. G1:
4.0 Enhancing Flexibility (Fx)

The flexibility (Fx) of any system means adaptability to environmental variations and the ability to adopt alternative strategies to a climate change crisis. It also refers to the ability to adjust to changes through emergency planning in the aftershock of disturbances and strongly relates to adaptability.

13. G.1:

4.1 Identifying, Quantifying, and Controlling the Flexibility

* 31. Can the existing built environment systems **withstand different climate variations** with the lowest possible degradation of performance indicators?

- ☐ Yes
- ☐ No
- ☐ Partial
- ☐ Unsure

* 32. What are the main **encounterable challenges** to identifying, quantifying, and controlling the flexibility of an urban system? (For example, energy demands flexibility).

- ☐ Advanced management strategies
- ☐ Innovative techniques
- ☐ Emergency planning
- ☐ All the above

14. G.1:
4.2 Adopting Alternative Strategies to the Crisis.

* 33. From the role of your department/institution, should decision-making processes and institutions be **flexible to adapt and update** the relevant strategies, rules, and procedures?

- ☐ Yes
- ☐ No
- ☐ N/A
- ☐ Unsure

* 34. How satisfied are you with the urban systems' **adopting alternative strategies** to absorb, respond to, and recover from a sudden shock?

- ☐ Dissatisfied
- ☐ Slightly dissatisfied
- ☐ Neither satisfied nor dissatisfied
- ☐ Slightly satisfied
- ☐ Satisfied

15. G.1:
4.3 Adaptation and Inherent Capacity.

* 35. To what level do you agree that the **flexible measures serving many climate impacts** should allow additional options like allowing for multi approaches, enabling self-combination with other methods and measures, preserving options, and altering or reversing the actions.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

* 36. What is the level of **importance of using emergency systems** in enhancing the adaptive capability of the built environment systems?

- ☐ I don't know
- ☐ Not at all important
- ☐ Slightly important
- ☐ Somewhat important
- ☐ Moderately important
- ☐ Very important

16. G.1:
4.4 Climate Adaptation Policies and Processes.

* 37. How do you rate the **flexibility of the decision-making processes** in allowing for alterations and updates to the relevant climate adaptation strategies, rules, and processes?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

17. G.1:
4.5 Incorporating Traditional Knowledge & Practices.

* 38. Are **traditional knowledge and practices converted to new techniques** that suit the needs, and new knowledge, technologies, and obligations to combat climate change?

- ☐ Yes
- ☐ No
- ☐ Unsure

* 39. How do you rate the ability of the built environment systems to adapt to variations and consider alternative strategies to a climate change crisis?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

18. G.1:
4.6 Efforts to Mitigate Climate Change Impacts.

* 40. How effective is the **engagement of the community** in activities that mitigate the losses caused by climate change disasters?

- ☐ Ineffective
- ☐ Weak
- ☐ Neutral
- ☐ Effective
- ☐ Very effective

19. G.1:
5.0 Encouraging Resourcefulness (Rs)

Resourcefulness (Rs) is defined as the capacity to identify problems, establish priorities, and allocate and mobilize resources before, during, and after an event that may disrupt elements, systems, or other units of analysis, taking into account human factors.

20. G.1:
5.1 Disaster Preparedness.

* 41. Do the national regulations and standards **state the requirements** that enable the built environment system to find alternative ways at the time of crisis to achieve goals or meet needs?

- ☐ Yes
☐ No
☐ Unsure

* 42. Do the national regulations and standards **encourage identifying problems** accompanying a disaster event, establishing priorities, and mobilizing resources following the event?

- ☐ Yes
☐ No
☐ Unsure

* 43. Do built environment systems have the capacity to **mobilize resources** and the ability to measure their performance during disruption events?

- ☐ Yes
☐ No
☐ Unsure

* 44. Do the built environment systems have the ability to **find alternative ways** at the time of crisis to achieve goals or meet needs?

- ☐ Yes
☐ No
☐ Unsure

21. G.1:
5.2 Emergency Management.

* 45. How do you rate the **quality and capacity** of the built environment systems to manage the needed services and resources during emergencies promptly and correctly?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

* 46. What is the level of **effectiveness** of the ways of interaction, skills, and active capacity of people on the resourcefulness of the built environment system?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

* 47. Please rank the importance of the following principles and dimensions from most to least preferred according to your experience. [1 is the lowest preferred]



Providing necessary support to the emergency management system by the political and economic structure.



Disaster preparedness through preparing the residents and the whole community.



Utilizing the community's trusted resources to allow the community to cope with the climate change hazards.



The ability of the community to mitigate the losses through making smart decisions.

22. G.1: 5.3 Resources Utilization

* 48. Do the national regulations and relevant standards consider **distributing and accessing all resources** to build resourcefulness for the built environment systems?

- ☐ Yes
☐ No

* 49. The core resources that constitute resourcefulness can be classified into three categories as below. Please rate their level of importance.

	Not at all important	Slightly important	Somewhat important	Moderately important	Very important
Material resources include infrastructures, environmental conditions, housing, food, health, financial resources, and tools.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intellectual resources include culture, social capital, ecological knowledge, networking, time, science, and education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Civic resources related to citizenship that enables people to participate domain of resourcefulness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 50. Below are some factors that enhance the resourcefulness of the built environment. Please rank them according to their priorities: *[1 is the lowest priority]*

<input type="radio"/>	The emergency management system's political, economic, and logistical structure.
<input type="radio"/>	Citizen, community, and country disaster preparedness.
<input type="radio"/>	The ability of the community or country during the emergency to mitigate losses through making smart decisions.

* 51. In terms of mobilizing resources, do the relevant governmental authorities and regulatory bodies assess the **community's ability to mobilize** different resources when responding to shocks or stresses?

- ☐ Yes
- ☐ No
- ☐ Unsure

23. G.1:

5.4 Mitigating the Losses by the Community.

* 52. Has the community been engaged directly or indirectly in **mitigating the losses** caused by climate change disasters in the past?

- ☐ Yes
- ☐ No
- ☐ Unsure
- ☐ N/A

24. G.1:
5.5 Visualize and Act.

* 53. Do the relevant governmental authorities and regulatory bodies assess the community's ability to use past experience when acting on the threat of future shocks and stresses?

- ☐ Yes
- ☐ No
- ☐ Unsure

25. G.1:

5.6 Identify Problems and Establish Priorities.

* 54. Do the relevant governmental authorities and regulatory bodies assess the community's ability to foresee and identify severe problems affecting the built environment systems?

☐ Yes

☐ No

* 55. Are there task forces within the community as part of an emergency response plan to protect the built environment systems?

☐ Yes

☐ No

26. G.1:
6.0 Improving Rapidity (Rp)

Rapidity (Rp) refers to the ability of the system to recover from the encountered crisis even with some losses. The concept refers to the speed of the affected system or facility to promptly recover to its full operational function through responsiveness, adaptation, and recovery activities.

27. G1:

6.1 Responsiveness & Restorative Capacity

* 56. Do you think the local regulations and standards accommodate the requirements related to responsiveness, adaptation, and recovery activities that promptly assist the affected system or facility in recovering its full operational function system?

☐ Yes

☐ Unsure

☐ No

* 57. Do you agree that the enforcement of the regulations to install real-time automated monitoring systems, such as the Supervisory Control and Data Acquisition system (SCADA) on each system or facility, can enhance the restorative capability of the system/facility to recover from the crises in a reasonable time?

☐ Strongly disagree

☐ Agree

☐ Disagree

☐ Strongly agree

☐ Neither agree nor disagree

* 58. How do you rate the priority level of installing real-time automated monitoring systems to warn against climate change crises or stresses and provide emergency response guidance?

☐ Not a priority

☐ High priority

☐ Low priority

☐ Essential

☐ Medium priority

28. G.1:
6.2 Adaptation

* 59. Have decision-making frameworks been developed for robust and rapid adaptation planning and evaluation of climate change impacts on the built environment systems?

☐ Yes

☐ Unsure

☐ No

29. G.1: 6.3 Rapid Recovery

* 60. To what level do you agree that the local regulations and standards include the requirements that appropriately enhance the recovery speed of the built environment systems to recover to its full operational function after encountering a climate change crisis?

	Strongly disagree	Disagree	Neither agree nor disagree	Agree	Strongly agree
Shelter systems (i.e., buildings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Life Support Systems (i.e., energy & water supply systems,... etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Movement Systems (i.e., transportation infrastructure (roads, bridges, ... etc.))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Space Systems (i.e., the utility for park & recreation purposes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

30. G1:
6.4 Recovery Activities (Resource allocation)

* 61. Which of the following are considered significant factors to enhance the ability of the system or facility to rapid recovery from an experienced disturbance? [select all that applies]

- ☐ Timely reorganize within desired boundaries
- ☐ Resume function by fostering fast response mechanisms
- ☐ Autonomous, self-directed action
- ☐ All the above
- ☐ None of the above

* 62. Considering flooding as a significant climate change problem, how do you rate the contribution of the national regulations and standards to advance the recovery of the built environment systems?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

* 63. In your opinion, do sufficient repair resources contribute to the enhancement of the rapidity and improvement of the system's resilience?

- ☐ Yes
- ☐ No
- ☐ Unsure

64. How do you rate the implementation of risk identification assessment and management plan by the governmental authorities and regulatory bodies in the construction projects?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

31. Overall

65. If you have any other aspects that will help enhance the built environment resilience, you can drag them into the comment box; otherwise, click Next.

32. Thank you

We thank you very much for participating in this important
study.

Research Team

33. G.2:
1.0 Leveraging Reflectivity (Rf)

Entities, organizations, institutions, and the public need to react to disturbances. They also need to share their views, feedback, and what they learned from previous experiences and leverage them to inform future decision-making.

34. G.2:

1.1 Learning from the Past

* 66. How does your company progress in promoting good practice in the built environment on the community level, and advancing future measures to minimize the impacts of climate change disturbance events?

- | | |
|---|--|
| <input type="radio"/> No progress | <input type="radio"/> Good Progress |
| <input type="radio"/> Low progress | <input type="radio"/> Excellent progress |
| <input type="radio"/> Moderate progress | |

* 67. Is climate change learning philosophy (communication, knowledge sharing, and experiences) at the core business of your organization/company?

- | | |
|---------------------------|-------------------------------|
| <input type="radio"/> Yes | <input type="radio"/> Somehow |
| <input type="radio"/> No | <input type="radio"/> Unsure |

* 68. How do you rate the construction industry's sector in learning, building knowledge, and benefiting from the recorded data of the previous stresses and getting them reflected in the design and construction of new projects?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

* 69. Does the construction industry sector strengthen the principles of robust design, tailoring the project to adapt to the future climate change challenges to avoid any potential future damages?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

35. G.2:

1.2 Active Participation of Professional Stakeholders and Experienced Actors

* 70. Which of the following applies to the construction industry's sectors concerning climate change impacts? (Select all that applies)

- ☐ None ☐ Linking adaptation actions to climate impacts
- ☐ Developing plans and managing for change ☐ Integrating climate into existing planning
- ☐ Considering conservation goals and management strategies ☐ All the above
- ☐ Adopting forward-looking, climate-informed goals
- ☐ Other (please specify)

* 71. How do you rate the following activities in your county/area?

	Poor	Fair	Average	Good	Excellent
Public awareness and attitudes to help reduce disaster risk	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Improving systems' management efforts	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Reducing mortality and economic losses	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Developing the necessary plans for implementation	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 72. Do construction sectors undertake or deal with disseminating public awareness to reduce the climate change disaster risk in the built environment, improve management efforts, and reduce mortality and economic losses?

- ☐ Yes ☐ Unsure
- ☐ No ☐ Plan for future

36. G.2:
1.3 Planing for Future

* 73. Is integrated development planning (strategy and plans) developed, and regularly updated by the relevant departments?

- ☐ Never ☐ Often
☐ Rarely ☐ Always
☐ Sometimes

* 74. Do you believe that the construction industry sector has the capacity to plan for anticipated or unknown climate change disasters?

- ☐ Yes ☐ Unsure
☐ No

* 75. Does your city have a holistic cross-sectoral vision, strategy, or plan consolidated with appropriate data and delivered through policy, standards, regulations, and codes?

- ☐ Yes ☐ Unsure
☐ No

37. G.2:
1.4 Preparation for Disasters

* 76. What is the level of importance of getting the community engaged to generate some level of preparedness against climate change disasters from the point of view of your company?

- ☐ Not at all important ☐ Moderately important
☐ Slightly important ☐ Very important
☐ Neutral

* 77. Do community engagement techniques (such as benchmarking research, context, and skill levels) effectively generate some level of preparedness for the built environment systems against climate change hazards?

- ☐ Yes ☐ Unsure
☐ No ☐ N/A

* 78. Have experts and professionals from the construction sector been engaged in any community engagement techniques to prepare the built environment against climate change disasters?

- ☐ Never ☐ Often
☐ Rarely ☐ Always
☐ Sometimes

* 79. How often have planning regulations been enforced addressing the potential climate change stresses and shocks that the built environment systems might face?

- ☐ Never ☐ Often
☐ Rarely ☐ Always
☐ Sometimes

38. G.2:
1.5 Decision-Making Facilitating

* 80. How do you rate the role played by the NGOs, NPOs, Academia, Universities, and Research Centers in compiling the previous climatic experiences for the governmental authorities to leverage them to inform future decision-making?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

* 81. Has your company been engaged in any policy-making decision techniques to increase the preparedness of the built environment against climate change disasters?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

* 82. Does the construction sector share thoughts, suggestions, and recommendations with the decision-makers that might help them enhance the decision-making process to improve the preparedness against climate change disasters?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

39. G.2:

1.6 Reflective Environment Systems

* 83. The reflective environment consists of systems that accept the change and uncertainty inherited from the past or generated over time. According to this presumption, how do you value the below-built environment systems?

	Poor	Fair	Average	Good	Excellent
Shelter systems (i.e., buildings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Life Support Systems (i.e., energy & water supply systems,... etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Movement Systems (i.e., transportation infrastructure (roads, bridges, ... etc.))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Space Systems (i.e., the utility for park & recreation purposes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 84. How often have the following practices been adopted by your company?

	Never	Rarely	Sometimes	Often	Always
Seeking permanent solutions based on the current status of the built environment systems	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Modifying standards, norms, and regulations based on collected information	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Emerging evidence from climate change stress and shocks experienced	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

40. G.2:
4.0 Enhancing Flexibility (Fx)

The flexibility (Fx) of any system means adaptability to environmental variations and the ability to adopt alternative strategies to a climate change crisis. It also refers to the ability to adjust to changes through emergency planning in the aftershock of disturbances and strongly relates to adaptability.

41. G.2:

4.1 Identifying, Quantifying, and Controlling Flexibility.

* 85. Can the existing built environment systems withstand different climate variations with the lowest possible degradation of performance indicators?

- ☐ Yes
- ☐ No
- ☐ Partial
- ☐ Unsure

* 86. What are the main challenges to identifying, quantifying, and controlling the flexibility of an urban system? (For example, energy demands flexibility.).

- ☐ Advanced management strategies.
- ☐ Innovative techniques.
- ☐ Emergency planning
- ☐ All the above.

42. G.2:

4.2 Adopting Alternative Strategies to the Crisis.

* 87. Does your company seizes opportunities and adapt strategies to initiate informed and long-term changes in the system so that it responds accurately to changing conditions to maintain desired functions?

- ☐ Yes
- ☐ No
- ☐ N/A
- ☐ Unsure

* 88. How satisfied are you with the urban systems' adopting alternative strategies to absorb, respond to, and recover from a sudden shock?

- ☐ Dissatisfied
- ☐ Slightly dissatisfied
- ☐ Neither satisfied nor dissatisfied
- ☐ Slightly satisfied
- ☐ Satisfied

43. G.2:

4.3 Adaptation and Inherent Capacity.

* 89. To what level do you agree that the flexible climate measures should allow multi approaches, enable self-combination with other methods and measures, preserve options, and alter/reverse the actions.

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

* 90. What is the level of importance of using emergency systems in enhancing the adaptive capability of the built environment systems?

- ☐ I don't know
- ☐ Not at all important
- ☐ Slightly important
- ☐ Somewhat important
- ☐ Moderately important
- ☐ Very important

44. G.2:
4.4 Climate Adaptation Policies and Processes.

* 91. How do you rate the flexibility of the decision-making processes in allowing for alterations and updates to the relevant climate adaptation strategies, rules, and processes?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

45. G.2:

4.5 Incorporating Traditional Knowledge & Practices.

* 92. Are traditional knowledge and practices converted to new techniques that suit the needs, and new knowledge, technologies, and obligations to combat climate change?

- ☐ Yes
- ☐ No
- ☐ Unsure

* 93. How do you rate the built environment systems' ability to adjust to changes in the aftershock of disturbances?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

46. G.2:
4.6 Efforts to Mitigate Climate Change Impacts.

* 94. How effective is the engagement of the community in activities that mitigate the losses caused by climate change disasters?

- ☐ Ineffective
- ☐ Weak
- ☐ Neutral
- ☐ Effective
- ☐ Very effective

47. G.2:
5.0 Encouraging Resourcefulness (Rs).

Resourcefulness (Rs) is defined as the capacity to identify problems, establish priorities, and allocate and mobilize resources before, during, and after an event that may disrupt elements, systems, or other units of analysis, taking into account human factors.

48. G.2:
5.1 Disaster Preparedness.

* 95. Do the national regulations and standards **encourage identifying problems** accompanying a disaster event, establishing priorities, & mobilizing resources following the event?

- ☐ Yes
☐ No
☐ Unsure

* 96. Do the national regulations and standards **state the requirements** that enable the built environment system to find alternative ways at the time of crisis to achieve goals or meet needs?

- ☐ Yes
☐ No
☐ Unsure

* 97. Do built environment systems have the capacity to **mobilize resources** and the ability to measure their performance during disruption events?

- ☐ Yes
☐ No
☐ Unsure

* 98. Do the built environment systems have the ability to **find alternative ways** at the time of crisis to achieve goals or meet needs?

- ☐ Yes
☐ No
☐ Unsure

49. G.2:
5.2 Emergency Management.

* 99. How do you rate the quality and capacity of the built environment systems to manage the needed services and resources during emergencies promptly and correctly?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

* 100. Please rank the importance of the following principles and dimensions from most to least preferred according to your experience. [1 is the lowest priority]



Providing necessary support to the emergency management system by the political and economic structure.



Disaster preparedness through preparing the residents and the whole community.















Utilizing the community's trusted resources to allow the community to cope with the climate change hazards.









The ability of the community to mitigate the losses through making smart decisions.

50. G.2:
5.3 Resources Utilization.

* 101. Rank the following resources for prioritizing hazards and introducing solutions through identifying all actions that make the system flexible: *[1 is the lowest priority]*

		Human
		Technological
		Economy
		Technical
		Infrastructure
		Informational resources and their monitoring

* 102. Below are some factors that enhance the resourcefulness of the built environment. Please rank them according to their priorities: *[1 is the lowest priority]*

		The emergency management system's political, economic, and logistical structure.
		Citizen, community, and country disaster preparedness.
		The ability of the community or country during the emergency to mitigate losses through making smart decisions.

* 103. The core resources that constitute resourcefulness can be classified into three categories as below. Please rate their level of importance.

	Not at all important	Slightly important	Neutral	Moderately important	Very important
Material resources include infrastructures, environmental conditions, housing, food, health, financial resources, and tools.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intellectual resources include culture, social capital, ecological knowledge, networking, time, science, and education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Civic resources related to citizenship that enables people to participate domain of resourcefulness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

51. G.2:

5.4 Mitigating the Losses by the Community.

* 104. Has the community been engaged directly or indirectly in mitigating the losses caused by climate change disasters in the past?

- ☐ Yes
- ☐ No
- ☐ Unsure
- ☐ N/A

52. G.2:
5.5 Visualize and Act.

* 105. Do the relevant governmental authorities and regulatory bodies, with the help of the construction industry sector, assess the community's ability to use experience when acting on the threat of future shocks and stresses?

- ☐ Yes
- ☐ No
- ☐ Unsure

53. G.2:

5.6 Identify Problems and Establish Priorities.

* 106. Do the relevant governmental authorities and regulatory bodies assess the community's ability to foresee and identify severe problems affecting the built environment systems?

- ☐ Yes
- ☐ No
- ☐ Unsure

* 107. Are there task forces within the community as part of an emergency response plan to protect the built environment systems?

- ☐ Yes
- ☐ No
- ☐ Unsure

54. G.2:
6.0 Improving Rapidity (Rp)

Rapidity (Rp) refers to the ability of the system to recover from the encountered crisis even with some losses. The concept refers to the speed of the affected system or facility to promptly recover to its full operational function through responsiveness, adaptation, and recovery activities.

55. G.2:

6.1 Responsiveness & Restorative Capacity

* 108. Do you think the local regulations and standards accommodate the requirements related to responsiveness, adaptation, and recovery activities that promptly assist the affected system or facility in recovering to its full operational function system?

☐ Yes

☐ Unsure

☐ No

* 109. Do you agree that the installation of real-time automated monitoring systems, such as the Supervisory Control and Data Acquisition system (SCADA), can enhance the restorative capability of the system/facility to recover from the crises in a reasonable time?

☐ Strongly disagree

☐ Agree

☐ Disagree

☐ Strongly agree

☐ Neither agree nor disagree

* 110. How do you rate the priority level of installing real-time automated monitoring systems to warn against climate change crises or stresses and provide emergency response guidance?

☐ Not a priority

☐ High priority

☐ Low priority

☐ Essential

☐ Medium priority

56. G.2:
6.2 Adaptation

* 111. Based on experience, have decision-making frameworks been developed for robust and rapid adaptation planning and evaluation of climate change impacts on the built environment systems?

☐ Yes

☐ Unsure

☐ No

57. G.2: 6.3 Rapid Recovery

* 112. How do you score the built environment systems in responding to the climate change impacts (e.g., flooding, sea-level rise, heat stress,...etc.) and the speed of the affected system or facility to recover to its full operational function?

	No recovery (the system cannot recover)	Low recovery (the system is significantly impacted)	Medium recovery (the system has some losses)	Rapid recovery (the system is affected but recovered)	Very quick recovery (the system encountered no effect)
Shelter systems (i.e., buildings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Life Support Systems (i.e., energy & water supply systems,... etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Movement Systems (i.e., transportation infrastructure (roads, bridges, ... etc.))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Space Systems (i.e., the utility for park & recreation purposes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

58. G.2:
6.4 Recovery Activities (Resource allocation)

* 113. To what level do you agree that the process of recovery involves not only repairing and renovating the physical infrastructure but reconstructing social relationships?

- | | |
|--|--------------------------------------|
| <input type="radio"/> Strongly disagree | <input type="radio"/> Agree |
| <input type="radio"/> Disagree | <input type="radio"/> Strongly agree |
| <input type="radio"/> Neither agree nor disagree | |

* 114. Does the construction industry consider sufficient repair resources that enhance rapidity and improve system resilience?

