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RESEARCH ARTICLE

WHAT IS THE RELATIONSHIP BETWEEN AGE AND ENVIRONMENTAL VALUE SYSTEMS IN THE COSTAL ROAD PROJECT (CRP) IN MUMBAI?

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Abstract

Introduction:-

Research Question:
What is the relationship between age and environmental value systems in the Costal Road Project (CRP) in Mumbai?

Living in Mumbai: a metropolitan and urbanised country, I was interested to investigate how people perceived the exponential growth of infrastructure in Mumbai. A few weeks back when I was passing through the Marine Drive in Mumbai, I saw landfilling taking place for the construction of the Coastal Road Project (CRP). My 8 year old cousin said that this is so bad for the ocean but my dad said that cars in Mumbai are increasing and the project is important. Thisconversation made me interested to research about the relationship between age and environmental value systems in relation to the CRP in Mumbai.

Context: Why is this study important?
Land reclamation forbuilding roads is extremely harmful for the environment as it causes loss of marine biodiversity, noise pollution, air pollution, geological problems and increasessea-levels. This ultimately eliminates flood barriers and natural buffers like mangroves.

Mumbai is a city on the western coastline of India which sits on the Arabian Ocean. CRP is an extension of the Rs1600 Crore Bandra-Worli Sealink for which 164 hectares of land will undergo reclamation and extensive construction will take place to make the 8 lane freeway as shown in figures 1 and 2.While the project will ease traffic congestion, mangrove habitation of about 33.37 ha would be affected(MCGM). The city will lose nearly 1% of its mangrove cover to the project (Chatterjee).Mangroves provide several essential ecosystem services like flood protection, water quality maintenance, provide habitats to numerous species and sustain the fishes. Mumbai has a large population of 16 species of mangroves that provide habitat to 82 butterfly species, 2018 bird species, 13 crab species, 20 fish species and several mammals (Mehta). The great loss of the mangroves is said to be mitigated by the government and Brihanmumbai Municipal Corporation by afforestation of five times the trees and mangroves however due to biophysical and geographical reasons there is no space to plant those many trees.

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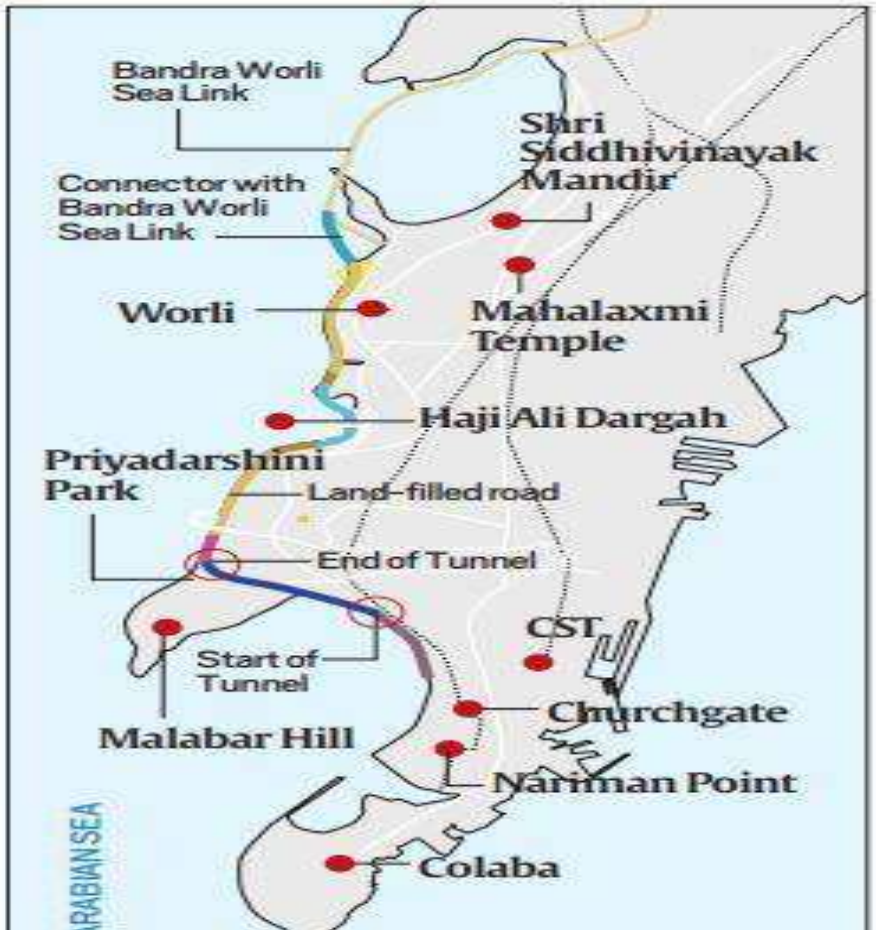


Fig 1:- Route of the coastal road project.

Fig 2:- satellite image of proposed project.

Several manmade projects like GRP serve the objective of improving human life however they cause anthropocentric global warming that ultimately harms the human species in the future. In order to change humans perceptions and ultimately improve methods and processes of innovation, it is substantial to first understand the population's EVS. An increase in or shift to ecocentrism will portray that in the future projects and developments like CRP will be more sustainable and ecological. While reading about the project online I realised thatwriters of blogs against the project due to the environmental impact were mostly in the age range of 18-30. As a result, investigating the relationship between age and environmental value systems in relation to the CRP, may determine whether Mumbai's population is supporting ecosystems, humans and/or technology. Which will enable comparison of the EVSs of different generations (age groups) to provide an insight to the future of an area's environmental position.

Hypothesis

Younger people are expected to have a technocentric perspective about the CRP's construction due to widespread technological advancements in the world. However, due to raised awareness about increasing environmental problems through social mediaand education, they may portray an ecocentric approach too. Middle aged people are expected to have an anthropocentric or technocentric perspective in relation to the project as they have experienced and been exposed to technology more than people in their late 50's to 70's. Older people will have a more anthropocentric view.

Planning

Experimental variables

Table 1:- Variables.

		Reason
Independent variable	Age groups	Since Mumbai is the financial capital with numerous opportunities, people of all age groups are attracted to live in this city. Every age group has different experiences, maturity levels and mental abilities. These factors influence their perceptions and thus it's important to understand the EVSs of citizens of Mumbai in relation to CRP to predict the state of future developments.
Dependent variable	Environmental Value Systems (EVSs)	To support the objective of the study.
Controlled variables	1. Region of participants: Mumbai 2. Education: At least high-school graduates 3. Religion: Hindu	The target is people living in Mumbai as the project is located in Mumbai and high school education is important to understand the survey and topic. Religious values also change perceptions thus only Hindus are surveyed. To ensure controlled variables were considered and followed, they are clearly mentioned in the message as shown in fig4. The questionnaire was only sent to Hindu's.

Sample size

To collect data for this investigation, I used stratified sampling. Since age is my independent variable stratified sampling would enable me to divide the population into accurate groups for primary data collection. The groups were divided as the following:

1. 15-20
2. 21-30
3. 31-40
4. 41-50

5. 51-60
6. 61+

Materials used
Laptop with internet access
Phone with instant messaging app to forward the questionnaire

Ethical considerations
The participants were informed about the purpose of the study before they filled the form. For reasons of privacy, anonymity has been followed. None of the participants were forced to answer the questionnaire. Since the questionnaire was sent digitally, it saves paper and thus is environmentally friendly. No safety considerations were made as the survey was sent digitally and didn't involve any live communication of any sort.

Procedure
10-15 people from each age group