- | | |
|---------------------------|------------------------------|
| <input type="radio"/> Yes | <input type="radio"/> Unsure |
| <input type="radio"/> No | |

* 115. How do you rate the recovery of the built environment systems (buildings, utilities, transportation systems, and public open spaces) once hit by a flood?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

* 116. How do you rate the implementation of risk identification assessment and management plan in the construction projects you are involved in (buildings, utilities, roads, rails, open county/areas, ...etc.)?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

59. Overall

117. If you have any other aspects that will help enhance the built environment's resilience, you can drag them into the comment box; otherwise, click Next.

60. Thank you

We thank you very much for participating in this important
study.

Research Team

61. G.3:
1.0 Leveraging Reflectivity (Rf)

Entities, organizations, institutions, and the public need to react to disturbances. They also need to share their views, feedback, and what they learned from previous experiences and leverage them to inform future decision-making.

62. G.3:

1.1 Learning from the Past

* 118. What progress has been achieved by the relevant authorities and the construction sector on a community level to advance future measures and minimize the impacts of climate change disturbance events?

- ☐ No progress
- ☐ Low progress
- ☐ Moderate Progress
- ☐ Good Progress
- ☐ Excellent progress

* 119. Do you think that climate change learning philosophy (communication, knowledge sharing, and experiences) is at the core business of the relevant governmental authorities, NPOs, and NGOs?

- ☐ Yes
- ☐ No
- ☐ Somehow
- ☐ Unsure

* 120. How do you rate the role played by the below authorities and organizations in using the information and data related to the previous experiences of climate change disasters, stresses, and shocks by reflecting them in the regulations, standards, and new developments?

	Poor	Fair	Average	Good	Excellent
Governmental authorities and regulatory bodies	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
NGOs & NPOs	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Construction industry	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

63. G.3:

1.2 Active Participation of Professional Stakeholders and Experienced Actors

* 121. To what level are you satisfied with the progress of local government authorities, NGOs, NPOs, and construction sectors in terms of actioning climate change impacts on the built environment?

- | | |
|--|--|
| <input type="radio"/> Dissatisfied | <input type="radio"/> Slightly satisfied |
| <input type="radio"/> Slightly dissatisfied | <input type="radio"/> Satisfied |
| <input type="radio"/> Neither satisfied nor dissatisfied | |

* 122. What is the level of importance of disseminating public awareness about reducing the climate change disaster risk in the built environment, improving management efforts, and reducing mortality and economic losses?

- | | |
|--|--|
| <input type="radio"/> Not at all important | <input type="radio"/> Moderately important |
| <input type="radio"/> Slightly important | <input type="radio"/> Very important |
| <input type="radio"/> Neutral | |

64. G.3:
1.3 Planing for Future

* 123. Is integrated development planning (strategy and plans indicated by the vision of the city) developed, reviewed, and updated by the relevant departments?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

* 124. Do you believe that the relevant local government authorities, NGOs, NPOs, construction sector, and other relevant organizations have the capacity to plan for anticipated or unknown climate change disasters?

- | | |
|---------------------------|------------------------------|
| <input type="radio"/> Yes | <input type="radio"/> Unsure |
| <input type="radio"/> No | |

65. G.3:
1.4 Preparation for Disasters

* 125. Is community engagement important to generate some level of preparedness against climate change disasters?

- | | |
|--|--|
| <input type="radio"/> Not at all important | <input type="radio"/> Moderately important |
| <input type="radio"/> Slightly important | <input type="radio"/> Very important |
| <input type="radio"/> Somewhat important | |

* 126. How often do community engagement techniques (such as benchmarking research, context, and skill levels) effectively generate some level of preparedness for the built environment systems against climate change hazards?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

* 127. Have researchers, scholars, and scientists in academic institutions and universities been engaged in any community engagement techniques to prepare the built environment against climate change disasters?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

66. G.3:
1.5 Decision-Making Facilitating

* 128. How do you rate the role played by the NGOs, NPOs, Academia,...etc., in terms of providing the previous experiences to the governmental authorities to leverage them to inform future decision-making?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

* 129. Has your institute been engaged in any policy-making decision techniques to increase the preparedness of the built environment against climate change disasters?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

* 130. Do academic institutions, universities, scholars, and researchers share thoughts, suggestions, and recommendations with the decision-makers to help them enhance the decision-making process and explicitly integrate them to improve the preparedness of the built environment systems against climate change disasters?

- | | |
|---------------------------------|------------------------------|
| <input type="radio"/> Never | <input type="radio"/> Often |
| <input type="radio"/> Rarely | <input type="radio"/> Always |
| <input type="radio"/> Sometimes | |

1.6 Reflective Environment Systems

	Poor	Fair	Average	Good	Excellent
Shelter systems (i.e., buildings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Life Support Systems (i.e., energy & water supply systems,... etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Movement Systems (i.e., transportation infrastructure (roads, bridges, ... etc.))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Space Systems (i.e., the utility for park & recreation purposes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

[illegible]

68. G.3:
4.0 Enhancing Flexibility (Fx)

The flexibility (Fx) of any system means adaptability to environmental variations and the ability to adopt alternative strategies to a climate change crisis. It also refers to the ability to adjust to changes through emergency planning in the aftershock of disturbances and strongly relates to adaptability.

69. G.3:

4.1 Identifying, Quantifying, and Controlling Flexibility.

* 133. Can the existing built environment systems withstand different climate variations with the lowest possible degradation of performance indicators?

- ☐ Yes
- ☐ No
- ☐ Partial
- ☐ Unsure

* 134. What are the main challenges to identifying, quantifying, and controlling the flexibility of an urban system? (For example, energy demands flexibility).

- ☐ Advanced management strategies
- ☐ Innovative techniques
- ☐ Emergency planning
- ☐ All the above

70. G.3: 4.2 Adopting Alternative Strategies to the Crisis.

* 135. How do you rate the relevant authorities, organizations, and construction industry in terms of seizing opportunities and adapting strategies to initiate informed and long-term changes in the system so that it responds accurately to changing conditions to maintain desired functions?

	Poor	Fair	Average	Good	Excellent
Shelter systems (i.e., buildings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Life Support Systems (i.e., energy & water supply systems,... etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Movement Systems (i.e., transportation infrastructure (roads, bridges, ... etc.))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Space Systems (i.e., the utility for park & recreation purposes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

* 136. How do you rate the alternative strategies taken by the governmental authorities and the construction industry to adapt to climate change? e.g., strategies taken to protect against sea-level rise, temperature rise, flooding, storm surge, ...etc.

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

* 137. How satisfied are you with the urban systems' adopting alternative strategies to absorb, respond to, and recover from a sudden shock?

- ☐ Dissatisfied
- ☐ Slightly dissatisfied
- ☐ Neither satisfied nor dissatisfied
- ☐ Slightly satisfied
- ☐ Satisfied

71. G.3:
4.3 Adaptation and Inherent Capacity.

* 138. To what level do you agree with the following statement?

"The flexible climate measures serving many impacts should allow additional options like allowing for multi approaches, enabling self-combination with other methods and measures, preserving options, altering or reversing the actions."

- ☐ Strongly disagree
- ☐ Disagree
- ☐ Neither agree nor disagree
- ☐ Agree
- ☐ Strongly agree

* 139. What is the level of importance of using emergency systems in enhancing the adaptive capability of the built environment systems?

- ☐ I don't know
- ☐ Not at all important
- ☐ Slightly important
- ☐ Somewhat important
- ☐ Moderately important
- ☐ Very important

72. G.3:
4.4 Climate Adaptation Policies and Processes.

* 140. How do you rate the flexibility of the decision-making processes in allowing for alterations and updates to the relevant climate adaptation strategies, rules, and processes?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

73. G.3:
4.5 Incorporating Traditional Knowledge & Practices.

* 141. Are traditional knowledge and practices converted to new techniques that suit the needs, and new knowledge, technologies, and obligations to combat climate change?

- ☐ No
- ☐ Yes
- ☐ Unsure

* 142. How do you rate the built environment systems' ability to adjust to changes in the aftershock of disturbances?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

74. G.3:
4.6 Efforts to Mitigate Climate Change Impacts.

* 143. How effective is the engagement of the community in activities that mitigate the losses caused by climate change disasters?

- ☐ Ineffective
- ☐ Weak
- ☐ Neutral
- ☐ Effective
- ☐ Very effective

75. G.3:
5.0 Encouraging Resourcefulness (Rs).

Resourcefulness (Rs) is defined as the capacity to identify problems, establish priorities, and allocate and mobilize resources before, during, and after an event that may disrupt elements, systems, or other units of analysis, taking into account human factors.

76. G.3:
5.1 Disaster Preparedness.

* 144. Do the national regulations and standards **state the requirements** that enable the built environment system to find alternative ways at the time of crisis to achieve goals or meet needs?

- ☐ Yes
☐ No
☐ Unsure

* 145. Do the national regulations and standards **encourage identifying problems** accompanying a disaster event, establishing priorities, & mobilizing resources following the event?

- ☐ Yes
☐ No
☐ Unsure

* 146. Do built environment systems have the capacity to **mobilize resources** and the ability to measure their performance during the disruption event?

- ☐ Yes
☐ No
☐ Unsure

* 147. Do the built environment systems have the ability to **find alternative ways** at the time of crisis to achieve goals or meet needs?

- ☐ Yes
☐ No
☐ Unsure

77. G.3:
5.2 Emergency Management.

* 148. How do you rate the quality and capacity of the built environment systems to manage the needed services and resources during emergencies promptly and correctly?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

* 149. Do you think that the way of interaction, skills, and active capacity of people affect the resourcefulness of the system?

- ☐ Yes
- ☐ No
- ☐ Unsure

* 150. Please rank the importance of the following principles and dimensions from most to least preferred according to your experience. [1 is the least preferred]

	Providing necessary support to the emergency management system by the political and economic structure.
	Disaster preparedness through preparing the residents and the whole community.
	Utilizing the community's trusted resources to allow the community to cope with the climate change hazards.
	The ability of the community to mitigate the losses through making smart decisions.

78. G.3: 5.3 Resources Utilization.

* 151. What is the level of linkage between academia, policy-making, and the public sector to tackle and deal with crises or shocks?

- ☐ Poor
- ☐ Fair
- ☐ Average
- ☐ Good
- ☐ Excellent

* 152. Below are some factors that enhance the resourcefulness of the built environment. Please rank them according to their priorities: *[1 is the lowest priority]*

	The emergency management system's political, economic, and logistical structure.
	Citizen, community, and country disaster preparedness.
	The ability of the community or country during the emergency to mitigate losses through making smart decisions.

* 153. The core resources that constitute resourcefulness can be classified into three categories as below. Please identify their level of importance.

	Not at all important	Slightly important	Neutral	Moderately important	Very important
Material resources include infrastructures, environmental conditions, housing, food, health, financial resources, and tools.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Intellectual resources include culture, social capital, ecological knowledge, networking, time, science, and education.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Civic resources related to citizenship that enables people to participate domain of resourcefulness.	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

79. G.3:

5.4 Mitigating the Losses by the Community.

* 154. Has the community been engaged directly or indirectly in mitigating the losses caused by climate change disasters in the past?

- ☐ Yes
- ☐ No
- ☐ Unsure

80. G.3:
5.5 Visualize and Act.

* 155. Do the relevant governmental authorities and regulatory bodies with the help of research centers assess the community's ability to use past experience when acting on the threat of future shocks and stresses?

- ☐ Yes
- ☐ No
- ☐ Unsure

81. G.3:

5.6 Identify Problems and Establish Priorities.

* 156. Do the relevant governmental authorities and regulatory bodies assess the community's ability to foresee and identify severe problems affecting the built environment systems?

- ☐ Yes
- ☐ No
- ☐ Unsure

* 157. Are there task forces within the community as part of an emergency response plan to protect the built environment systems?

- ☐ Yes
- ☐ No
- ☐ Unsure

82. G.3:
6.0 Improving Rapidity (Rp)

Rapidity (Rp) refers to the ability of the system to recover from an encountered crisis even with some losses. The concept refers to the speed of the affected system or facility to promptly recover to its full operational function through responsiveness, adaptation, and recovery activities.

83. G.3:

6.1 Responsiveness & Restorative Capacity

* 158. Do you think the local regulations and standards accommodate the requirements related to responsiveness, adaptation, and recovery activities that promptly assist the affected system or facility in recovering its full operational function?

☐ Yes

☐ Unsure

☐ No

* 159. What is the level of importance of installing real-time automated monitoring systems, such as the Supervisory Control and Data Acquisition system (SCADA), to enhance the restorative capability of the system/facility to recover from the crises in a reasonable time?

☐ Not at all important

☐ Moderately important

☐ Slightly important

☐ Very important

☐ Somewhat important

* 160. How do you rate the priority level of installing real-time automated monitoring systems to warn against climate change crises or stresses and provide emergency response guidance?

☐ Not a priority

☐ High priority

☐ Low priority

☐ Essential

☐ Medium priority

84. G.3:
6.2 Adaptation

* 161. Based on experience, have decision-making frameworks been developed for robust and rapid adaptation planning and evaluation of climate change impacts on the built environment systems?

☐ Yes

☐ Unsure

☐ No

85. G.3: 6.3 Rapid Recovery

* 162. Based on current research and knowledge, what is your level of satisfaction with the recovery speed against the climate change impacts demonstrated by the built environment systems?

	Dissatisfied	Slightly dissatisfied	Neither satisfied nor dissatisfied	Slightly satisfied	Satisfied
Shelter systems (i.e., buildings)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Life Support Systems (i.e., energy & water supply systems,... etc.)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Movement Systems (i.e., transportation infrastructure (roads, bridges, ... etc.))	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
Open Space Systems (i.e., the utility for park & recreation purposes)	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

86. G.3:
6.4 Recovery Activities (Resource allocation)

* 163. What is your level of agreement with the following statement?

"The process of recovery involves not only repairing and renovating the physical infrastructure but reconstructing social relationships."

- | | |
|--|--------------------------------------|
| <input type="radio"/> Strongly disagree | <input type="radio"/> Agree |
| <input type="radio"/> Disagree | <input type="radio"/> Strongly agree |
| <input type="radio"/> Neither agree nor disagree | |

* 164. Do you think that the construction industries need to tailor and consider sufficient repair resources to enhance the rapidity of the built environment system and improve its resilience?

- | | |
|---------------------------|------------------------------|
| <input type="radio"/> Yes | <input type="radio"/> Unsure |
| <input type="radio"/> No | |

* 165. Considering flooding as a significant climate change problem, how do you rate the recovery of the built environment systems?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

* 166. How do you rate the implementation of risk identification assessment and management plan in the construction projects (buildings, utilities, roads, rails, ...etc.) to improve the systems' rapidity?

- | | |
|-------------------------------|---------------------------------|
| <input type="radio"/> Poor | <input type="radio"/> Good |
| <input type="radio"/> Fair | <input type="radio"/> Excellent |
| <input type="radio"/> Average | |

87. Overall

167. If you have any other aspects that will help enhance the built environment's resilience, you can drag them into the comment box; otherwise, click Next.

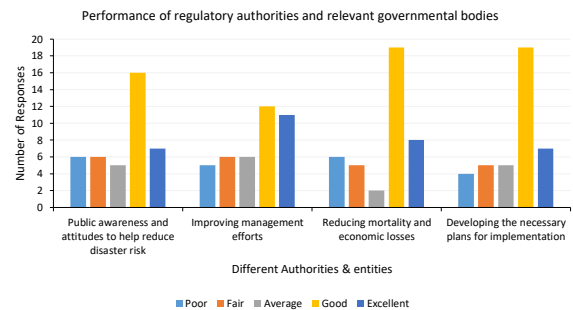
88. Thank you

We thank you very much for participating in this important
study.

Research Team

1) The relative importance index (RII)

$$RII = \sum \frac{W_i}{A \times N}$$



Group 1 Q17. How do you rate the performance of regulatory authorities and relevant governmental bodies in your county/area in considering the following?

Total surveyed (Survey date)	31					
Qs Rating	1	2	3	4	5	
Statement on subject	Poor	Fair	Average	Good	Excellent	Total
Public awareness and attitudes to help reduce disaster risk	6	6	5	16	7	40
Improving management efforts	5	6	6	12	11	40
Reducing mortality and economic losses	6	5	2	19	8	40
Developing the necessary plans for implementation	4	5	5	19	7	40
Total	21	22	18	66	33	160

Calculations									
Statement on subject	Poor	Fair	Average	Good	Excellent	Total		RII	Rank
Public awareness and attitudes to help reduce disaster risk	6	12	15	64	35	132	40	155 0.851613	4
Improving management efforts	5	12	18	48	55	138	40	155 0.890323	3
Reducing mortality and economic losses	6	10	6	76	40	138	40	155 0.890323	2
Developing the necessary plans for implementation	4	10	15	76	35	140	40	155 0.903226	1

Group 2 Q71. How do you rate the following activities in your county/area?

Total surveyed (Survey date)	79					
Qs Rating	1	2	3	4	5	
Statement on subject	Poor	Fair	Average	Good	Excellent	Total
Public awareness and attitudes to help reduce disaster risk	14	17	28	28	4	91
Improving management efforts	10	16	25	32	8	91
Reducing mortality and economic losses	9	17	23	31	11	91
Developing the necessary plans for implementation	5	14	29	32	11	91
Total	38	64	105	123	34	364

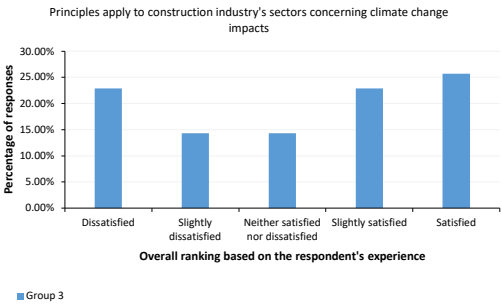
Calculations									
Statement on subject	Poor	Fair	Average	Good	Excellent	Total		RII	Rank
Public awareness and attitudes to help reduce disaster risk	14	34	84	112	20	264	91	395 0.668354	4
Improving management efforts	10	32	75	128	40	285	91	395 0.721519	3
Reducing mortality and economic losses	9	34	69	124	55	291	91	395 0.736709	2
Developing the necessary plans for implementation	5	28	87	128	55	303	91	395 0.767089	1

To what level are you satisfied with the progress of local government authorities, NGOs, NPOs, and construction sectors in terms of actioning climate change impacts on the built environment?

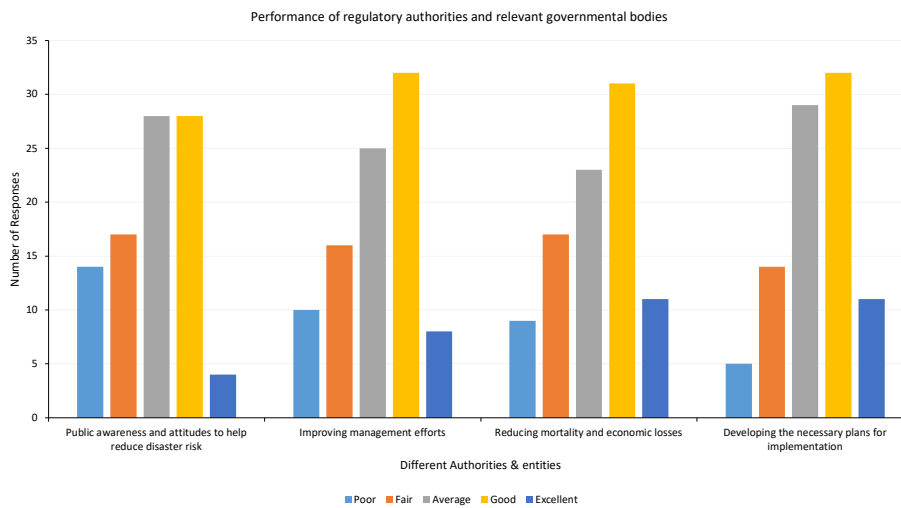
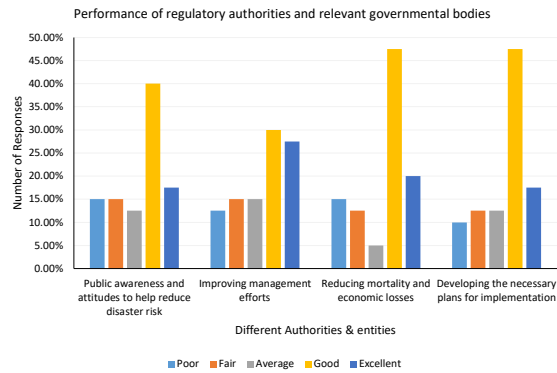
Q121

Group 3

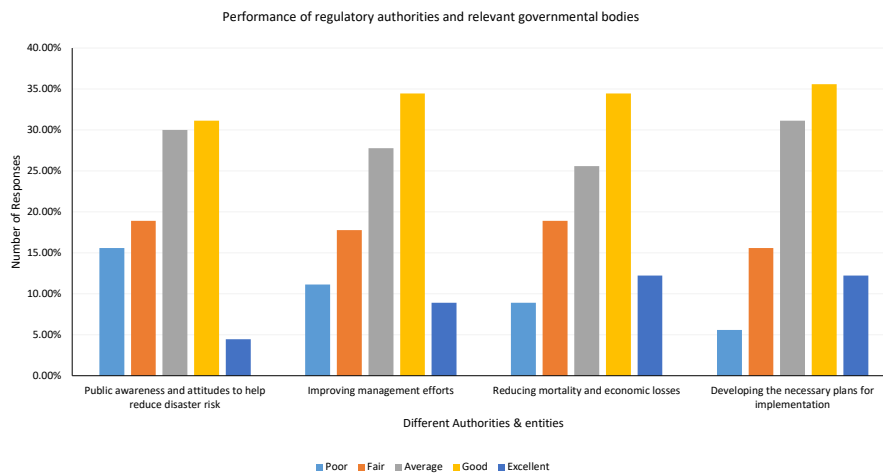
Answer Choices	Score	Responses	
Dissatisfied	1/5	22.86%	8
Slightly dissatisfied	2/5	14.29%	5
Neither satisfied nor dissatisfied	3/5	14.29%	5
Slightly satisfied	4/5	22.86%	8
Satisfied	5/5	25.71%	9
Answered			35
Skipped			220



Poor	Fair	Average	Good	Excellent
15.00%	15.00%	12.50%	40.00%	17.50%
12.50%	15.00%	15.00%	30.00%	27.50%
15.00%	12.50%	5.00%	47.50%	20.00%
10.00%	12.50%	12.50%	47.50%	17.50%



Poor	Fair	Average	Good	Excellent
15.56%	18.89%	30.00%	31.11%	4.44%
11.11%	17.78%	27.78%	34.44%	8.89%
8.89%	18.89%	25.56%	34.44%	12.22%
5.56%	15.56%	31.11%	35.56%	12.22%



2) 2.1 Chi-Square Test: Evaluating the public awareness and attitudes, improving management efforts, reducing mortality and economic losses, and developing necessary plans for disaster reduction from the perspectives of different groups

Response	Public awareness [Poor]	Improving management efforts [Poor]	Reducing mortality & economic losses [Poor]	Developing necessary plans [Poor]	Grand total
Group 1	6	5	6	4	21
Group 2	14	10	9	5	38
Group 3	1	1	1	1	4
Grand total	21	16	16	10	63

Expected Response	Public awareness [Poor]	Improving management efforts [Poor]	Reducing mortality & economic losses [Poor]	Developing necessary plans [Poor]	Grand total
Group 1	7.0000	5.3333	5.3333	3.3333	21
Group 2	12.6667	9.6508	9.6508	6.0317	38
Group 3	1.3333	1.0159	1.0159	0.6349	4
Grand total	21	16	16	10	63

p 0.983748907 do not reject null hypothesis
P to reject 0.05 less than 0.05 is strong evidence against null hypothesis
Ho is that there is no relationship between different groups
Conclusion: Accept the Nul hypothesis

2.2 Chi-Square Test: Evaluating the public awareness and attitudes, improving management efforts, reducing mortality and economic losses, and developing necessary plans for disaster reduction from the perspectives of different groups

Response	Public awareness [Fair]	Improving management efforts [Fair]	Reducing mortality & economic losses [Fair]	Developing necessary plans [Fair]	Grand total
Group 1	12	12	10	10	44
Group 2	34	32	34	28	128
Group 3	4	4	4	4	16
Grand total	50	48	48	42	188

Expected Response	Public awareness [Fair]	Improving management efforts [Fair]	Reducing mortality & economic losses [Fair]	Developing necessary plans [Fair]	Grand total
Group 1	11.7021	11.2340	11.2340	9.8298	44
Group 2	34.0426	32.6809	32.6809	28.5957	128
Group 3	4.2553	4.0851	4.0851	3.5745	16
Grand total	50	48	48	42	188

p 0.99923068
Conclusion: Accept the Nul hypothesis

2.3 Chi-Square Test: Evaluating the public awareness and attitudes, improving management efforts, reducing mortality and economic losses, and developing necessary plans for disaster reduction from the perspectives of different groups

Response	Public awareness [Average]	Improving management efforts [Average]	Reducing mortality & economic losses [Average]	Developing necessary plans [Average]	Grand total
Group 1	15	18	6	15	54
Group 2	84	75	69	87	315
Group 3	3	3	3	3	12
Grand total	102	96	78	105	381

Expected Response	Public awareness [Average]	Improving management efforts [Average]	Reducing mortality & economic losses [Average]	Developing necessary plans [Average]	Grand total
Group 1	14.4567	13.6063	11.0551	14.8819	54
Group 2	84.3307	79.3701	64.4882	86.8110	315
Group 3	3.2126	3.0236	2.4567	3.3071	12
Grand total	102	96	78	105	381

p 0.612998282
Conclusion: Accept the Nul hypothesis

2.4 Chi-Square Test: Evaluating the public awareness and attitudes, improving management efforts, reducing mortality and economic losses, and developing necessary plans for disaster reduction from the perspectives of different groups

Response	Public awareness [Good]	Improving management efforts [Good]	Reducing mortality & economic losses [Good]	Developing necessary plans [Good]	Grand total
Group 1	64	48	76	76	264
Group 2	112	128	124	128	492
Group 3	32	32	32	32	128
Grand total	208	208	232	236	884

Expected Response	Public awareness [Good]	Improving management efforts [Good]	Reducing mortality & economic losses [Good]	Developing necessary plans [Good]	Grand total
Group 1	62.1176	62.1176	69.2851	70.4796	264
Group 2	115.7647	115.7647	129.1222	131.3484	492
Group 3	30.1176	30.1176	33.5928	34.1719	128
Grand total	208	208	232	236	884

p 0.369384412
Conclusion: Accept the Nul hypothesis

Chi-Square Test: Evaluating the public awareness and attitudes, improving management efforts, reducing mortality and economic losses, and developing necessary plans for disaster reduction from the perspectives of different groups
[Excellent]

Response	Public awareness [Excellent]	Improving management efforts [Excellent]	Reducing mortality & economic losses [Excellent]	Developing necessary plans [Excellent]	Grand total
Group 1	35	55	40	35	165
Group 2	20	40	55	55	170
Group 3	65	65	65	65	260
Grand total	120	160	160	155	595

Expected Response	Public awareness [Excellent]	Improving management efforts [Excellent]	Reducing mortality & economic losses [Excellent]	Developing necessary plans [Excellent]	Grand total
Group 1	33.2773	44.3697	44.3697	42.9832	165
Group 2	34.2857	45.7143	45.7143	44.2857	170
Group 3	52.4370	69.9160	69.9160	67.7311	260
Grand total	120	160	160	155	595

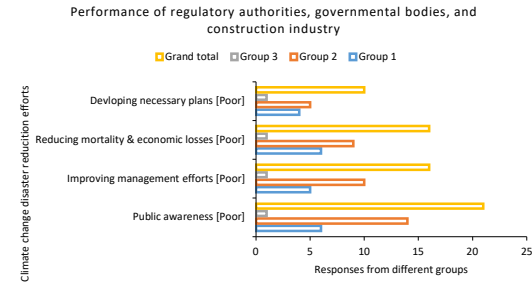
p0.003390031

P to reject0.05less than 0.05 is strong evidence against null hypothesis

Ho proves that there is a relation between answers from different groups

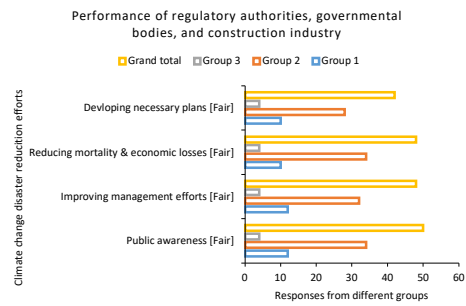
Conclusion: Reject the Nul hypothesis

Chi-Square Test: Evaluating the public awareness and attitudes, improving management efforts, reducing mortality and economic losses, and developing necessary plans for disaster reduction from the perspectives of different groups.

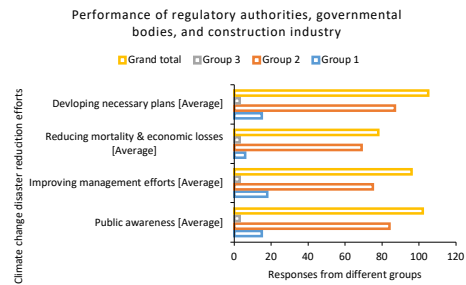


Q13	Group 1		Poor	Fair	Average	Good	Excellent	
		Public awareness		6	12	15	64	35
		Improving management efforts		5	12	18	48	55
		Reducing mortality & economic losses		6	10	6	76	40
		Developing necessary plans		4	10	15	76	35
			21	44	54	264	165	

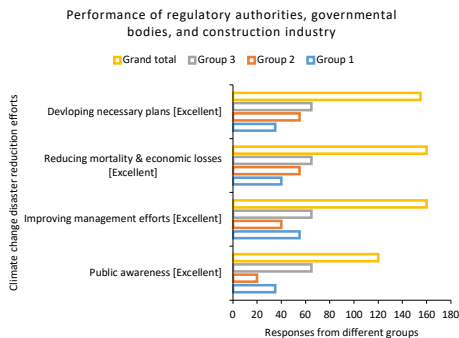
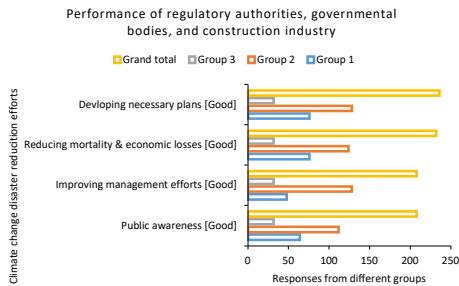
Q71	Group 2	Public awareness	14	34	84	112	20
		Improving management efforts	10	32	75	128	40
		Reducing mortality & economic losses	9	34	69	124	55
		Developing necessary plans	5	28	87	128	55
			38	128	315	492	170



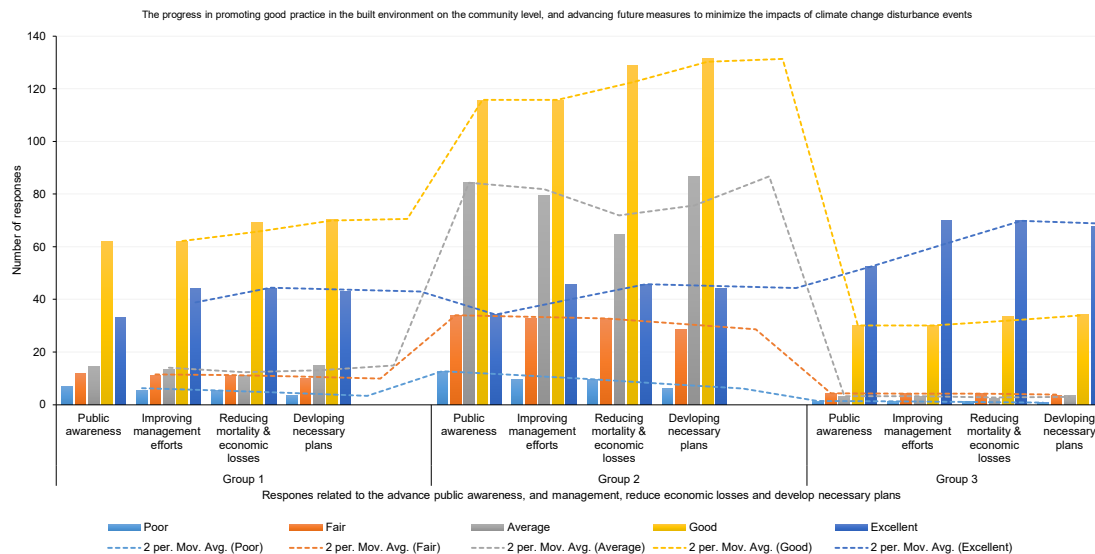
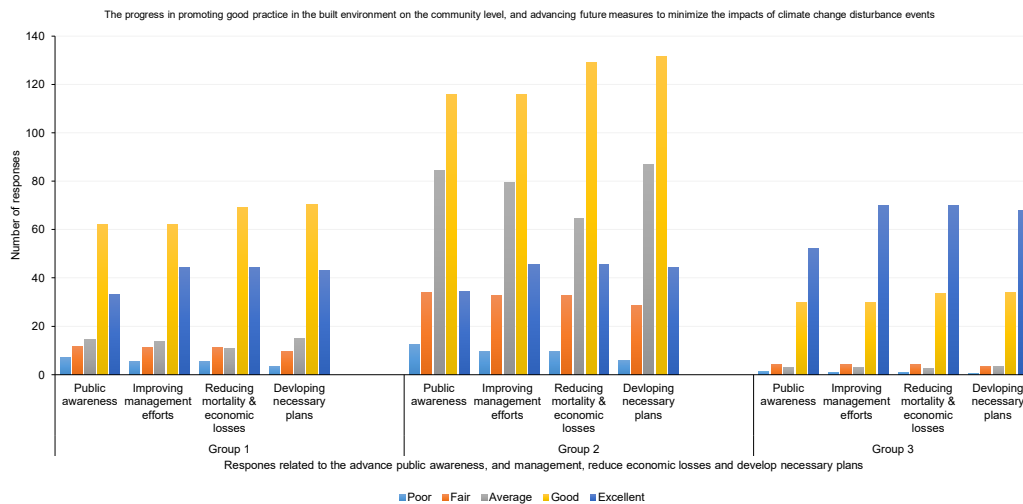
Q122	Group 3	Public awareness					
		Improving management efforts	1	4	3	32	65
		Reducing mortality & economic losses	1	4	3	32	65
		Developing necessary plans	1	4	3	32	65
		Total grand	4	16	12	128	260



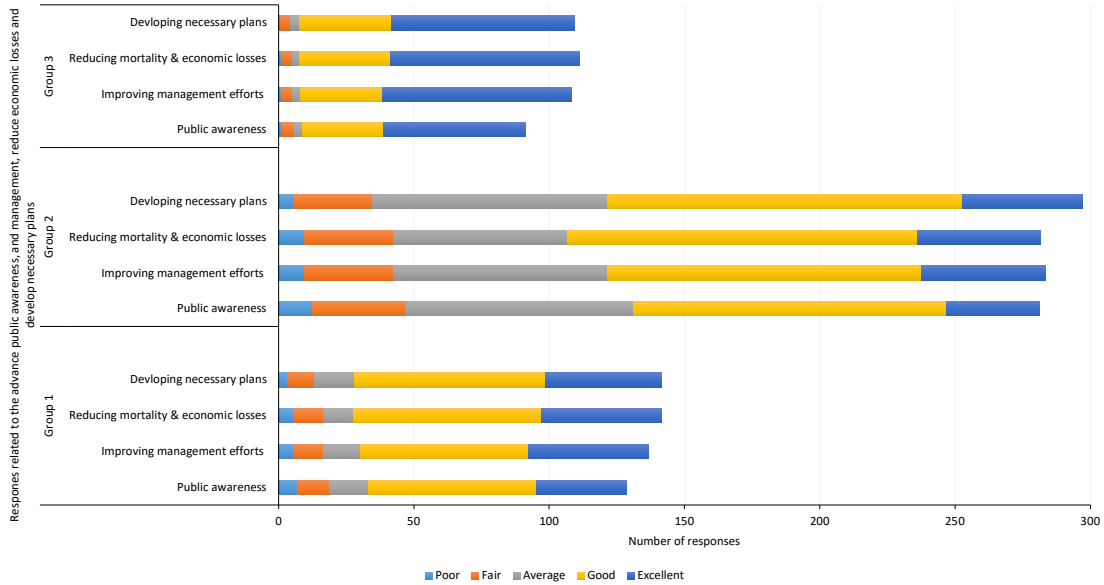
Overall	Poor	Fair	Average	Good	Excellent	
Public awareness	21		50	102	208	120
Improving management efforts	16		48	96	208	160
Reducing mortality & economic losses	16		48	78	232	160
Developing necessary plans	10		42	105	236	155
	63		188	381	884	595



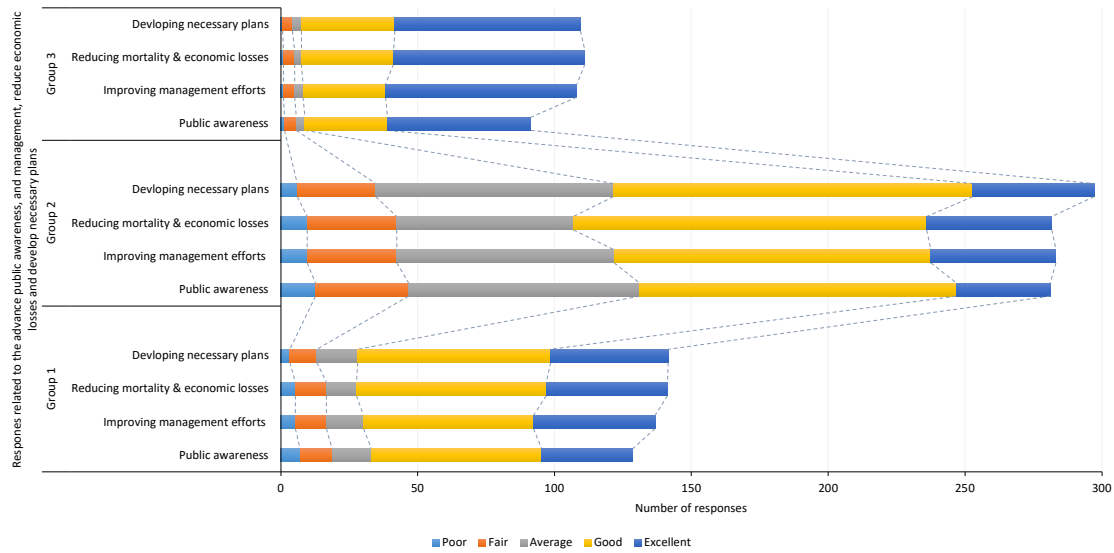
		Expected	Poor	Fair	Average	Good	Excellent
Q13	Group 1	Public awareness	7.000	11.702	14.457	62.118	33.277
		Improving management efforts	5.333	11.234	13.606	62.118	44.370
		Reducing mortality & economic losses	5.333	11.234	11.055	69.285	44.370
		Developing necessary plans	3.333	9.830	14.882	70.480	42.983
Q71	Group 2	Public awareness	12.667	34.043	84.331	115.765	34.286
		Improving management efforts	9.651	32.681	79.370	115.765	45.714
		Reducing mortality & economic losses	9.651	32.681	64.488	129.122	45.714
		Developing necessary plans	6.032	28.596	86.811	131.348	44.286
Q122	Group 3	Public awareness	1.333	4.255	3.213	30.118	52.437
		Improving management efforts	1.016	4.085	3.024	30.118	69.916
		Reducing mortality & economic losses					
		Developing necessary plans	1.016	4.085	2.457	33.593	69.916
			0.635	3.574	3.307	34.172	67.731



The progress in promoting good practice in the built environment on the community level, and advancing future measures to minimize the impacts of climate change disturbance events



The progress in promoting good practice in the built environment on the community level, and advancing future measures to minimize the impacts of climate change disturbance events



CHITEST						CHITEST							
Public awareness		Group 1	Group 2	Group 3	Total	Improving management efforts		Group 1	Group 2	Group 3	Total		
Q13	Poor	6	14	1	21	0.041916	Q13	Poor	5	10	1	16	0.031936128
Q71	Fair	12	34	4	50	0.0998	Q71	Fair	12	32	4	48	0.095808383
Q122	Average	15	84	3	102	0.203593	Q122	Average	18	75	3	96	0.191616766
	Good	64	112	32	208	0.41517		Good	48	128	32	208	0.415169661
	Excellent	35	20	65	120	0.239521		Excellent	55	40	65	160	0.319361277
	Total	132	264	105	501			Total	138	285	105	528	

CHITEST						
Reducing mortality & economic losses		Group 1	Group 2	Group 3	Total	
Q13	Poor	6	9	1	16	0.031936
Q71	Fair	10	34	4	48	0.095808
Q122	Average	6	69	3	78	0.155689
	Good	76	124	32	232	0.463074
	Excellent	40	55	65	160	0.319361
	Total	138	291	105	534	

4.407185629 9.293413 3.353293
13.22155689 27.88024 10.05988

21.48502994 45.30539 16.34731

63.90419162 134.7545 48.62275

44.07185629 92.93413 33.53293
2.028E-17

ypothesis
Ho is that there is no difference between actual and expected number of respondents from the three groups
P to reject 0.05 less than 0.05 is strong evidence against null hypothesis
p 2.03E-17 do not reject null hypothesis

CHITEST						
Developing necessary plans		Group 1	Group 2	Group 3	Total	
Q13	Poor	4	5	1	10	0.01996
Q71	Fair	10	28	4	42	0.083832
Q122	Average	15	87	3	105	0.209581
	Good	76	128	32	236	0.471058
	Excellent	35	55	65	155	0.309381
	Total	140	303	105	548	

2.794411178 6.047904 2.095808
11.73652695 25.4012 8.802395

29.34131737 63.50299 22.00599

65.94810379 142.7305 49.46108

43.31337325 93.74251 32.48503
2.925E-17

Ho is that there is no difference between actual and expected number of respondents from the three groups
P to reject 0.05 less than 0.05 is strong evidence against null hypothesis
p 2.93E-17 do not reject null hypothesis

29. The reflective environment consists of systems that accept the change and uncertainty inherited from the past or generated over time. According to this presumption, how do you value the below-built environmental systems?

All groups

	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Shelter systems	11	22	46	51
Life Support Systems	9	16	34	57
Movement Systems	8	14	34	64
Open Space Systems	10	11	32	63

Group 1

	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Shelter systems	5	4	10	9
Life Support Systems	1	4	8	13
Movement Systems	1	4	5	17
Open Space Systems	3	2	4	16

	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Group 1 Shelter systems	5	4	10	9
Life Support Systems	1	4	8	13
Movement Systems	1	4	5	17
Open Space Systems	3	2	4	16
Group 2 Shelter systems	2	11	27	31
Life Support Systems	5	6	19	33
Movement Systems	3	7	19	33
Open Space Systems	4	5	20	34
Group 3 Shelter systems	4	7	9	11
Life Support Systems	3	6	7	11
Movement Systems	4	3	10	14
Open Space Systems	3	4	8	13

Group 2

	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Shelter systems	2	11	27	31
Life Support Systems	5	6	19	33
Movement Systems	3	7	19	33
Open Space Systems	4	5	20	34

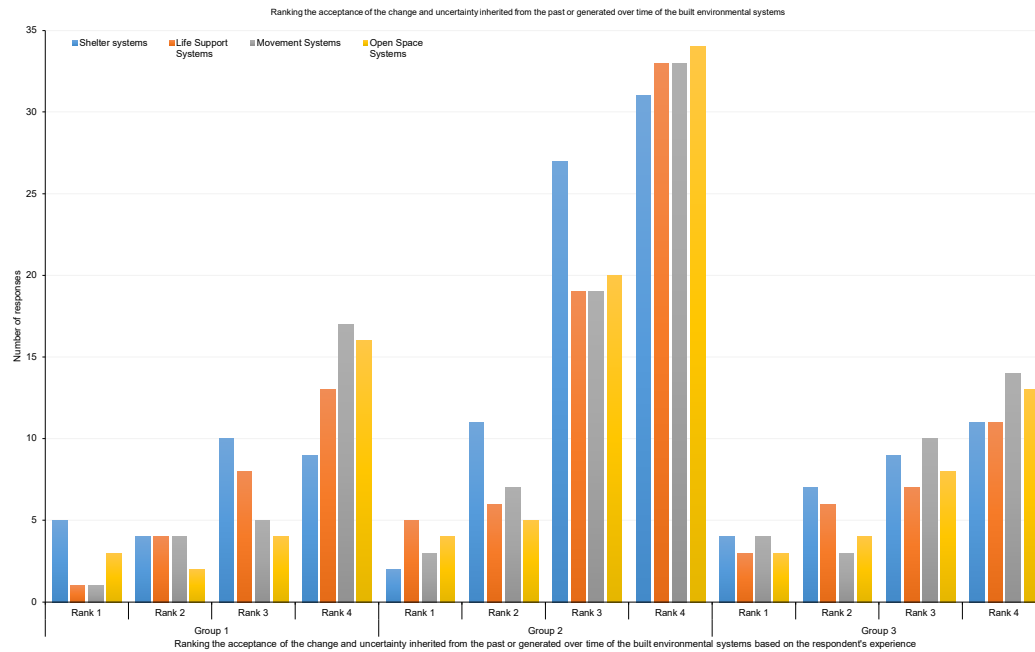
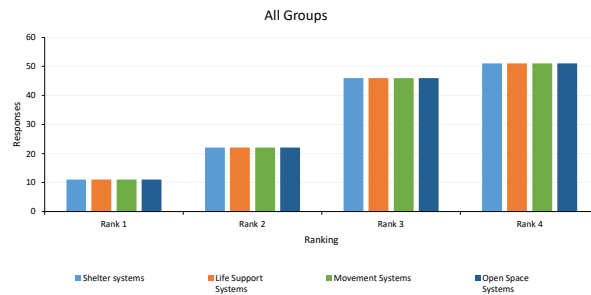
		Shelter systems	Life Support Systems	Movement Systems	Open Space Systems	
Group 1	Rank 1		5	1	1	3
	Rank 2		4	4	4	2
	Rank 3		10	8	5	4
Group 2	Rank 4		9	13	17	16
	Rank 1		2	5	3	4
	Rank 2		11	6	7	5
Group 3	Rank 3		27	19	19	20
	Rank 4		31	33	33	34
	Rank 1		4	3	4	3
	Rank 2		7	6	3	4
	Rank 3		9	7	10	8
	Rank 4		11	11	14	13

Group 3

	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Shelter systems	4	7	9	11
Life Support Systems	3	6	7	11
Movement Systems	4	3	10	14
Open Space Systems	3	4	8	13

All groups

	1 Rank 1	2 Rank 2	3 Rank 3	4 Rank 4
Shelter systems	11	22	46	51
Life Support Systems	11	22	46	51
Movement Systems	11	22	46	51
Open Space Systems	11	22	46	51



The relative importance index (RII)

$$RII = \sum \frac{W_i}{A \times N}$$

Group 1

Q29. The reflective environment consists of systems that accept the change and uncertainty inherited from the past or generated over time. According to this presumption, how do you value the below-built environmental systems?

Total surveyed	31					
Qs Rating	1	2	3	4	5	
Statement on subject	Poor	Fair	Average	Good	Excellent	Total
Shelter systems (i.e., buildings)	5	4	10	9	3	31
Life Support Systems (i.e., energy & water supply systems,... etc.)	1	4	7	13	6	31
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	1	4	5	16	5	31
Open Space Systems (i.e., the utility for park & recreation purposes)	3	2	4	15	7	31
Total	10	14	26	53	21	124

Calculations

Statement on subject	Poor	Fair	Average	Good	Excellent	Total			RII	Rank
Shelter systems (i.e., buildings)	5	8	30	36	15	94	31	155	0.6065	4
Life Support Systems (i.e., energy & water supply systems,... etc.)	1	8	21	52	30	112	31	155	0.7226	3
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	1	8	15	64	25	113	31	155	0.7290	2
Open Space Systems (i.e., the utility for park & recreation purposes)	3	4	12	60	35	114	31	155	0.7355	1

Group 2

Q83. The reflective environment consists of systems that accept the change and uncertainty inherited from the past or generated over time. According to this presumption, how do you value the below-built environment systems?

Total surveyed	78					
Qs Rating	1	2	3	4	5	
Statement on subject	Poor	Fair	Average	Good	Excellent	Total
Shelter systems (i.e., buildings)	2	11	28	31	7	79
Life Support Systems (i.e., energy & water supply systems,... etc.)	5	7	19	33	15	79
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	3	7	20	33	16	79
Open Space Systems (i.e., the utility for park & recreation purposes)	4	5	21	34	15	79
Total	14	30	88	131	53	316

Calculations

Statement on subject	Poor	Fair	Average	Good	Excellent	Total			RII	Rank
Shelter systems (i.e., buildings)	2	22	84	124	35	267	79	390	0.6846	4
Life Support Systems (i.e., energy & water supply systems,... etc.)	5	14	57	132	75	283	79	390	0.7256	3
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	3	14	60	132	80	289	79	390	0.7410	1
Open Space Systems (i.e., the utility for park & recreation purposes)	4	10	63	136	75	288	79	390	0.7385	2

Group 3

Q131. How do you rate the reflectivity of the built environment systems in accepting the change and uncertainty inherited from the past or generated over time?

Total surveyed	33					
Qs Rating	1	2	3	4	5	
Statement on subject	Poor	Fair	Average	Good	Excellent	Total
Shelter systems (i.e., buildings)	4	6	9	12	2	33
Life Support Systems (i.e., energy & water supply systems,... etc.)	3	6	7	11	6	33
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	4	3	10	13	3	33
Open Space Systems (i.e., the utility for park & recreation purposes)	3	4	8	13	5	33
Total	14	19	34	49	16	132

Calculations

Statement on subject	Poor	Fair	Average	Good	Excellent	Total			RII	Rank
Shelter systems (i.e., buildings)	4	12	27	48	10	101	33	165	0.6121	4
Life Support Systems (i.e., energy & water supply systems,... etc.)	3	12	21	44	30	110	33	165	0.6667	2
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	4	6	30	52	15	107	33	165	0.6485	3
Open Space Systems (i.e., the utility for park & recreation purposes)	3	8	24	52	25	112	33	165	0.6788	1

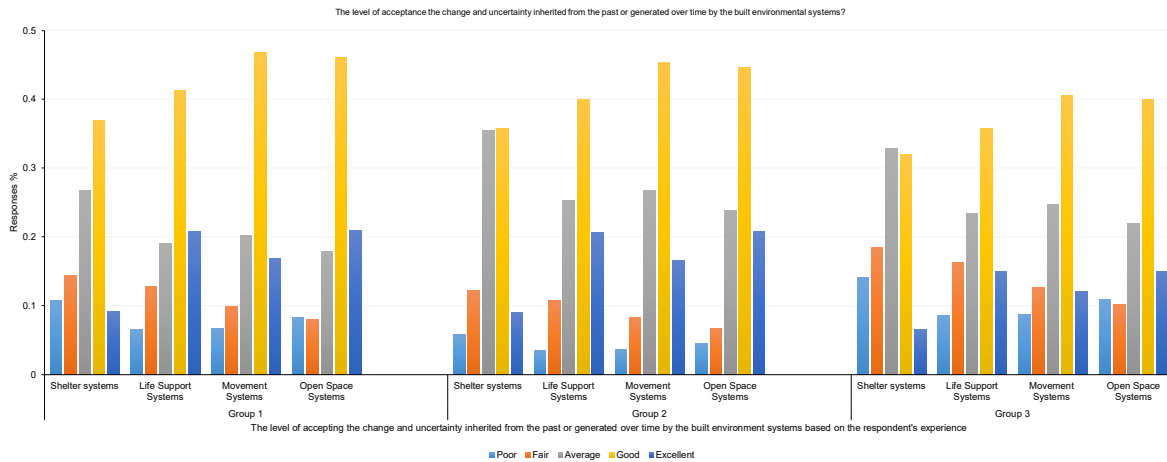
All Groups

Total surveyed	142					
Qs Rating	1	2	3	4	5	
Statement on subject	Poor	Fair	Average	Good	Excellent	Total
Shelter systems (i.e., buildings)	11	21	47	52	12	143
Life Support Systems (i.e., energy & water supply systems,... etc.)	9	17	33	57	27	143
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	8	14	35	62	24	143
Open Space Systems (i.e., the utility for park & recreation purposes)	10	11	33	62	27	143
Total	38	63	148	233	90	572

Calculations

Statement on subject	Poor	Fair	Average	Good	Excellent	Total			RII	Rank
Shelter systems (i.e., buildings)	11	42	141	208	60	462	143	710	0.6507	4
Life Support Systems (i.e., energy & water supply systems,... etc.)	9	34	99	228	135	505	143	710	0.7113	3
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	8	28	105	248	120	509	143	710	0.7169	2
Open Space Systems (i.e., the utility for park & recreation purposes)	10	22	99	248	135	514	143	710	0.7239	1

			Poor	Fair	Average	Good	Excellent			Expected	Poor	Fair	Average	Good	Excellent	
Q29	Group 1	Shelter systems (i.e., buildings) Life Support Systems (i.e., energy & water supply systems,... etc.)	16.13%	12.90%	32.26%	29.03%	9.68%	100.00%	Q13	Group 1	Shelter systems Life Support Systems	10.75%	14.45%	26.70%	36.86%	9.09%
		Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	3.23%	12.90%	22.58%	41.94%	19.35%	100.00%			Movement Systems	6.51%	12.82%	19.08%	41.23%	20.89%
		Open Space Systems (i.e., the utility for park & recreation purposes)	3.23%	12.90%	16.13%	51.61%	16.13%	100.00%			Open Space Systems	6.68%	9.90%	20.17%	46.78%	16.80%
			9.68%	6.45%	12.90%	48.39%	22.58%	100.00%				8.32%	7.99%	17.92%	46.09%	20.96%
			32.26%	45.16%	83.87%	170.97%	67.74%		Q71	Group 2	Shelter systems Life Support Systems Movement Systems	5.90%	12.15%	35.47%	35.76%	9.00%
Q83	Group 2	Shelter systems (i.e., buildings) Life Support Systems (i.e., energy & water supply systems,... etc.)	2.53%	13.92%	35.44%	39.24%	8.86%	100.00%			Open Space Systems	3.58%	10.78%	25.33%	39.99%	20.69%
		Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	6.33%	8.86%	24.05%	41.77%	18.99%	100.00%				3.67%	8.33%	26.79%	45.37%	16.64%
		Open Space Systems (i.e., the utility for park & recreation purposes)	3.80%	8.86%	25.32%	41.77%	20.25%	100.00%				4.57%	6.72%	23.80%	44.70%	20.76%
			5.06%	6.33%	26.58%	43.04%	18.99%	100.00%	Q122	Group 3	Shelter systems Life Support Systems Movement Systems Open Space Systems	14.13%	18.42%	32.80%	32.02%	6.51%
			17.72%	37.97%	111.39%	165.82%	67.09%					8.56%	16.34%	23.43%	35.81%	14.95%
Q131	Group 3	Shelter systems (i.e., buildings) Life Support Systems (i.e., energy & water supply systems,... etc.)	12.12%	18.18%	27.27%	36.36%	6.06%	100.00%				8.79%	12.63%	24.78%	40.63%	12.03%
		Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	9.09%	18.18%	21.21%	33.33%	18.18%	100.00%				10.94%	10.19%	22.01%	40.03%	15.00%
		Open Space Systems (i.e., the utility for park & recreation purposes)	12.12%	9.09%	30.30%	39.39%	9.09%	100.00%								
			9.09%	12.12%	24.24%	39.39%	15.15%	100.00%								
			42.42%	57.58%	103.03%	148.48%	48.48%									
		Overall														
		Shelter systems (i.e., buildings)	30.78%	45.01%	94.97%	104.64%	24.60%									
		Life Support Systems (i.e., energy & water supply systems,... etc.)	18.65%	39.95%	67.84%	117.04%	56.52%									
		Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))														
		Open Space Systems (i.e., the utility for park & recreation purposes)	19.14%	30.85%	71.75%	132.78%	45.47%									
			23.83%	24.90%	63.73%	130.82%	56.72%									
			92.40%	140.71%	298.29%	485.28%	183.32%									



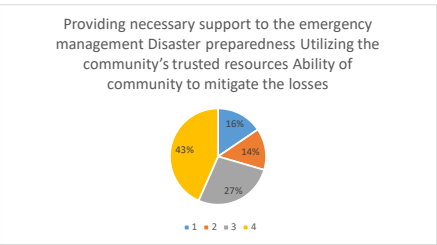
Q47. Please rank the importance of the following principles and dimensions from most to least preferred according to your experience. [1 is the lowest preferred]

All groups

	1	2	3	4					
	Rank 1	Rank 2	Rank 3	Rank 4	Total	%	%	%	%
Resourcefulness Principles									
Providing necessary support to the emergency management	51	34	24	20	129	40%	26%	19%	16%
Disaster preparedness	33	44	34	18	129	26%	34%	26%	14%
Utilizing the community's trusted resources	18	27	49	35	129	14%	21%	38%	27%
Ability of community to mitigate the losses	27	24	22	56	129	21%	19%	17%	43%

Group 1

	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Providing necessary support to the emergency management	11			
Disaster preparedness	7			
Utilizing the community's trusted resources	3			
Ability of community to mitigate the losses	7			

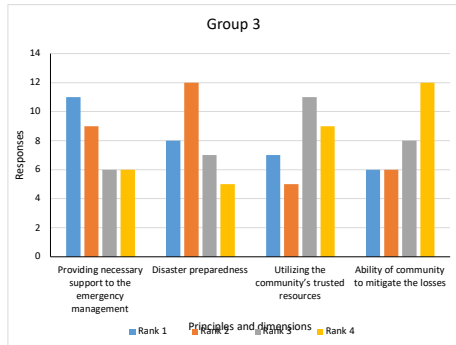
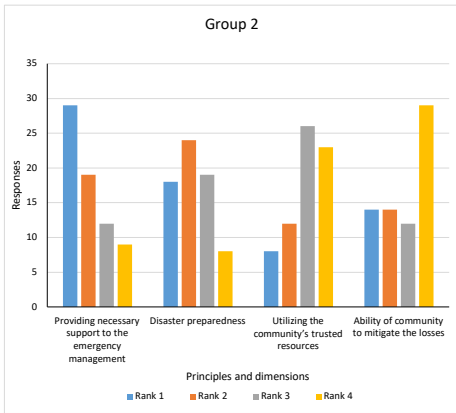
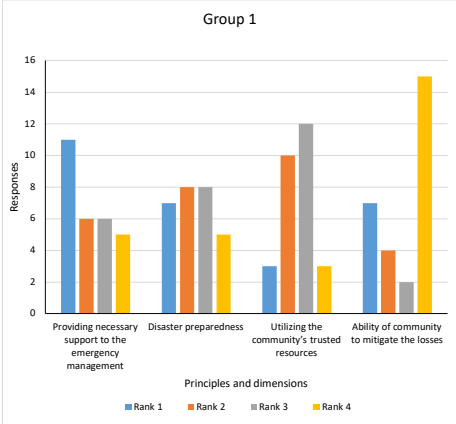
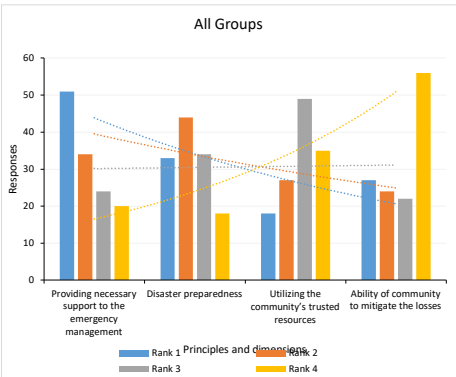


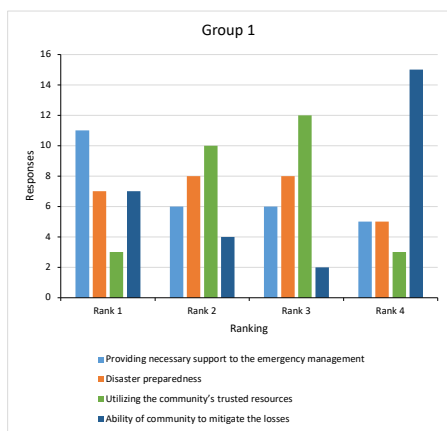
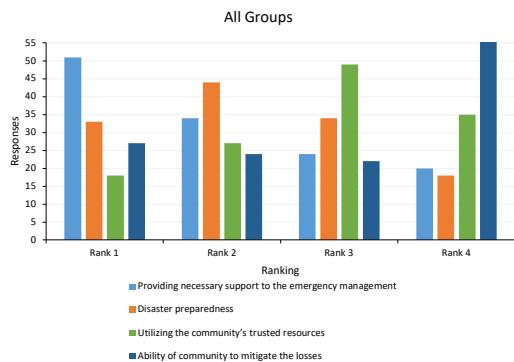
Group 2

	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Providing necessary support to the emergency management	29	19	12	9
Disaster preparedness	18	24	19	8
Utilizing the community's trusted resources	8	12	26	23
Ability of community to mitigate the losses	14	14	12	29

Group 3

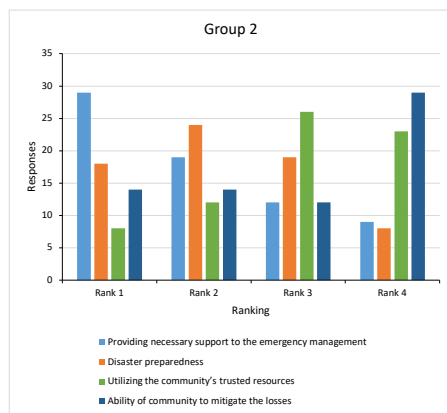
	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Providing necessary support to the emergency management	11	9	6	6
Disaster preparedness	8	12	7	5
Utilizing the community's trusted resources	7	5	11	9
Ability of community to mitigate the losses	6	6	8	12



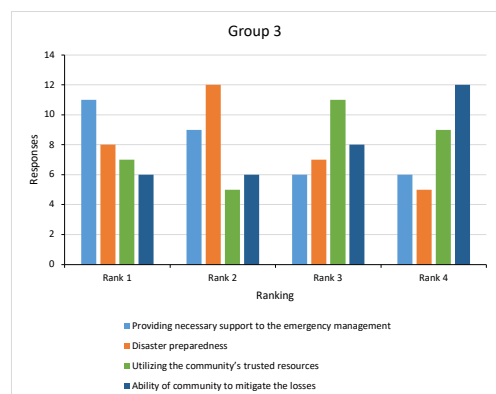


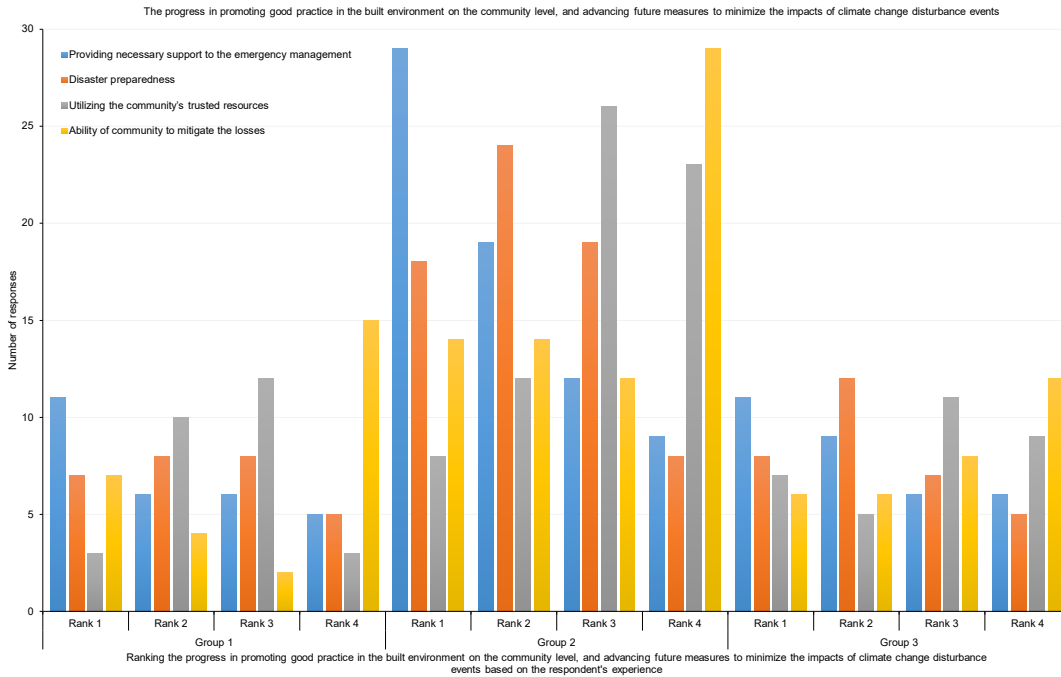
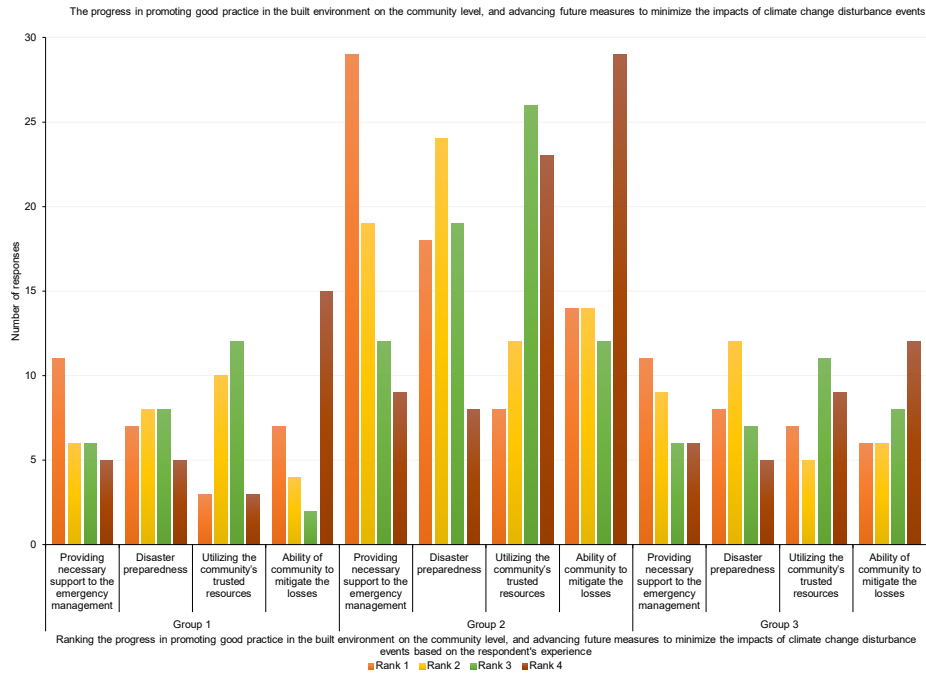
	1	2	3	4
	Rank 1	Rank 2	Rank 3	Rank 4
Group 1				
Providing necessary support to the emergency management		11	6	6
Disaster preparedness		7	8	8
Utilizing the community's trusted resources		3	10	12
Ability of community to mitigate the losses		7	4	2
Group 2				
Providing necessary support to the emergency management		29	19	12
Disaster preparedness		18	24	19
Utilizing the community's trusted resources		8	12	26
Ability of community to mitigate the losses		14	14	12
Group 3				
Providing necessary support to the emergency management		11	9	6
Disaster preparedness		8	12	7
Utilizing the community's trusted resources		7	5	11
Ability of community to mitigate the losses		6	6	8

This table is reversing the datat of the above table



	Providing necessary support to the emergency management	Disaster preparedness	Utilizing the community's trusted resources	Ability of community to mitigate the losses
Group 1				
Rank 1	11	7	3	7
Rank 2	6	8	10	4
Rank 3	6	8	12	2
Rank 4	5	5	3	15
Group 2				
Rank 1	29	18	8	14
Rank 2	19	24	12	19
Rank 3	12	19	26	12
Rank 4	9	8	23	29
Group 3				
Rank 1	11	7	3	7
Rank 2	6	8	10	4
Rank 3	6	8	12	2
Rank 4	5	5	3	15





The relative importance index (RII)

$$RII = \sum \frac{W_i}{A \times N}$$

Group 1 Q47. Please rank the importance of the following principles and dimensions from most to least preferred according to your experience. [1 is the lowest preferred]

Total surveyed	28				
Qs Rating	1	2	3	4	
Statement on subject	1	2	3	4	Total
Providing necessary support to the emergency management system by the poli	11	6	6	5	28
Disaster preparedness through preparing the residents and the whole communi	7	8	8	5	28
Utilizing the community's trusted resources to allow the community to cope with	3	10	12	3	28
The ability of the community to mitigate the losses through making smart decisi	7	4	2	15	28
Total	28	28	28	28	112

Calculations							
Statement on subject	1	2	3	4	Total		
Providing necessary support to the emergency management system by the political an	11	12	18	20	61	28	112 0.5446 4
Disaster preparedness through preparing the residents and the whole community.	7	16	24	20	67	28	112 0.5982 3
Utilizing the community's trusted resources to allow the community to cope with the c	3	20	36	12	71	28	112 0.6339 2
The ability of the community to mitigate the losses through making smart decisions.	7	8	6	60	81	28	112 0.7232 1

Group 2 Q100. Please rank the importance of the following principles and dimensions from most to least preferred according to your experience. [1 is the lowest priority]

Total surveyed	69				
Qs Rating	1	2	3	4	
Statement on subject	1	2	3	4	Total
Providing necessary support to the emergency management system by the poli	29	19	12	9	69
Disaster preparedness through preparing the residents and the whole communi	18	24	19	8	69
Utilizing the community's trusted resources to allow the community to cope with	8	12	26	23	69
The ability of the community to mitigate the losses through making smart decisi	14	14	12	29	69
Total	69	69	69	69	276

Calculations							
Statement on subject	1	2	3	4	Total		
Providing necessary support to the emergency management system by the political an	29	38	36	36	139	69	276 0.5036 4
Disaster preparedness through preparing the residents and the whole community.	18	48	57	32	155	69	276 0.5616 3
Utilizing the community's trusted resources to allow the community to cope with the c	8	24	78	92	202	69	276 0.7319 1
The ability of the community to mitigate the losses through making smart decisions.	14	28	36	116	194	69	276 0.7029 2

Group 3 Q150. Please rank the importance of the following principles and dimensions from most to least preferred according to your experience. [1 is the least preferred]

Total surveyed	32				
Qs Rating	1	2	3	4	
Statement on subject	1	2	3	4	Total
Providing necessary support to the emergency management system by the poli	11	8	6	7	32
Disaster preparedness through preparing the residents and the whole communi	8	13	7	4	32
Utilizing the community's trusted resources to allow the community to cope with	7	5	11	9	32
The ability of the community to mitigate the losses through making smart decisi	6	6	8	12	32
Total	32	32	32	32	128

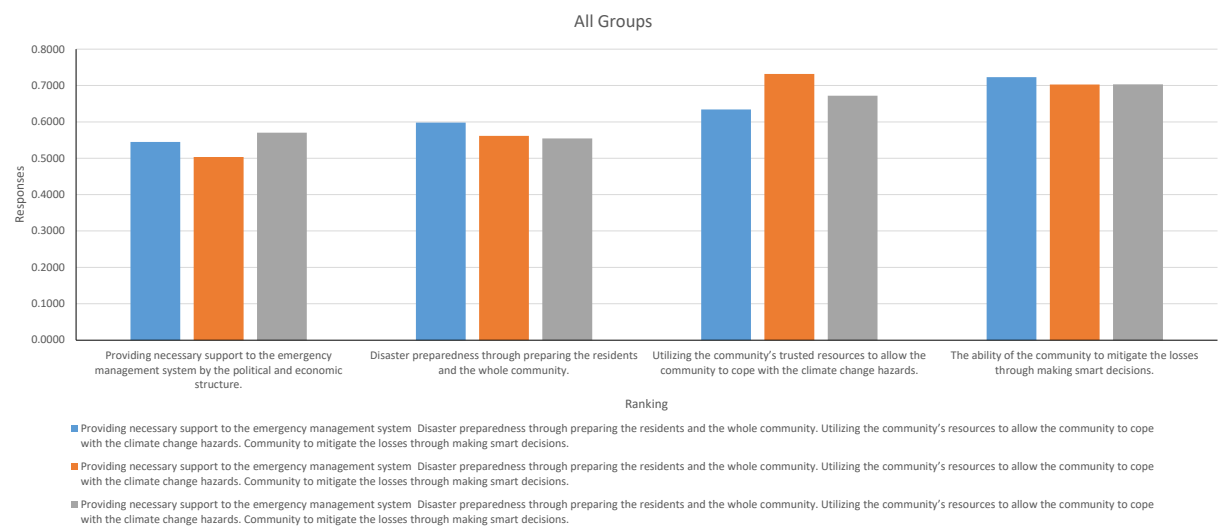
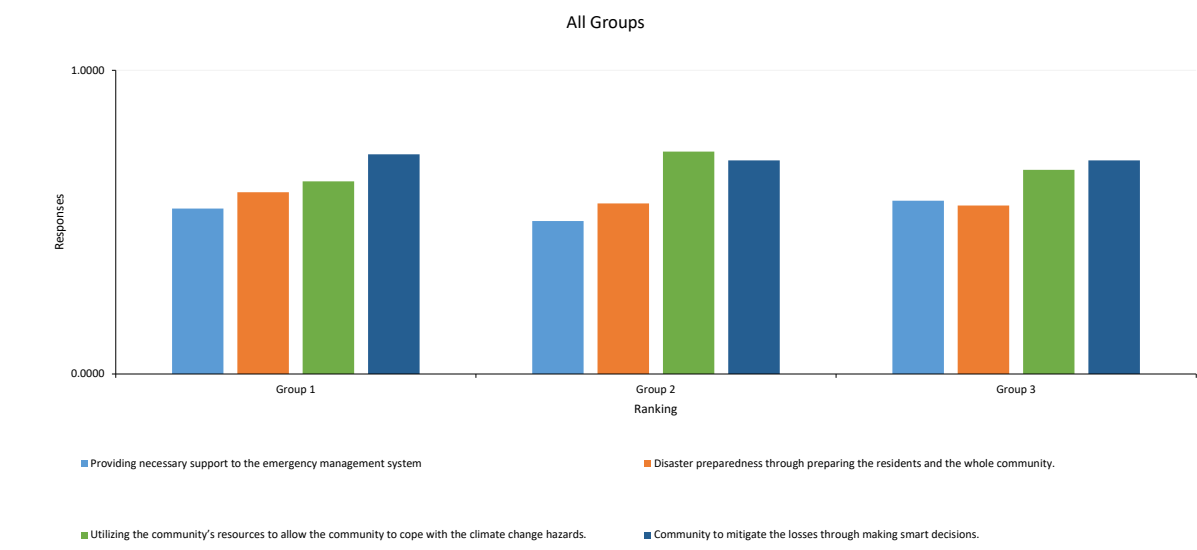
Calculations							
Statement on subject	1	2	3	4	Total		
Providing necessary support to the emergency management system by the political an	11	16	18	28	73	32	128 0.5703 3
Disaster preparedness through preparing the residents and the whole community.	8	26	21	16	71	32	128 0.5547 4
Utilizing the community's trusted resources to allow the community to cope with the c	7	10	33	36	86	32	128 0.6719 2
The ability of the community to mitigate the losses through making smart decisions.	6	12	24	48	90	32	128 0.7031 1

All Groups

Total surveyed	129				
Qs Rating	1	2	3	4	
Statement on subject	1	2	3	4	Total
Shelter systems (i.e., buildings)	51	33	24	21	129
Life Support Systems (i.e., energy & water supply systems,... etc.)	33	45	34	17	129
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	18	27	49	35	129
Open Space Systems (i.e., the utility for park & recreation purposes)	27	24	22	56	129
Total	129	129	129	129	516

Calculations							
Statement on subject	1	2	3	4	Total		
Shelter systems (i.e., buildings)	51	66	72	84	273	129	516 0.5291 4
Life Support Systems (i.e., energy & water supply systems,... etc.)	33	90	102	68	293	129	516 0.5678 3
Movement Systems (i.e., transportation infrastructure (roads, bridges, ...etc.))	18	54	147	140	359	129	516 0.6957 2
Open Space Systems (i.e., the utility for park & recreation purposes)	27	48	66	224	365	129	516 0.7074 1

Statement on subject	Group 1	Group 2	Group 3	Overall
Providing necessary support to the	0.5446	0.5036	0.5703	0.5291
Disaster preparedness through pre	0.5982	0.5616	0.5547	0.5678
Utilizing the community's resource	0.6339	0.7319	0.6719	0.6957
Community to mitigate the losses i	0.7232	0.7029	0.7031	0.7074



Q49. The core resources that constitute resourcefulness can be classified into three categories as below. Please rate their level of importance.

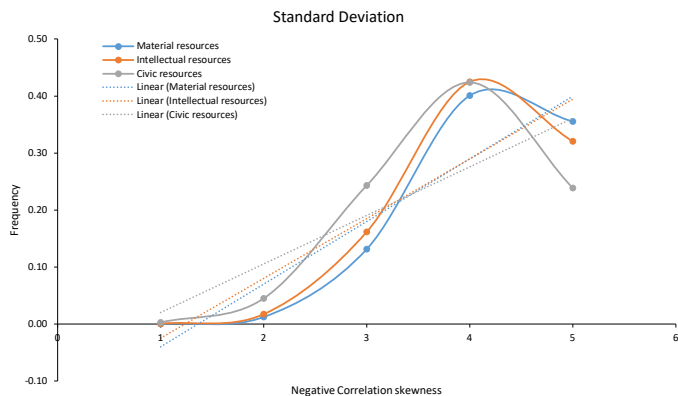
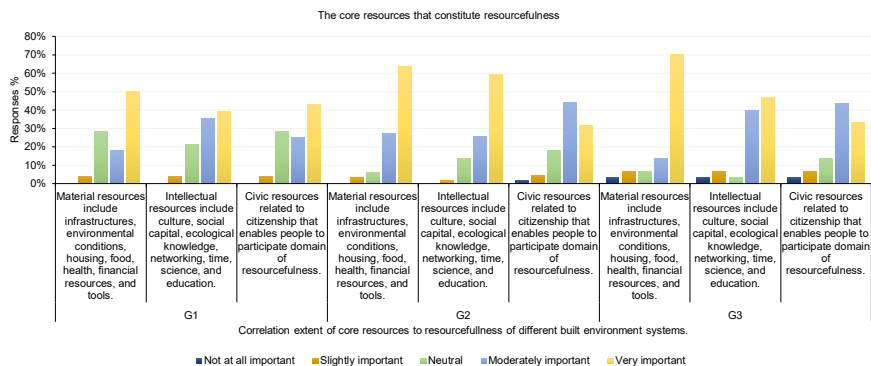
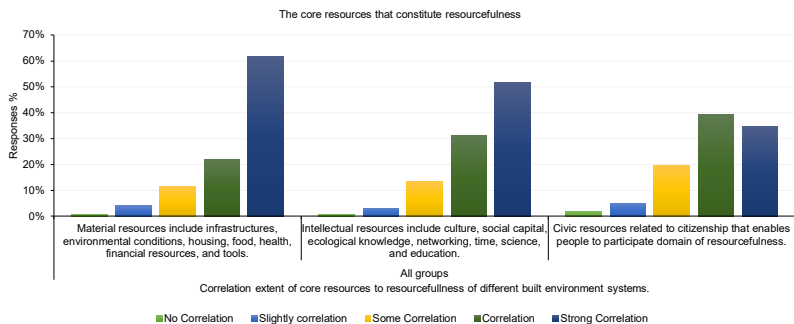
			Material resources include infrastructures, environmental conditions, housing, food, health, financial resources, and tools.	Intellectual resources include culture, social capital, ecological knowledge, networking, time, science, and education.	Civic resources related to citizenship that enables people to participate domain of resourcefulness.			
			Material resources	Intellectual resources	Civic resources	Standard Deviation	Standard Deviation	Standard Deviation
Q49	Group 1	1	3	5	5	0.1317	0.3207	0.2389
		2				0.0000	0.0000	0.0001
		3	5	5	5	0.3556	0.3207	0.2389
		4				0.0000	0.0000	0.0001
		5	3	3	3	0.1317	0.1619	0.2432
		6	3	3	3	0.1317	0.1619	0.2432
		7	5	4	4	0.3556	0.4250	0.4238
		8	4	2	4	0.4006	0.0177	0.4238
		9	5	4	5	0.3556	0.4250	0.2389
		10	5	5	5	0.3556	0.3207	0.2389
		11	4	4	4	0.4006	0.4250	0.4238
		12	5	5	5	0.3556	0.3207	0.2389
		13	5	5	5	0.3556	0.3207	0.2389
		14	5	5	5	0.3556	0.3207	0.2389
		15	5	4	4	0.3556	0.4250	0.4238
		16	5	5	5	0.3556	0.3207	0.2389
		17	5	5	4	0.3556	0.3207	0.4238
		18	3	3	3	0.1317	0.1619	0.2432
		19	2	2	2	0.0126	0.0177	0.0452
		20	4	3	3	0.4006	0.1619	0.2432
		21	3	3	3	0.1317	0.1619	0.2432
		22	5	5	5	0.3556	0.3207	0.2389
		23	5	5	5	0.3556	0.3207	0.2389
		24	3	4	3	0.1317	0.4250	0.2432
		25	4	4	4	0.4006	0.4250	0.4238
		26	3	4	5	0.1317	0.4250	0.2389
		27				0.0000	0.0000	0.0001
		28	4	4	4	0.4006	0.4250	0.4238
		29	3	3	3	0.1317	0.1619	0.2432
		30	5	4	3	0.3556	0.4250	0.2432
		31	5	5	5	0.3556	0.3207	0.2389
Q103	Group 2	1						
			5	5	5	0.3556	0.3207	0.2389
		2						
			5	5	4	0.3556	0.3207	0.4238
		3				0.3556	0.3207	0.2389
		4	5	5	5	0.3556	0.3207	0.2389
		5	4	5	4	0.4006	0.3207	0.4238
		6	5	5	5	0.3556	0.3207	0.2389
		7	5	4	4	0.3556	0.4250	0.4238
		8	5	5	5	0.3556	0.3207	0.2389
		9	5	5	4	0.3556	0.3207	0.4238
		10	5	4	4	0.3556	0.4250	0.4238
		11	4	3	4	0.4006	0.1619	0.4238
		12	4	4	4	0.4006	0.4250	0.4238
		13	5	5	5	0.3556	0.3207	0.2389
		14	5	5	5	0.3556	0.3207	0.2389
		15	3	3	3	0.1317	0.1619	0.2432
		16	5	5	5	0.3556	0.3207	0.2389
		17	4	5	3	0.4006	0.3207	0.2432
		18	5	5	4	0.3556	0.3207	0.4238
		19	3	4	3	0.1317	0.4250	0.2432
		20	4	5	4	0.4006	0.3207	0.4238
		21	4	4	2	0.4006	0.4250	0.0452
		22	5	5	5	0.3556	0.3207	0.2389
		23	5	4	4	0.3556	0.4250	0.4238
		24				0.0000	0.0000	0.0001
		25				0.0000	0.0000	0.0001
		26	5	4	2	0.3556	0.4250	0.0452
		27	2	5	5	0.0126	0.3207	0.2389
		28	4	3	2	0.4006	0.1619	0.0452
		29	5	5	4	0.3556	0.3207	0.4238
		30	5	5	3	0.3556	0.3207	0.2432
		31				0.0000	0.0000	0.0001
		32	3	3	3	0.1317	0.1619	0.2432
		33	5	5	5	0.3556	0.3207	0.2389
		34	4	5	4	0.4006	0.3207	0.4238
		35	5	5	5	0.3556	0.3207	0.2389
		36	5	3	5	0.3556	0.1619	0.2389
		37	5	5	5	0.3556	0.3207	0.2389
		38	4	5	4	0.4006	0.3207	0.4238
		39	5	5	4	0.3556	0.3207	0.4238
		40				0.0000	0.0000	0.0001
		41	5	4	4	0.3556	0.4250	0.4238
		42				0.0000	0.0000	0.0001
		43	5	5	5	0.3556	0.3207	0.2389
		44	4	3	4	0.4006	0.1619	0.4238
		45	5	4	3	0.3556	0.4250	0.2432
		46	5	5	4	0.3556	0.3207	0.4238

Core resources		
All Groups Standard Deviation	Material resources	
	1	0.0004
	2	0.0126
	3	0.1317
	4	0.4006
	5	0.3556
Intellectual resources		
	1	0.0006
	2	0.0177
	3	0.1619
	4	0.4250
	5	0.3207
Civic resources		
	1	0.0027
	2	0.0452
	3	0.2432
	4	0.4238
	5	0.2389

Q153

Group 3	47				0.0000	0.0000	0.0001
	48	3	3	3	0.1317	0.1619	0.2432
	49	5	4	4	0.3556	0.4250	0.4238
	50	5	5	5	0.3556	0.3207	0.2389
	51	4	5	4	0.4006	0.3207	0.4238
	52	4	3	3	0.4006	0.1619	0.2432
	53				0.0000	0.0000	0.0001
	54	5	4	3	0.3556	0.4250	0.2432
	55	5	5	5	0.3556	0.3207	0.2389
	56				0.0000	0.0000	0.0001
	57	4	3	4	0.4006	0.1619	0.4238
	58	5	5	5	0.3556	0.3207	0.2389
	59	4	4	4	0.4006	0.4250	0.4238
	60				0.0000	0.0000	0.0001
	61				0.0000	0.0000	0.0001
	62	5	5	4	0.3556	0.3207	0.4238
	63	5	5	5	0.3556	0.3207	0.2389
	64	5	4	3	0.3556	0.4250	0.2432
	65	5	5	4	0.3556	0.3207	0.4238
	66	5	4	3	0.3556	0.4250	0.2432
	67	4	4	4	0.4006	0.4250	0.4238
	68	5	4	5	0.3556	0.4250	0.2389
	69	5	5	4	0.3556	0.3207	0.4238
	70	5	5	5	0.3556	0.3207	0.2389
	71				0.0000	0.0000	0.0001
	72	4	5	4	0.4006	0.3207	0.4238
	73	4	5	4	0.4006	0.3207	0.4238
	74	2	2	1	0.0126	0.0177	0.0027
	75	4	5	3	0.4006	0.3207	0.2432
	76	5	5	4	0.3556	0.3207	0.4238
	77	5	4	4	0.3556	0.4250	0.4238
	78				0.0000	0.0000	0.0001
	1	5	5	5			
	2	5	4	4	0.3556	0.3207	0.2389
	3	4	4	4	0.3556	0.4250	0.4238
	4	5	4	2	0.3556	0.4250	0.0452
	5	5	5	5	0.3556	0.3207	0.2389
	6	5	5	4	0.3556	0.3207	0.4238
	7	5	4	3	0.3556	0.4250	0.2432
	8	3	3	3	0.1317	0.1619	0.2432
	9	5	4	4	0.3556	0.4250	0.4238
	10	5	4	3	0.3556	0.4250	0.2432
	11	5	4	3	0.3556	0.4250	0.2432
	12	3	4	4	0.1317	0.4250	0.4238
	13	1	1	1	0.0004	0.0006	0.0027
	14	5	5	5	0.3556	0.3207	0.2389
	15	2	5	4	0.0126	0.3207	0.4238
	16	5	4	4	0.3556	0.4250	0.4238
	17	5	4	4	0.3556	0.4250	0.4238
	18				0.0000	0.0000	0.0001
	19	4	5	4	0.4006	0.3207	0.4238
	20				0.0000	0.0000	0.0001
	21	5	5	4	0.3556	0.3207	0.4238
	22	4	2	3	0.4006	0.0177	0.2432
	23	5	5	5	0.3556	0.3207	0.2389
	24	4	5	5	0.4006	0.3207	0.2389
	25	5	5	4	0.3556	0.3207	0.4238
	26	5	5	4	0.3556	0.3207	0.4238
	27	2	2	2	0.0126	0.0177	0.0452
	28				0.0000	0.0000	0.0001
	29	5	4	5	0.3556	0.4250	0.2389
	30	5	5	5	0.3556	0.3207	0.2389
	31	5	4	4	0.3556	0.4250	0.4238
	32	5	4	5	0.3556	0.4250	0.2389
	33	5	5	5	0.3556	0.3207	0.2389
Mean					4.4032	4.2742	3.9919
SD					0.9009	0.8957	0.9413

			Answer c Responses %						
			Q49						
			G1						
			Not at all important No Correlati	Slightly important Slightly correlatio	Neutral Some Correlati	Moderately important Correlation	Very important Strong Correlation		
Q49	31	G1	Material r	0.00%	3.57%	28.57%	17.86%	50.00%	
			Intellectu	0.00%	3.57%	21.43%	35.71%	39.29%	
			Civic res	0.00%	3.57%	28.57%	25.00%	42.86%	
Q103	78	G2	Material r	0.00%	3.03%	6.06%	27.27%	63.64%	
			Intellectu	0.00%	1.52%	13.64%	25.76%	59.09%	
			Civic res	1.52%	4.55%	18.18%	43.94%	31.82%	
Q153	33	G3	Material r	3.33%	6.67%	6.67%	13.33%	70.00%	
			Intellectu	3.33%	6.67%	3.33%	40.00%	46.67%	
			Civic res	3.33%	6.67%	13.33%	43.33%	33.33%	
	142	All groups	Material r	0.73%	3.95%	11.42%	22.04%	61.86%	100.00%
			Intellectu	0.73%	3.12%	13.20%	31.18%	51.78%	100.01%
			Civic res	1.56%	4.79%	19.54%	39.41%	34.72%	100.00%

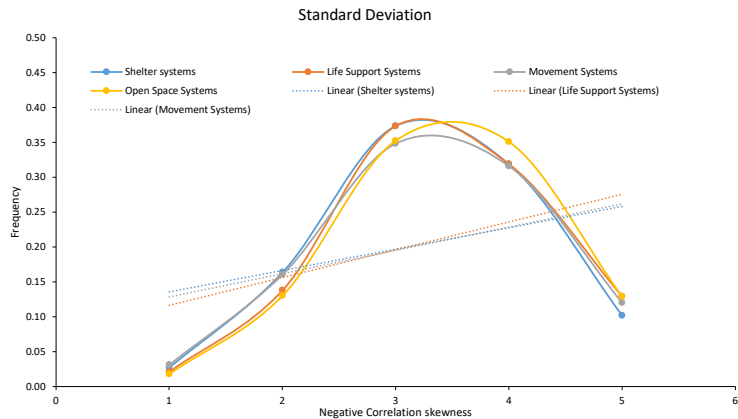
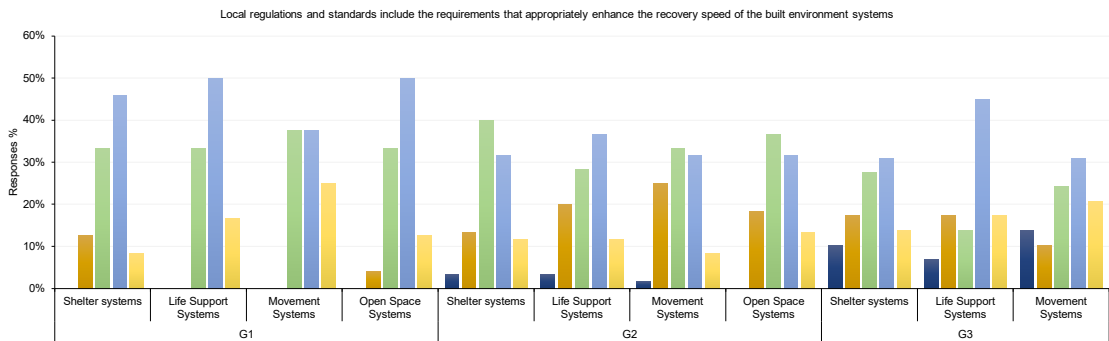
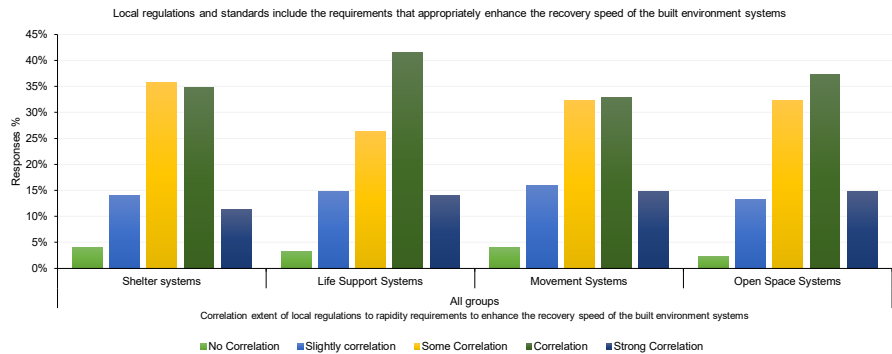


Q60. To what level do you agree that the local regulations and standards include the requirements that appropriately enhance the recovery speed of the built environment systems to its full operational function after encountering a climate change crisis?

										Built Environment Systems				
										All Groups				
										Standard Deviation	Shelter systems			
Q60	Group 1	1	4	4	5	4	Standard Deviation	Standard Deviation	Standard Deviation	Standard Deviation		1	0.0270	
		2					0.0017	0.0013	0.0025	0.0009		2	0.1639	
		3	4	4	4	4	0.3190	0.3413	0.3163	0.3510		3	0.3735	
		4					0.0017	0.0013	0.0025	0.0009		4	0.3190	
		5	3	4	4	4	0.3735	0.3413	0.3163	0.3510		5	0.1021	
		6	3	3	3	3	0.3735	0.3485	0.3482	0.3525	Life Support Systems			
		7					0.0017	0.0013	0.0025	0.0009		1	0.0212	
		8	3	4	4	4	0.3735	0.3413	0.3163	0.3510		2	0.1380	
		9	3	4	3	4	0.3735	0.3413	0.3482	0.3510		3	0.3735	
		10	2	3	3	2	0.1639	0.3485	0.3482	0.1306		4	0.3190	
		11					0.0017	0.0013	0.0025	0.0009		5	0.1296	
		12	3	3	3	3				Movement Systems				
		13		5	5	5	0.3735	0.3485	0.3482		0.3525			
		14	2	3	4	4	0.0017	0.1296	0.1205		0.1288		1	0.0311
		15					0.1639	0.3485	0.3163		0.3510		2	0.1607
		16	5	5	4	4	0.0017	0.0013	0.0025		0.0009		3	0.3482
		17	4	4	5	4	0.1021	0.1296	0.3163	0.3510		4	0.3163	
		18	4	4	4	3	0.3190	0.3413	0.1205	0.3510		5	0.1205	
										Open Space Systems				
	19	3	3	3	4	0.3190	0.3413	0.3163	0.3525		1	0.0178		
	20	2	3	3	3	0.3735	0.3485	0.3482	0.3510		2	0.1306		
	21	3	3	3	3	0.1639	0.3485	0.3482	0.3525		3	0.3525		
	22	4	4	4	4	0.3735	0.3485	0.3482	0.3510		4	0.3510		
	23	4	5	5	5	0.3190	0.1296	0.1205	0.1288		5	0.1288		
	24	4	4	3	3	0.3190	0.3413	0.3482	0.3525					
	25	4	4	4	4	0.3190	0.3413	0.3163	0.3510					
	26	4	4	5	4	0.3190	0.3413	0.1205	0.3510					
	27					0.0017	0.0013	0.0025	0.0009					
	28					0.0017	0.0013	0.0025	0.0009					
	29	4	4	4	3	0.3190	0.3413	0.3163	0.3525					
	30	3	3	3	3	0.3735	0.3485	0.3482	0.3525					
31	5	5	5	5	0.1021	0.1296	0.1205	0.1288						
Q112	Group 2	1					0.3190	0.3413	0.3163	0.3510				
		2	4	4	4	4								
		3	3	3	2	3	0.3735	0.3485	0.1607					0.3525
		4	3	2	2	2	0.3735	0.1380	0.1607					0.1306
		5	3	4	4	4	0.3735	0.3413	0.3163					0.3510
		6	2	2	2	2	0.0017	0.0013	0.0025	0.0009				
		7	4	5	4	3	0.1639	0.1380	0.1607	0.1306				
		8	1	2	2	3	0.3190	0.1296	0.3163	0.3525				
		9	4	3	2	2	0.0270	0.1380	0.1607	0.3525				
		10	4	4	4	4	0.3190	0.3485	0.1607	0.1306				
		11	4	2	4	3	0.3190	0.3413	0.3163	0.3510				
		12	4	4	4	4	0.3190	0.1380	0.3163	0.3525				
		13	4	4	4	4	0.3190	0.3413	0.3163	0.3510				
		14	1	1	1	3	0.3190	0.3413	0.3163	0.1288				
		15	3	3	3	3	0.0270	0.0212	0.0311	0.3525				
		16	5	4	4	4	0.3735	0.3485	0.3482	0.3525				
		17					0.1021	0.3413	0.3163	0.3510				
		18					0.0017	0.0013	0.0025	0.0009				
		19	3	4	3	3	0.0017	0.0013	0.0025	0.0009				
		20	3	2	3	4	0.3735	0.3413	0.3482	0.3525				
		21	4	3	2	2	0.3735	0.1380	0.3482	0.3510				
		22	3	4	3	3	0.3190	0.3485	0.1607	0.1306				
		23	3	2	4	4	0.3735	0.3413	0.3482	0.3525				
		24					0.3735	0.1380	0.3163	0.3510				
		25					0.0017	0.0013	0.0025	0.0009				
		26	4	3	2	2	0.0017	0.0013	0.0025	0.0009				
		27	2	3	2	4	0.3190	0.3485	0.1607	0.1306				
		28	3	3	3	3	0.1639	0.3485	0.1607	0.3510				
		29					0.3735	0.3485	0.3482	0.3525				
		30	2	4	4	5	0.0017	0.0013	0.0025	0.0009				
		31					0.1639	0.3413	0.3163	0.1288				
32	4	3	2	3	0.0017	0.0013	0.0025	0.0009						
33	3	3	3	3	0.3190	0.3485	0.1607	0.3525						
34	4	4	3	4	0.3735	0.3485	0.3482	0.3525						
35	2	2	2	2	0.3190	0.3413	0.3482	0.3510						
36	2	2	2	2	0.1639	0.1380	0.1607	0.1306						
37	3	3	3	3	0.3735	0.3485	0.3482	0.3525						
38	3	3	2	4	0.3735	0.3485	0.1607	0.3510						
39	5	5	3	4	0.3735	0.3485	0.3482	0.3510						
40					0.1021	0.1296	0.3482	0.3510						
41	3	3	3	3	0.0017	0.0013	0.0025	0.0009						
42					0.3735	0.3485	0.3482	0.3525						
43					0.0017	0.0013	0.0025	0.0009						
44	3	3	4	4	0.0017	0.0013	0.0025	0.0009						
45	3	2	2	3	0.3735	0.3485	0.3163	0.3510						
46	3	2	2	3	0.3735	0.1380	0.1607	0.3525						

Q162	Group 3	47					0.0017	0.0013	0.0025	0.0009
		48	3	3	3	3	0.3735	0.3485	0.3482	0.3525
		49	3	4	3	2	0.3735	0.3413	0.3482	0.1306
		50	4	5	4	4	0.3190	0.1296	0.3163	0.3510
		51					0.0017	0.0013	0.0025	0.0009
		52	4	4	3	3	0.3190	0.3413	0.3482	0.3525
		53					0.0017	0.0013	0.0025	0.0009
		54	2	1	3	3	0.1639	0.0212	0.3482	0.3525
		55	2	2	2	2	0.1639	0.1380	0.1607	0.1306
		56					0.0017	0.0013	0.0025	0.0009
		57	5	3	4	5	0.1021	0.3485	0.3163	0.1288
		58	4	4	4	4	0.3190	0.3413	0.3163	0.3510
		59	5	5	5	5	0.1021	0.1296	0.1205	0.1288
		60					0.0017	0.0013	0.0025	0.0009
		61					0.0017	0.0013	0.0025	0.0009
		62	3	3	3	3	0.3735	0.3485	0.3482	0.3525
		63	5	5	5	5	0.1021	0.1296	0.1205	0.1288
		64	3	4	3	3	0.3735	0.3413	0.3482	0.3525
		65	3	4	4	2	0.3735	0.3413	0.3163	0.1306
		66	3	4	4	4	0.3735	0.3413	0.3163	0.3510
		67	4	4	4	4	0.3190	0.3413	0.3163	0.3510
		68	4	4	3	4	0.3190	0.3413	0.3482	0.3510
		69	4	4	4	4	0.3190	0.3413	0.3163	0.3510
		70	5	5	5	5	0.1021	0.1296	0.1205	0.1288
		71					0.0017	0.0013	0.0025	0.0009
		72	5	4	5	4	0.1021	0.3413	0.1205	0.3510
		73	3	3	3	3	0.3735	0.3485	0.3482	0.3525
		74	4	4	5	5	0.3190	0.3413	0.1205	0.1288
		75	4	5	4	5	0.3190	0.1296	0.3163	0.1288
		76	3	4	3	2	0.3735	0.3413	0.3482	0.1306
		77	2	2	3	3	0.1639	0.1380	0.3482	0.3525
		78					0.0017	0.0013	0.0025	0.0009
		1	5	5	5	5				
		2	2	3	1	3	0.1021	0.1296	0.1205	0.1288
		3	3	4	5	5	0.1639	0.3485	0.0311	0.3525
		4	4	5	3	4	0.3735	0.3413	0.1205	0.1288
		5	5	5	4	5	0.3190	0.1296	0.3482	0.3510
		6					0.1021	0.1296	0.3163	0.1288
		7	4	4	5	5	0.0017	0.0013	0.0025	0.0009
		8	3	4	3	4	0.3190	0.3413	0.1205	0.1288
		9	4	5	3	3	0.3735	0.3413	0.3482	0.3510
		10	3	4	5	5	0.3190	0.1296	0.3482	0.3525
		11	3	4	5	5	0.3735	0.3413	0.1205	0.1288
		12	3	3	4	4	0.3735	0.3485	0.3163	0.3510
		13	2	2	2	2	0.1639	0.1380	0.1607	0.1306
		14	3	4	4	4	0.3735	0.3413	0.3163	0.3510
		15	1	2	1	1	0.0270	0.1380	0.0311	0.0178
		16	3	4	4	3	0.3735	0.3413	0.3163	0.3525
		17	2	2	2	2	0.1639	0.1380	0.1607	0.1306
		18					0.0017	0.0013	0.0025	0.0009
		19	4	4	4	4	0.3190	0.3413	0.3163	0.3510
		20					0.0017	0.0013	0.0025	0.0009
		21	4	4	4	4	0.3190	0.3413	0.3163	0.3510
		22	2	2	2	2	0.1639	0.1380	0.1607	0.1306
		23	5	5	5	5	0.1021	0.1296	0.1205	0.1288
		24	1	1	1	1	0.0270	0.0212	0.0311	0.0178
		25	3	3	3	3	0.3735	0.3485	0.3482	0.3525
		26	4	2	3	4	0.3190	0.1380	0.3482	0.3510
		27	4	4	4	4	0.3190	0.3413	0.3163	0.3510
		28					0.0017	0.0013	0.0025	0.0009
		29	5	4	5	3	0.1021	0.3413	0.1205	0.3525
		30	2	3	3	4	0.1639	0.3485	0.3482	0.3510
		31	1	1	1	1	0.0270	0.0212	0.0311	0.0178
		32	4	4	4	3	0.3190	0.3413	0.3163	0.3525
		33	4	4	3	4	0.3190	0.3413	0.3482	0.3510
Mean		3.3393	3.4779	3.3894	3.4956					
SD		1.0094	1.0273	1.0727	1.0011					

			Answer converted to	Responses %					
				Q49					
				Not at all important	Slightly important	Neutral Some	Moderately important	Very important	
				No Correlation	Slightly correlation	Correlation	Correlation	Strong Correlation	
Q49	31	G1	Shelter systems	0.00%	12.50%	33.33%	45.83%	8.33%	
			Life Support Systems	0.00%	0.00%	33.33%	50.00%	16.67%	
			Movement Systems	0.00%	0.00%	37.50%	37.50%	25.00%	
			Open Space Systems	0.00%	4.17%	33.33%	50.00%	12.50%	
Q103	78	G2	Shelter systems	3.33%	13.33%	40.00%	31.67%	11.67%	
			Life Support Systems	3.33%	20.00%	28.33%	36.67%	11.67%	
			Movement Systems	1.67%	25.00%	33.33%	31.67%	8.33%	
			Open Space Systems	0.00%	18.33%	36.67%	31.67%	13.33%	
Q153	33	G3	Shelter systems	10.34%	17.24%	27.59%	31.03%	13.79%	
			Life Support Systems	6.90%	17.24%	13.79%	44.83%	17.24%	
			Movement Systems	13.79%	10.34%	24.14%	31.03%	20.69%	
			Open Space Systems	10.34%	10.34%	20.69%	37.93%	20.69%	
	142	All groups	Shelter systems	4.09%	13.99%	35.74%	34.82%	11.36%	100.00%
Life Support Systems			3.34%	14.75%	26.32%	41.55%	14.05%	100.00%	
Movement Systems			3.93%	15.99%	32.29%	32.89%	14.90%	100.00%	
Open Space Systems			2.26%	13.30%	32.41%	37.30%	14.74%	100.00%	



Responden	Group	opinion	Rank	t _i	T _i
19	2	4		84.5	26
21	1	3		52.5	38
25	2	3		52.5	
28	2	2		22.5	22
30	1	1		6	11
34	1	3		52.5	
39	1	3		52.5	
47	2	3		52.5	
48	1	2		22.5	
50	1	3		52.5	
53	1	3		52.5	
58	1	3		52.5	
64	1	3		52.5	
74	1	2		22.5	
75	1	1		6	
78	1	4		84.5	
79	1	3		52.5	
87	1	3		52.5	
89	1	2		22.5	
90	2	4		84.5	
91	1	1		6	
92	1	2		22.5	
93	2	3		52.5	
98	2	2		22.5	
101	2	3		52.5	
102	2	2		22.5	
103	2	3		52.5	
104	2	1		6	
109	1	2		22.5	
112	1	2		22.5	
113	2	3		52.5	
114	2	2		22.5	
116	2	2		22.5	
119	2	3		52.5	
120	2	3		52.5	
123	2	3		52.5	
126	2	3		52.5	
127	2	3		52.5	
132	2	4		84.5	
134	2	3		52.5	
135	2	2		22.5	
136	2	4		84.5	
143	2	3		52.5	
144	2	3		52.5	
145	2	1		6	
149	2	4		84.5	
150	2	2		22.5	
156	2	4		84.5	
157	2	4		84.5	
158	2	2		22.5	
159	2	3		52.5	
160	2	3		52.5	
161	2	4		84.5	
162	2	4		84.5	
163	2	4		84.5	
165	2	4		84.5	
168	1	3		52.5	
169	2	4		84.5	
173	2	3		52.5	
178	2	4		84.5	
179	2	4		84.5	
180	1	4		84.5	
189	2	3		52.5	
192	1	3		52.5	
195	1	2		22.5	
196	2	3		52.5	
199	2	2		22.5	
200	1	4		84.5	
202	2	3		52.5	
205	2	3		52.5	
207	1	3		52.5	
209	2	1		6	
213	2	4		84.5	
214	2	3		52.5	
219	1	2		22.5	
220	2	1		6	
222	2	1		6	
225	2	4		84.5	
226	2	3		52.5	
231	2	4		84.5	
232	2	4		84.5	
233	1	2		22.5	
234	2	4		84.5	
235	2	3		52.5	
237	2	2		22.5	
238	1	2		22.5	
239	2	1		6	
240	2	3		52.5	
242	2	4		84.5	
244	2	4		84.5	
245	2	1		6	
246	2	1		6	
247	2	2		22.5	
248	2	4		84.5	
249	2	3		52.5	
252	2	4		84.5	
253	2	2		22.5	

G1 G2
5.2 Q47,100-3

Group
1 G1
2 G2

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 192

UDF -1.37478

UDF 0.169199

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G2	69	
total	97	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G2	2415	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2:B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	40.23214	1126.5 =SUMIF(A:A;G3;C:C)
G2	52.55797	3626.5

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	720.5	=N24-M14
G2	1211.5	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	-245.5	=M30-\$M\$57*\$M\$58/2
G2	245.5	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"";COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i	
7027.5	=SUM(E:E)

$$T = \sum T_i$$

Step 10: Determine denominator (= SE)

denominator 119.6661 =SQRT(M7*M8/(M9*(M9-1)*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z -2.05154 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Step 12: Determine significance

sig 0.040214 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.040214 =2*(1-NORMSDIST(ABS(M57)))

Responden	Group	opinion	Rank	t _i	T _i
19	2	1		11	21
21	1	4		75.5	44
25	2	4		75.5	
28	2	4		75.5	
30	1	2		30.5	18
34	1	4		75.5	484.5
39	1	4		75.5	
47	2	2		30.5	
48	1	1		11	
50	1	1		11	
53	1	4		75.5	
58	1	4		75.5	
64	1	2		30.5	
74	1	4		75.5	
75	1	3		46.5	14
78	1	1		11	227.5
79	1	2		30.5	
87	1	1		11	
89	1	4		75.5	
90	2	3		46.5	
91	1	4		75.5	
92	1	1		11	
93	2	4		75.5	
98	2	1		11	
101	2	4		75.5	
102	2	1		11	
103	2	1		11	
104	2	4		75.5	
109	1	4		75.5	
112	1	1		11	
113	2	4		75.5	
114	2	4		75.5	
116	2	4		75.5	
119	2	4		75.5	
120	2	1		11	
123	2	4		75.5	
126	2	4		75.5	
127	2	1		11	
132	2	3		46.5	
134	2	1		11	
135	2	3		46.5	
136	2	2		30.5	
143	2	1		11	
144	2	1		11	
145	2	3		46.5	
149	2	2		30.5	
150	2	4		75.5	
156	2	3		46.5	
157	2	1		11	
158	2	4		75.5	
159	2	4		75.5	
160	2	4		75.5	
161	2	2		30.5	
162	2	3		46.5	
163	2	2		30.5	
165	2	2		30.5	
168	1	4		75.5	
169	2	3		46.5	
173	2	4		75.5	
178	2	2		30.5	
179	2	3		46.5	
180	1	3		46.5	
189	2	4		75.5	
192	1	4		75.5	
195	1	4		75.5	
196	2	2		30.5	
199	2	4		75.5	
200	1	1		11	
202	2	4		75.5	
205	2	1		11	
207	1	2		30.5	
209	2	4		75.5	
213	2	3		46.5	
214	2	4		75.5	
219	1	4		75.5	
220	2	4		75.5	
222	2	4		75.5	
225	2	1		11	
226	2	4		75.5	
231	2	2		30.5	
232	2	3		46.5	
233	1	4		75.5	
234	2	2		30.5	
235	2	4		75.5	
237	2	4		75.5	
238	1	4		75.5	
239	2	2		30.5	
240	2	2		30.5	
242	2	2		30.5	
244	2	3		46.5	
245	2	2		30.5	
246	2	4		75.5	
247	2	1		11	
248	2	1		11	
249	2	4		75.5	
252	2	3		46.5	
253	2	4		75.5	

G1 G2
5.2 Q47,100-4

Group
1 G1
2 G2

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 254.5

UDF 0.184475

UDF 0.853641

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G2	69	
total	97	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G2	2415	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2;B:B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	50.875	1424.5 =SUMIF(A:A;G3;C:C)
G2	48.23913	3328.5

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	1018.5	=N24-M14
G2	913.5	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	52.5	=M30-\$M\$7*\$M\$8/2
G2	-52.5	$U_i - \frac{n_i \times n_i}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"");COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12)
 $T_i = \frac{t_i^3 - t_i}{12}$

Step 9: Sum the results of step 8

Sum T _i	8577	=SUM(E:E)
		$T = \sum T_i$

Step 10: Determine denominator (= SE)

denominator 118.3152 =SQRT(M7*M8/(M9*(M9-1)*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z 0.44373 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

Step 12: Determine significance

sig 0.657238 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.657238 =2*(1-NORMSDIST(ABS(M57)))

$$Z = \frac{U_i - \frac{n_i \times n_i}{2}}{SE}$$

Responden	Group	opinion	Rank	t _i	T _i
19	2	3		74.5	18
21	1	1		20.5	40
25	2	2		53	25
28	2	1		20.5	
30	1	4		90.5	14
34	1	2		53	227.5
39	1	1		20.5	
47	2	1		20.5	
48	1	3		74.5	
50	1	4		90.5	
53	1	1		20.5	
58	1	2		53	
64	1	1		20.5	
74	1	3		74.5	
75	1	2		53	
78	1	3		74.5	
79	1	4		90.5	
87	1	2		53	
89	1	1		20.5	
90	2	2		53	
91	1	2		53	
92	1	4		90.5	
93	2	1		20.5	
98	2	4		90.5	
101	2	2		53	
102	2	3		74.5	
103	2	4		90.5	
104	2	3		74.5	
109	1	3		74.5	
112	1	4		90.5	
113	2	1		20.5	
114	2	1		20.5	
116	2	1		20.5	
119	2	1		20.5	
120	2	4		90.5	
123	2	2		53	
126	2	1		20.5	
127	2	2		53	
132	2	1		20.5	
134	2	2		53	
135	2	1		20.5	
136	2	3		74.5	
143	2	2		53	
144	2	4		90.5	
145	2	4		90.5	
149	2	3		74.5	
150	2	1		20.5	
156	2	1		20.5	
157	2	3		74.5	
158	2	1		20.5	
159	2	1		20.5	
160	2	2		53	
161	2	3		74.5	
162	2	2		53	
163	2	1		20.5	
165	2	1		20.5	
168	1	1		20.5	
169	2	2		53	
173	2	2		53	
178	2	1		20.5	
179	2	1		20.5	
180	1	1		20.5	
189	2	1		20.5	
192	1	2		53	
195	1	1		20.5	
196	2	1		20.5	
199	2	1		20.5	
200	1	3		74.5	
202	2	2		53	
205	2	4		90.5	
207	1	1		20.5	
209	2	2		53	
213	2	1		20.5	
214	2	2		53	
219	1	3		74.5	
220	2	2		53	
222	2	2		53	
225	2	3		74.5	
226	2	2		53	
231	2	3		74.5	
232	2	1		20.5	
233	1	1		20.5	
234	2	3		74.5	
235	2	1		20.5	
237	2	1		20.5	
238	1	1		20.5	
239	2	4		90.5	
240	2	1		20.5	
242	2	3		74.5	
244	2	2		53	
245	2	4		90.5	
246	2	3		74.5	
247	2	4		90.5	
248	2	2		53	
249	2	1		20.5	
252	2	1		20.5	
253	2	1		20.5	

G1 G2
5.2 Q47,100-1

Group
1 G1
2 G2

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 286

UDF 0.930401

UDF 0.352163

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G2	69	
total	97	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G2	2415	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2:B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	51.53571	1443 =SUMIF(A:A;G3;C:C)
G2	47.97101	3310

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	1037	=N24-M14
G2	895	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	71	=M30-\$M\$7*\$M\$8/2
G2	-71	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"");COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12)

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i	7342	=SUM(E:E)
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$$T = \sum T_i$$

Step 10: Determine denominator (= SE)

denominator 119.3931 =SQRT(M7*M8/(M9*(M9-1)*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z 0.594674 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Step 12: Determine significance

sig 0.552061 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.552061 =2*(1-NORMSDIST(ABS(M57)))

Responden	Group	opinion	Rank	t _i	T _i
19	2	2		41.5	32
21	1	2		41.5	2728
25	2	1		13	25
28	2	3		71	27
30	1	3		71	1638
34	1	1		13	
39	1	2		41.5	
47	2	4		91	13
48	1	4		91	182
50	1	2		41.5	
53	1	2		41.5	
58	1	1		13	
64	1	4		91	
74	1	1		13	
75	1	4		91	
78	1	2		41.5	
79	1	1		13	
87	1	4		91	
89	1	3		71	
90	2	1		13	
91	1	3		71	
92	1	3		71	
93	2	2		41.5	
98	2	3		71	
101	2	1		13	
102	2	4		91	
103	2	2		41.5	
104	2	2		41.5	
109	1	1		13	
112	1	3		71	
113	2	2		41.5	
114	2	3		71	
116	2	3		71	
119	2	2		41.5	
120	2	2		41.5	
123	2	1		13	
126	2	2		41.5	
127	2	4		91	
132	2	2		41.5	
134	2	4		91	
135	2	4		91	
136	2	1		13	
143	2	4		91	
144	2	2		41.5	
145	2	2		41.5	
149	2	1		13	
150	2	3		71	
156	2	2		41.5	
157	2	2		41.5	
158	2	3		71	
159	2	2		41.5	
160	2	1		13	
161	2	1		13	
162	2	1		13	
163	2	3		71	
165	2	3		71	
168	1	2		41.5	
169	2	1		13	
173	2	1		13	
178	2	3		71	
179	2	2		41.5	
180	1	2		41.5	
189	2	2		41.5	
192	1	1		13	
195	1	3		71	
196	2	4		91	
199	2	3		71	
200	1	2		41.5	
202	2	1		13	
205	2	2		41.5	
207	1	4		91	
209	2	3		71	
213	2	2		41.5	
214	2	1		13	
219	1	1		13	
220	2	3		71	
222	2	3		71	
225	2	2		41.5	
226	2	1		13	
231	2	1		13	
232	2	2		41.5	
233	1	3		71	
234	2	1		13	
235	2	2		41.5	
237	2	3		71	
238	1	3		71	
239	2	3		71	
240	2	4		91	
242	2	1		13	
244	2	1		13	
245	2	3		71	
246	2	2		41.5	
247	2	3		71	
248	2	3		71	
249	2	2		41.5	
252	2	2		41.5	
253	2	3		71	

G1 G2
5.2 Q47,100-2

Group
1 G1
2 G2

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 247

UDF 0

UDF 1

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G2	69	
total	97	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G2	2415	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2:B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	51.64286	1446 =SUMIF(A:A;G3;C:C)
G2	47.92754	3307

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	1040	=N24-M14
G2	892	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	74	=M30-\$M\$57*\$M\$58/2
G2	-74	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"");COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12)

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i	5848	=SUM(E:E)
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$$T = \sum T_i$$

Step 10: Determine denominator (= SE)

denominator 120.6843 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z 0.61317 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

Step 12: Determine significance

sig 0.539764 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.539764 =2*(1-NORMSDIST(ABS(M57)))

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Responden	Group	opinion	Rank	t _i	T _i
19	2	4		84.5	26
21	1	3		52.5	38
25	2	3		52.5	
28	2	2		22.5	22
30	1	1		6	11
34	1	3		52.5	
39	1	3		52.5	
47	2	3		52.5	
48	1	2		22.5	
50	1	3		52.5	
53	1	3		52.5	
58	1	3		52.5	
64	1	3		52.5	
74	1	2		22.5	
75	1	1		6	
78	1	4		84.5	
79	1	3		52.5	
87	1	3		52.5	
89	1	2		22.5	
90	2	4		84.5	
91	1	1		6	
92	1	2		22.5	
93	2	3		52.5	
98	2	2		22.5	
101	2	3		52.5	
102	2	2		22.5	
103	2	3		52.5	
104	2	1		6	
109	1	2		22.5	
112	1	2		22.5	
113	2	3		52.5	
114	2	2		22.5	
116	2	2		22.5	
119	2	3		52.5	
120	2	3		52.5	
123	2	3		52.5	
126	2	3		52.5	
127	2	3		52.5	
132	2	4		84.5	
134	2	3		52.5	
135	2	2		22.5	
136	2	4		84.5	
143	2	3		52.5	
144	2	3		52.5	
145	2	1		6	
149	2	4		84.5	
150	2	2		22.5	
156	2	4		84.5	
157	2	4		84.5	
158	2	2		22.5	
159	2	3		52.5	
160	2	3		52.5	
161	2	4		84.5	
162	2	4		84.5	
163	2	4		84.5	
165	2	4		84.5	
168	1	3		52.5	
169	2	4		84.5	
173	2	3		52.5	
178	2	4		84.5	
179	2	4		84.5	
180	1	4		84.5	
189	2	3		52.5	
192	1	3		52.5	
195	1	2		22.5	
196	2	3		52.5	
199	2	2		22.5	
200	1	4		84.5	
202	2	3		52.5	
205	2	3		52.5	
207	1	3		52.5	
209	2	1		6	
213	2	4		84.5	
214	2	3		52.5	
219	1	2		22.5	
220	2	1		6	
222	2	1		6	
225	2	4		84.5	
226	2	3		52.5	
231	2	4		84.5	
232	2	4		84.5	
233	1	2		22.5	
234	2	4		84.5	
235	2	3		52.5	
237	2	2		22.5	
238	1	2		22.5	
239	2	1		6	
240	2	3		52.5	
242	2	4		84.5	
244	2	4		84.5	
245	2	1		6	
246	2	1		6	
247	2	2		22.5	
248	2	4		84.5	
249	2	3		52.5	
252	2	4		84.5	
253	2	2		22.5	

G1 G2
5.2 Q47,100-3

Group
1 G1
2 G2

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 192

UDF -1.37478

UDF 0.169199

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G2	69	
total	97	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G2	2415	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2;B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	40.23214	1126.5 =SUMIF(A:A;G3;C:C)
G2	52.55797	3626.5

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	720.5	=N24-M14
G2	1211.5	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	-245.5	=M30-\$M\$57*\$M\$58/2
G2	245.5	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"";COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i		
7027.5	=SUM(E:E)	$T = \sum T_i$

Step 10: Determine denominator (= SE)

denominator 119.6661 =SQRT(M7*M8/(M9*(M9-1)*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z -2.05154 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

Step 12: Determine significance

sig 0.040214 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.040214 =2*(1-NORMSDIST(ABS(M57)))

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Responden	Group	opinion	Rank	t _i	T _i
19	2	1		11	21
21	1	4		75.5	44
25	2	4		75.5	
28	2	4		75.5	
30	1	2		30.5	18
34	1	4		75.5	484.5
39	1	4		75.5	
47	2	2		30.5	
48	1	1		11	
50	1	1		11	
53	1	4		75.5	
58	1	4		75.5	
64	1	2		30.5	
74	1	4		75.5	
75	1	3		46.5	14
78	1	1		11	227.5
79	1	2		30.5	
87	1	1		11	
89	1	4		75.5	
90	2	3		46.5	
91	1	4		75.5	
92	1	1		11	
93	2	4		75.5	
98	2	1		11	
101	2	4		75.5	
102	2	1		11	
103	2	1		11	
104	2	4		75.5	
109	1	4		75.5	
112	1	1		11	
113	2	4		75.5	
114	2	4		75.5	
116	2	4		75.5	
119	2	4		75.5	
120	2	1		11	
123	2	4		75.5	
126	2	4		75.5	
127	2	1		11	
132	2	3		46.5	
134	2	1		11	
135	2	3		46.5	
136	2	2		30.5	
143	2	1		11	
144	2	1		11	
145	2	3		46.5	
149	2	2		30.5	
150	2	4		75.5	
156	2	3		46.5	
157	2	1		11	
158	2	4		75.5	
159	2	4		75.5	
160	2	4		75.5	
161	2	2		30.5	
162	2	3		46.5	
163	2	2		30.5	
165	2	2		30.5	
168	1	4		75.5	
169	2	3		46.5	
173	2	4		75.5	
178	2	2		30.5	
179	2	3		46.5	
180	1	3		46.5	
189	2	4		75.5	
192	1	4		75.5	
195	1	4		75.5	
196	2	2		30.5	
199	2	4		75.5	
200	1	1		11	
202	2	4		75.5	
205	2	1		11	
207	1	2		30.5	
209	2	4		75.5	
213	2	3		46.5	
214	2	4		75.5	
219	1	4		75.5	
220	2	4		75.5	
222	2	4		75.5	
225	2	1		11	
226	2	4		75.5	
231	2	2		30.5	
232	2	3		46.5	
233	1	4		75.5	
234	2	2		30.5	
235	2	4		75.5	
237	2	4		75.5	
238	1	4		75.5	
239	2	2		30.5	
240	2	2		30.5	
242	2	2		30.5	
244	2	3		46.5	
245	2	2		30.5	
246	2	4		75.5	
247	2	1		11	
248	2	1		11	
249	2	4		75.5	
252	2	3		46.5	
253	2	4		75.5	

G1 G2
5.2 Q47,100-4

Group
1 G1
2 G2

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 254.5

UDF 0.184475

UDF 0.853641

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G2	69	
total	97	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G2	2415	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2;B:B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	50.875	1424.5 =SUMIF(A:A;G3;C:C)
G2	48.23913	3328.5

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	1018.5	=N24-M14
G2	913.5	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	52.5	=M30-\$M\$7*\$M\$8/2
G2	-52.5	$U_i - \frac{n_i \times n_i}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"");COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12)
 $T_i = \frac{t_i^3 - t_i}{12}$

Step 9: Sum the results of step 8

Sum T _i	8577	=SUM(E:E)
		$T = \sum T_i$

Step 10: Determine denominator (= SE)

denominator 118.3152 =SQRT(M7*M8/(M9*(M9-1)*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z 0.44373 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

Step 12: Determine significance

sig 0.657238 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.657238 =2*(1-NORMSDIST(ABS(M57)))

$$Z = \frac{U_i - \frac{n_i \times n_i}{2}}{SE}$$

Responden	Group	opinion	Rank	t _i	T _i
1	3	2		30	15
2	3	3		43.5	12
3	3	1		11.5	22
4	3	3		43.5	
5	3	3		43.5	
6	3	4		55	11
7	3	2		30	
8	3	1		11.5	
12	3	1		11.5	
13	3	2		30	
15	3	2		30	
21	1	1		11.5	
30	1	4		55	
34	1	2		30	
39	1	1		11.5	
48	1	3		43.5	
50	1	4		55	
53	1	1		11.5	
56	3	1		11.5	
58	1	2		30	
63	3	1		11.5	
64	1	1		11.5	
66	3	4		55	
74	1	3		43.5	
75	1	2		30	
78	1	3		43.5	
79	1	4		55	
87	1	2		30	
89	1	1		11.5	
91	1	2		30	
92	1	4		55	
99	3	1		11.5	
100	3	4		55	
107	3	2		30	
109	1	3		43.5	
112	1	4		55	
133	3	4		55	
138	3	4		55	
147	3	1		11.5	
154	3	1		11.5	
166	3	2		30	
168	1	1		11.5	
174	3	1		11.5	
175	3	2		30	
176	3	3		43.5	
177	3	3		43.5	
180	1	1		11.5	
181	3	2		30	
187	3	1		11.5	
192	1	2		30	
193	3	3		43.5	
195	1	1		11.5	
198	3	1		11.5	
200	1	3		43.5	
201	3	4		55	
207	1	1		11.5	
219	1	3		43.5	
221	3	2		30	
233	1	1		11.5	
238	1	1		11.5	

G1 G2
5.2 Q47,150-1

Group
1 G1
3 G3

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 274

UDF 0.569109

UDF 0.569282

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G3	32	
total	60	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G3	528	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2:B;B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	30.08929	842.5 =SUMIF(A:A;G3;C:C)
G3	30.85938	987.5

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	436.5	=N24-M14
G3	459.5	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	-11.5	=M30-\$M\$7*\$M\$8/2
G3	11.5	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"");COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12)

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i		
1418.5	=SUM(E:E)	$T = \sum T_i$

Step 10: Determine denominator (= SE)

denominator 64.77371 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/(12-M49))

Step 11: Determine Z

Z -0.17754 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

Step 12: Determine significance

sig 0.859083 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.859083 =2*(1-NORMSDIST(ABS(M57)))

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Responden	Group	opinion	Rank	t _i	T _i
1	3	1		8	15
2	3	2		25.5	20
3	3	2		25.5	665
4	3	1		8	
5	3	2		25.5	
6	3	3		43	15
7	3	1		8	
8	3	3		43	
12	3	2		25.5	
13	3	4		55.5	10
15	3	4		55.5	82.5
21	1	2		25.5	
30	1	3		43	
34	1	1		8	
39	1	2		25.5	
48	1	4		55.5	
50	1	2		25.5	
53	1	2		25.5	
56	3	4		55.5	
58	1	1		8	
63	3	2		25.5	
64	1	4		55.5	
66	3	2		25.5	
74	1	1		8	
75	1	4		55.5	
78	1	2		25.5	
79	1	1		8	
87	1	4		55.5	
89	1	3		43	
91	1	3		43	
92	1	3		43	
99	3	2		25.5	
100	3	1		8	
107	3	3		43	
109	1	1		8	
112	1	3		43	
133	3	2		25.5	
138	3	1		8	
147	3	2		25.5	
154	3	4		55.5	
166	3	1		8	
168	1	2		25.5	
174	3	2		25.5	
175	3	3		43	
176	3	4		55.5	
177	3	1		8	
180	1	2		25.5	
181	3	3		43	
187	3	3		43	
192	1	1		8	
193	3	2		25.5	
195	1	3		43	
198	3	2		25.5	
200	1	2		25.5	
201	3	3		43	
207	1	4		55.5	
219	1	1		8	
221	3	1		8	
233	1	3		43	
238	1	3		43	

G1 G2
5.2 Q47,150-2

Group
1 G1
3 G3

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 261

UDF 0.261259

UDF 0.793893

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G3	32	
total	60	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G3	528	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2;B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	31.48214	881.5 =SUMIF(A:A;G3;C:C)
G3	29.64063	948.5

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	475.5	=N24-M14
G3	420.5	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	27.5	=M30-\$M\$7*\$M\$8/2
G3	-27.5	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"");COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12)

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i		
1307.5	=SUM(E:E)	$T = \sum T_i$

Step 10: Determine denominator (= SE)

denominator 64.99022 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z 0.423141 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

Step 12: Determine significance

sig 0.672193 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.672193 =2*(1-NORMSDIST(ABS(M57)))

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Responden	Group	opinion	Rank	t _i	T _i
1	3	3		37	23
2	3	1		5.5	10
3	3	3		37	
4	3	4		54.5	12
5	3	1		5.5	
6	3	1		5.5	
7	3	3		37	
8	3	2		18	15
12	3	4		54.5	
13	3	1		5.5	
15	3	1		5.5	
21	1	3		37	
30	1	1		5.5	
34	1	3		37	
39	1	3		37	
48	1	2		18	
50	1	3		37	
53	1	3		37	
56	3	2		18	
58	1	3		37	
63	3	3		37	
64	1	3		37	
66	3	3		37	
74	1	2		18	
75	1	1		5.5	
78	1	4		54.5	
79	1	3		37	
87	1	3		37	
89	1	2		18	
91	1	1		5.5	
92	1	2		18	
99	3	3		37	
100	3	3		37	
107	3	4		54.5	
109	1	2		18	
112	1	2		18	
133	3	3		37	
138	3	2		18	
147	3	4		54.5	
154	3	3		37	
166	3	3		37	
168	1	3		37	
174	3	4		54.5	
175	3	4		54.5	
176	3	1		5.5	
177	3	4		54.5	
180	1	4		54.5	
181	3	4		54.5	
187	3	2		18	
192	1	3		37	
193	3	1		5.5	
195	1	2		18	
198	3	4		54.5	
200	1	4		54.5	
201	3	2		18	
207	1	3		37	
219	1	2		18	
221	3	3		37	
233	1	2		18	
238	1	2		18	

G1 G2
5.2 Q47,150-3

Group
1 G1
3 G3

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 216

UDF -0.82188

UDF 0.411146

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G3	32	
total	60	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G3	528	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2;B:B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	28.71429	804 =SUMIF(A:A;G3;C:C)
G3	32.0625	1026

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	398	=N24-M14
G3	498	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	-50	=M30-\$M\$7*\$M\$8/2
G3	50	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"";COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"";(D2^3-D2)/12)
 $T_i = \frac{t_i^3 - t_i}{12}$

Step 9: Sum the results of step 8

Sum T _i	1517.5	=SUM(E:E)
		$T = \sum T_i$

Step 10: Determine denominator (= SE)

denominator 64.58 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z -0.77423 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Step 12: Determine significance

sig 0.438793 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.438793 =2*(1-NORMSDIST(ABS(M57)))

Responden	Group	opinion	Rank	t _i	T _i
1	3	4		47	27
2	3	4		47	
3	3	4		47	
4	3	2	18.5	10	82.5
5	3	4		47	
6	3	2	18.5		
7	3	4		47	
8	3	4		47	
12	3	3	28.5	10	82.5
13	3	3	28.5		
15	3	3	28.5		
21	1	4		47	
30	1	2	18.5		
34	1	4		47	
39	1	4		47	
48	1	1		7	13
50	1	1		7	
53	1	4		47	
56	3	3	28.5		
58	1	4		47	
63	3	4		47	
64	1	2	18.5		
66	3	1		7	
74	1	4		47	
75	1	3	28.5		
78	1	1		7	
79	1	2	18.5		
87	1	1		7	
89	1	4		47	
91	1	4		47	
92	1	1		7	
99	3	4		47	
100	3	2	18.5		
107	3	1		7	
109	1	4		47	
112	1	1		7	
133	3	1		7	
138	3	3	28.5		
147	3	3	28.5		
154	3	2	18.5		
166	3	4		47	
168	1	4		47	
174	3	3	28.5		
175	3	1		7	
176	3	2	18.5		
177	3	2	18.5		
180	1	3	28.5		
181	3	1		7	
187	3	4		47	
192	1	4		47	
193	3	4		47	
195	1	4		47	
198	3	3	28.5		
200	1	1		7	
201	3	1		7	
207	1	2	18.5		
219	1	4		47	
221	3	4		47	
233	1	4		47	
238	1	4		47	

G1 G2
5.2 Q47,150-4

Group
1 G1
3 G3

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 251

UDF 0.024038

UDF 0.980823

Mann-Whitney U test

Step 1: Counts

Group	n	
G1	28	=COUNTIF(A:A;G3)
G3	32	
total	60	=SUM(M7:M8)

Step 2:

Group		
G1	406	=M7*(M7+1)/2
G3	528	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2;B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G1	31.60714	885 =SUMIF(A:A;G3;C:C)
G3	29.53125	945

Step 5: Determine difference with Max rank (U)

Group	Difference	
G1	479	=N24-M14
G3	417	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G1	31	=M30-\$M\$7*\$M\$8/2
G3	-31	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"";COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"";(D2^3-D2)/12)
 $T_i = \frac{t_i^3 - t_i}{12}$

Step 9: Sum the results of step 8

Sum T _i	1985	=SUM(E:E)
		$T = \sum T_i$

Step 10: Determine denominator (= SE)

denominator 63.65727 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/(12-M49))

Step 11: Determine Z

Z 0.486983 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

Step 12: Determine significance

sig 0.62627 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.62627 =2*(1-NORMSDIST(ABS(M57)))

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Responden	Group	opinion	Rank	t _i	T _i
1	3	2		54.5	28
2	3	3		77.5	18
3	3	1		20.5	40
4	3	3		77.5	
5	3	3		77.5	
6	3	4		94	15
7	3	2		54.5	280
8	3	1		20.5	
12	3	1		20.5	
13	3	2		54.5	
15	3	2		54.5	
19	2	3		77.5	
25	2	2		54.5	
28	2	1		20.5	
47	2	1		20.5	
56	3	1		20.5	
63	3	1		20.5	
66	3	4		94	
90	2	2		54.5	
93	2	1		20.5	
98	2	4		94	
99	3	1		20.5	
100	3	4		94	
101	2	2		54.5	
102	2	3		77.5	
103	2	4		94	
104	2	3		77.5	
107	3	2		54.5	
113	2	1		20.5	
114	2	1		20.5	
116	2	1		20.5	
119	2	1		20.5	
120	2	4		94	
123	2	2		54.5	
126	2	1		20.5	
127	2	2		54.5	
132	2	1		20.5	
133	3	4		94	
134	2	2		54.5	
135	2	1		20.5	
136	2	3		77.5	
138	3	4		94	
143	2	2		54.5	
144	2	4		94	
145	2	4		94	
147	3	1		20.5	
149	2	3		77.5	
150	2	1		20.5	
154	3	1		20.5	
156	2	1		20.5	
157	2	3		77.5	
158	2	1		20.5	
159	2	1		20.5	
160	2	2		54.5	
161	2	3		77.5	
162	2	2		54.5	
163	2	1		20.5	
165	2	1		20.5	
166	3	2		54.5	
169	2	2		54.5	
173	2	2		54.5	
174	3	1		20.5	
175	3	2		54.5	
176	3	3		77.5	
177	3	3		77.5	
178	2	1		20.5	
179	2	1		20.5	
181	3	2		54.5	
187	3	1		20.5	
189	2	1		20.5	
193	3	3		77.5	
196	2	1		20.5	
198	3	1		20.5	
199	2	1		20.5	
201	3	4		94	
202	2	2		54.5	
205	2	4		94	
209	2	2		54.5	
213	2	1		20.5	
214	2	2		54.5	
220	2	2		54.5	
221	3	2		54.5	
222	2	2		54.5	
225	2	3		77.5	
226	2	2		54.5	
231	2	3		77.5	
232	2	1		20.5	
234	2	3		77.5	
235	2	1		20.5	
237	2	1		20.5	
239	2	4		94	
240	2	1		20.5	
242	2	3		77.5	
244	2	2		54.5	
245	2	4		94	
246	2	3		77.5	
247	2	4		94	
248	2	2		54.5	
249	2	1		20.5	
252	2	1		20.5	
253	2	1		20.5	

G1 G2
5.2 Q100,150-1

Group
2 G2
3 G3

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 272

UDF 0.598368

UDF 0.549594

Mann-Whitney U test

Step 1: Counts

Group	n	
G2	69	=COUNTIF(A:A;G3)
G3	32	
total	101	=SUM(M7:M8)

Step 2:

Group			
G2	2415	=M7*(M7+1)/2	$\frac{n_i \times (n_i + 1)}{2}$
G3	528		

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2;B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G2	49.36232	3406 =SUMIF(A:A;G3;C:C)
G3	54.53125	1745

Step 5: Determine difference with Max rank (U)

Group	Difference	
G2	991 =N24-M14	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$
G3	1217	

Step 6: Determine numerator for Z

Group	Denom.	
G2	-113 =M30-\$M\$57*\$M\$58/2	$U_i - \frac{n_i \times n_2}{2}$
G3	113	

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"");COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12)

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i	7921.5	=SUM(E:E)
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$$T = \sum T_i$$

Step 10: Determine denominator (= SE)

denominator 130.523 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z -0.86575 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Step 12: Determine significance

sig 0.386628 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.386628 =2*(1-NORMSDIST(ABS(M57)))

Responden	Group	opinion	Rank	t _i	T _i
1	3	1		13.5	26
2	3	2		44.5	36
3	3	2		44.5	
4	3	1		13.5	
5	3	2		44.5	
6	3	3		75.5	26
7	3	1		13.5	1462.5
8	3	3		75.5	
12	3	2		44.5	
13	3	4		95	13
15	3	4		95	182
19	2	2		44.5	
25	2	1		13.5	
28	2	3		75.5	
47	2	4		95	
56	3	4		95	
63	3	2		44.5	
66	3	2		44.5	
90	2	1		13.5	
93	2	2		44.5	
98	2	3		75.5	
99	3	2		44.5	
100	3	1		13.5	
101	2	1		13.5	
102	2	4		95	
103	2	2		44.5	
104	2	2		44.5	
107	3	3		75.5	
113	2	2		44.5	
114	2	3		75.5	
116	2	3		75.5	
119	2	2		44.5	
120	2	2		44.5	
123	2	1		13.5	
126	2	2		44.5	
127	2	4		95	
132	2	2		44.5	
133	3	2		44.5	
134	2	4		95	
135	2	4		95	
136	2	1		13.5	
138	3	1		13.5	
143	2	4		95	
144	2	2		44.5	
145	2	2		44.5	
147	3	2		44.5	
149	2	1		13.5	
150	2	3		75.5	
154	3	4		95	
156	2	2		44.5	
157	2	2		44.5	
158	2	3		75.5	
159	2	2		44.5	
160	2	1		13.5	
161	2	1		13.5	
162	2	1		13.5	
163	2	3		75.5	
165	2	3		75.5	
166	3	1		13.5	
169	2	1		13.5	
173	2	1		13.5	
174	3	2		44.5	
175	3	3		75.5	
176	3	4		95	
177	3	1		13.5	
178	2	3		75.5	
179	2	2		44.5	
181	3	3		75.5	
187	3	3		75.5	
189	2	2		44.5	
193	3	2		44.5	
196	2	4		95	
198	3	2		44.5	
199	2	3		75.5	
201	3	3		75.5	
202	2	1		13.5	
205	2	2		44.5	
209	2	3		75.5	
213	2	2		44.5	
214	2	1		13.5	
220	2	3		75.5	
221	3	1		13.5	
222	2	3		75.5	
225	2	2		44.5	
226	2	1		13.5	
231	2	1		13.5	
232	2	2		44.5	
234	2	1		13.5	
235	2	2		44.5	
237	2	3		75.5	
239	2	3		75.5	
240	2	4		95	
242	2	1		13.5	
244	2	1		13.5	
245	2	3		75.5	
246	2	2		44.5	
247	2	3		75.5	
248	2	3		75.5	
249	2	2		44.5	
252	2	2		44.5	
253	2	3		75.5	

G1 G2
5.2 Q100,150-2

Group
2 G2
3 G3

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 219.5

UDF -0.66523

UDF 0.505903

Mann-Whitney U test

Step 1: Counts

Group	n	
G2	69	=COUNTIF(A:A;G3)
G3	32	
total	101	=SUM(M7:M8)

Step 2:

Group			
G2	2415	=M7*(M7+1)/2	$\frac{n_i \times (n_i + 1)}{2}$
G3	528		

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2;B:B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G2	50.80435	3505.5 =SUMIF(A:A;G3;C:C)
G3	51.42188	1645.5

Step 5: Determine difference with Max rank (U)

Group	Difference	
G2	1090.5	=N24-M14
G3	1117.5	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G2	-13.5	=M30-\$M\$7*\$M\$8/2
G3	13.5	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"");COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12)

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i	6992	=SUM(E:E)
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$$T = \sum T_i$$

Step 10: Determine denominator (= SE)

denominator 131.2991 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z -0.10282 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

Step 12: Determine significance

sig 0.918107 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.918107 =2*(1-NORMSDIST(ABS(M57)))

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Responden	Group	opinion	Rank	t _i	T _i
1	3	3		51	37
2	3	1		8	15
3	3	3		51	
4	3	4		85.5	32
5	3	1		8	
6	3	1		8	
7	3	3		51	
8	3	2		24	17
12	3	4		85.5	
13	3	1		8	
15	3	1		8	
19	2	4		85.5	
25	2	3		51	
28	2	2		24	
47	2	3		51	
56	3	2		24	
63	3	3		51	
66	3	3		51	
90	2	4		85.5	
93	2	3		51	
98	2	2		24	
99	3	3		51	
100	3	3		51	
101	2	3		51	
102	2	2		24	
103	2	3		51	
104	2	1		8	
107	3	4		85.5	
113	2	3		51	
114	2	2		24	
116	2	2		24	
119	2	3		51	
120	2	3		51	
123	2	3		51	
126	2	3		51	
127	2	3		51	
132	2	4		85.5	
133	3	3		51	
134	2	3		51	
135	2	2		24	
136	2	4		85.5	
138	3	2		24	
143	2	3		51	
144	2	3		51	
145	2	1		8	
147	3	4		85.5	
149	2	4		85.5	
150	2	2		24	
154	3	3		51	
156	2	4		85.5	
157	2	4		85.5	
158	2	2		24	
159	2	3		51	
160	2	3		51	
161	2	4		85.5	
162	2	4		85.5	
163	2	4		85.5	
165	2	4		85.5	
166	3	3		51	
169	2	4		85.5	
173	2	3		51	
174	3	4		85.5	
175	3	4		85.5	
176	3	1		8	
177	3	4		85.5	
178	2	4		85.5	
179	2	4		85.5	
181	3	4		85.5	
187	3	2		24	
189	2	3		51	
193	3	1		8	
196	2	3		51	
198	3	4		85.5	
199	2	2		24	
201	3	2		24	
202	2	3		51	
205	2	3		51	
209	2	1		8	
213	2	4		85.5	
214	2	3		51	
220	2	1		8	
221	3	3		51	
222	2	1		8	
225	2	4		85.5	
226	2	3		51	
231	2	4		85.5	
232	2	4		85.5	
234	2	4		85.5	
235	2	3		51	
237	2	2		24	
239	2	1		8	
240	2	3		51	
242	2	4		85.5	
244	2	4		85.5	
245	2	1		8	
246	2	1		8	
247	2	2		24	
248	2	4		85.5	
249	2	3		51	
252	2	4		85.5	
253	2	2		24	

G1 G2
5.2 Q100,150-3

Group
2 G2
3 G3

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 212

UDF -0.86326

UDF 0.387992

Mann-Whitney U test

Step 1: Counts

Group	n	
G2	69	=COUNTIF(A:A;G3)
G3	32	
total	101	=SUM(M7:M8)

Step 2:

Group		
G2	2415	=M7*(M7+1)/2
G3	528	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2:B;B;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G2	52.81884	3644.5 =SUMIF(A:A;G3;C:C)
G3	47.07813	1506.5

Step 5: Determine difference with Max rank (U)

Group	Difference	
G2	1229.5	=N24-M14
G3	978.5	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G2	125.5	=M30-\$M\$7*\$M\$8/2
G3	-125.5	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"",COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"");(D2^3-D2)/12

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i	7634	=SUM(E:E)
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$$T = \sum T_i$$

Step 10: Determine denominator (= SE)

denominator 130.7635 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z 0.959748 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Step 12: Determine significance

sig 0.337182 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.337182 =2*(1-NORMSDIST(ABS(M57)))

Responden	Group	opinion	Rank	t _i	T _i
1	3	4		81	41
2	3	4		81	
3	3	4		81	
4	3	2		30.5	20
5	3	4		81	
6	3	2		30.5	
7	3	4		81	
8	3	4		81	
12	3	3		50.5	20
13	3	3		50.5	
15	3	3		50.5	
19	2	1		10.5	20
25	2	4		81	
28	2	4		81	
47	2	2		30.5	
56	3	3		50.5	
63	3	4		81	
66	3	1		10.5	
90	2	3		50.5	
93	2	4		81	
98	2	1		10.5	
99	3	4		81	
100	3	2		30.5	
101	2	4		81	
102	2	1		10.5	
103	2	1		10.5	
104	2	4		81	
107	3	1		10.5	
113	2	4		81	
114	2	4		81	
116	2	4		81	
119	2	4		81	
120	2	1		10.5	
123	2	4		81	
126	2	4		81	
127	2	1		10.5	
132	2	3		50.5	
133	3	1		10.5	
134	2	1		10.5	
135	2	3		50.5	
136	2	2		30.5	
138	3	3		50.5	
143	2	1		10.5	
144	2	1		10.5	
145	2	3		50.5	
147	3	3		50.5	
149	2	2		30.5	
150	2	4		81	
154	3	2		30.5	
156	2	3		50.5	
157	2	1		10.5	
158	2	4		81	
159	2	4		81	
160	2	4		81	
161	2	2		30.5	
162	2	3		50.5	
163	2	2		30.5	
165	2	2		30.5	
166	3	4		81	
169	2	3		50.5	
173	2	4		81	
174	3	3		50.5	
175	3	1		10.5	
176	3	2		30.5	
177	3	2		30.5	
178	2	2		30.5	
179	2	3		50.5	
181	3	1		10.5	
187	3	4		81	
189	2	4		81	
193	3	4		81	
196	2	2		30.5	
198	3	3		50.5	
199	2	4		81	
201	3	1		10.5	
202	2	4		81	
205	2	1		10.5	
209	2	4		81	
213	2	3		50.5	
214	2	4		81	
220	2	4		81	
221	3	4		81	
222	2	4		81	
225	2	1		10.5	
226	2	4		81	
231	2	2		30.5	
232	2	3		50.5	
234	2	2		30.5	
235	2	4		81	
237	2	4		81	
239	2	2		30.5	
240	2	2		30.5	
242	2	2		30.5	
244	2	3		50.5	
245	2	2		30.5	
246	2	4		81	
247	2	1		10.5	
248	2	1		10.5	
249	2	4		81	
252	2	3		50.5	
253	2	4		81	

G1 G2
5.2 Q100,150-4

Group
2 G2
3 G3

Opinion coding
1 Lowest preferred
2
3
4
5 Most preferred

UDF 272.5

UDF 0.618773

UDF 0.536066

Mann-Whitney U test

Step 1: Counts

Group	n	
G2	69	=COUNTIF(A:A;G3)
G3	32	
total	101	=SUM(M7:M8)

Step 2:

Group		
G2	2415	=M7*(M7+1)/2
G3	528	$\frac{n_i \times (n_i + 1)}{2}$

Step 3: Determine ranks

Determine the rank for each respondent (use average rank)
C2: =RANK.AVG(B2:B;8;1)

Step 4: Determine average rank and sum of ranks per group

Group	Avg. Rank	Sum rank (R _i)
G2	51.14493	3529 =SUMIF(A:A;G3;C:C)
G3	50.6875	1622

Step 5: Determine difference with Max rank (U)

Group	Difference	
G2	1114	=N24-M14
G3	1094	$U_i = R_i - \frac{n_i \times (n_i + 1)}{2}$

Step 6: Determine numerator for Z

Group	Denom.	
G2	10	=M30-\$M\$7*\$M\$8/2
G3	-10	$U_i - \frac{n_i \times n_2}{2}$

Step 7: Determine the number of tied scores (t_i)

See column D
D2: =IF(COUNTIF(\$C\$1:C1;C2)>0;"";COUNTIF(C:C;C2))

Step 8: Determine the adjustment for ties per tied rank

See column E
E2: =IF(D2="";"";(D2^3-D2)/12)

$$T_i = \frac{t_i^3 - t_i}{12}$$

Step 9: Sum the results of step 8

Sum T _i	7735	=SUM(E:E)
--------------------	------	-----------

$$T = \sum T_i$$

Step 10: Determine denominator (= SE)

denominator 130.6791 =SQRT(M7*M8/(M9*(M9-1))*((M9^3-M9)/12-M49))

Step 11: Determine Z

Z 0.076523 =M36/M53

$$SE = \sqrt{\frac{n_1 \times n_2}{N(N-1)} \times \left(\frac{N^3 - N}{12} - \sum T_i \right)}$$

$$Z = \frac{U_i - \frac{n_1 \times n_2}{2}}{SE}$$

Step 12: Determine significance

sig 0.939003 =2*(1-NORM.S.DIST(ABS(M57);TRUE))
0.939003 =2*(1-NORMSDIST(ABS(M57)))

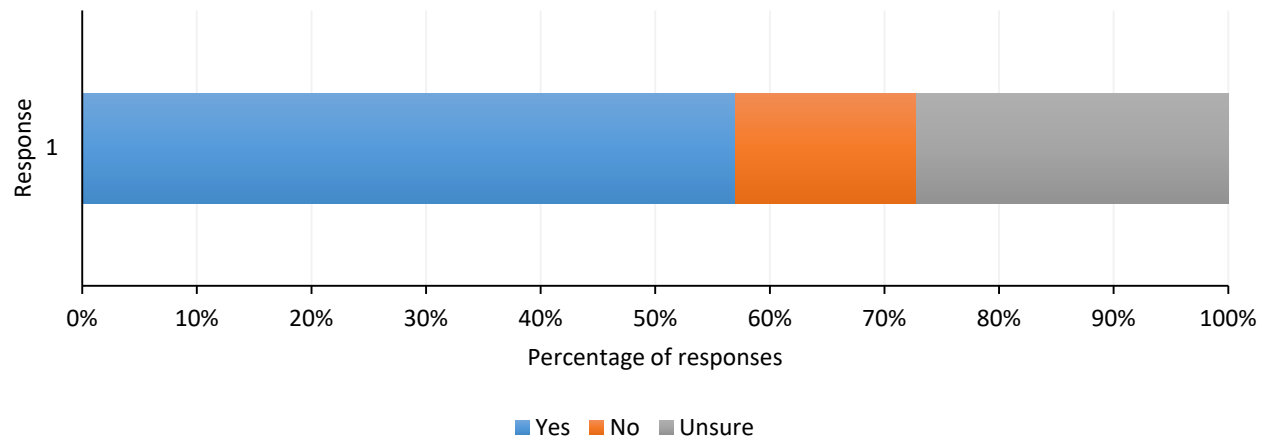
Q20,74&124 Do you believe that the relevant local government authorities and other relevant organizations have the capacity to plan for anticipated or unknown climate change disasters?

Overall

Yes	No	Unsure
57%	16%	27%

90	25	43	158
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The progress in promoting good practice in the built environment on the community level, and advancing future measures to minimize the impacts of climate change disturbance events



3.1 Complexity in Evaluating Some Resilience Characteristics

Cronbach's Alpha Result:

Cronbach Alpha Result: Total Number of Items/Total Number of Items - 1*(1-Sum of Item Variances/Variance Total) Below is the Likert scale responses received by G1,28,3.

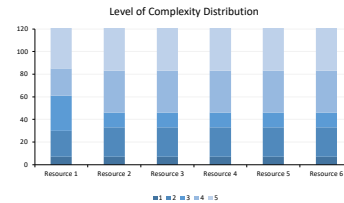
Group	Q30,84,132						Total
	Resource 1 Seeking permanent solutions based on the current status of the built environment systems	Resource 2 Modifying standards, norms, and regulations based on collected information.	Resource 3 Emerging evidence from climate change stress and shocks experienced.	Resource 4 Material resources include infrastructures, environmental conditions, housing, food, health, financial resources, and tools.	Resource 5 Intellectual resources include culture, social capital, ecological knowledge, networking, time, science, and education.	Resource 6 Civic resources related to citizenship that enables people to participate domain of resourcefulness.	
G1	5	4	3	3	5	5	25
2	2	2	2	5	5	5	21
3	3	3	3	3	3	3	18
4	2	1	1	3	3	3	13
5	4	4	4	5	4	4	25
6	3	3	3	4	2	4	19
7	3	2	2	5	4	5	21
8	2	2	2	5	5	5	21
9	3	3	4	4	4	4	22
10	1	2	1	5	5	5	19
11	5	5	5	5	5	5	30
12	4	4	3	5	5	5	26
13	5	5	5	5	4	4	28
14	3	2	2	5	5	5	22
15	4	4	3	5	5	4	25
16	4	4	4	3	3	3	21
17	3	4	3	2	2	2	16
18	4	1	3	4	3	3	18
19	1	1	1	3	3	3	12
20	2	3	3	5	5	5	23
21	2	2	4	5	5	5	23
22	3	4	4	3	4	3	21
23	4	4	4	4	4	4	24
24	5	3	4	4	5	5	26
25	4	3	4	4	4	4	23
26	3	3	3	3	3	3	18
27	3	3	3	3	4	3	21
28	4	4	4	5	5	5	27
29	5	5	5	5	5	5	30
30	4	5	4	5	5	4	27
31	2	3	1	5	5	5	19
32	3	2	2	5	5	5	21
33	3	3	4	4	5	4	23
34	3	3	3	5	5	5	24
35	2	2	2	5	4	4	19
36	2	2	2	5	5	5	21
37	3	3	3	5	5	4	23
38	3	3	3	5	4	4	22
39	4	4	4	4	4	4	24
40	4	4	4	4	4	4	24
41	5	4	2	5	5	5	26
42	1	1	1	5	5	5	18
43	4	4	4	3	3	3	21
44	5	4	5	5	5	5	29
45	3	3	3	4	5	3	21
46	4	4	4	5	5	4	26
47	3	4	4	4	4	3	21
48	4	3	5	3	4	5	23
49	3	4	3	4	4	2	20
50	5	5	5	5	5	5	30
51	3	3	3	5	3	4	22
52	4	4	4	5	4	2	23
53	2	2	2	5	5	5	18
54	3	2	2	4	3	2	16
55	3	3	3	5	5	3	23
56	1	3	3	5	5	3	20
57	4	4	4	3	3	3	21
58	5	5	5	5	5	5	30
59	4	4	3	4	5	4	24
60	4	4	4	5	5	5	27
61	2	2	2	5	3	5	19
62	2	2	2	5	5	5	21
63	5	4	4	4	5	4	26
64	4	5	3	5	5	4	26
65	4	4	4	5	4	4	25
66	5	5	5	5	5	5	30
67	3	4	3	4	3	4	22
68	1	1	1	5	4	3	15
69	5	3	3	5	5	4	25
70	1	5	2	5	4	3	17
71	4	4	4	4	4	4	24
72	3	3	3	5	5	4	23
73	4	4	2	5	5	5	19
74	3	4	4	5	4	3	21
75	4	4	4	5	4	4	26
76	2	2	2	5	4	3	18
77	3	4	4	4	4	4	23
78	5	3	3	5	5	5	26
79	3	3	1	4	5	4	18
80	2	3	2	4	5	4	20
81	3	4	4	2	2	1	16
82	4	4	4	4	5	3	16
83	4	3	3	5	5	4	24
84	4	3	3	5	4	4	23
85	5	5	5	5	5	5	30
86	4	4	3	5	4	4	24
87	3	3	2	4	4	4	20
88	5	5	5	5	4	2	26
89	5	5	5	5	5	5	30
90	5	2	2	5	5	4	21
91	3	4	3	5	4	3	22
92	5	5	5	3	3	3	24
93	0	4	2	5	4	4	19
94	4	5	2	5	4	3	23
95	3	5	2	5	4	3	22
96	2	4	4	3	4	4	21
97	0	0	0	5	5	5	15
98	3	4	4	5	5	5	26
99	4	2	2	2	5	4	19
100	2	2	2	5	4	4	19
101	2	4	4	5	4	4	23
102	5	5	5	4	5	4	28
103	3	5	3	5	4	5	25
104	2	2	2	4	2	3	15
105	5	5	5	5	5	5	30
106	2	2	2	4	5	5	20
107	3	3	4	5	5	4	24
108	5	5	3	5	5	4	27
109	5	5	5	2	2	2	21
110	4	4	3	5	5	5	26
111	0	0	0	5	5	5	15
112	1	2	1	5	4	4	17
113	4	2	4	5	4	5	24
114	2	2	2	5	5	5	21

#Item/resources = 6
Sum of the item variances = 7.1304
Variance of Total Scores = 19.5717

Cronbach's $\alpha = 0.7628$

Likert Scale:
1 Very Easy
2 Somewhat Easy
3 Neutral
4 Hard
5 Very Hard

Likert Scale						Total
1	2	3	4	5		
Resource 1	7	23	31	24	58	5
Resource 2	7	26	13	37	38	
Resource 3	7	26	13	37	38	
Resource 4	7	26	13	37	38	
Resource 5	7	26	13	37	38	
Resource 6	7	26	13	37	38	



Variance 1.564971301 1.526033058 1.469752066 0.847820794 0.813854976 0.907880854
Simple
Complex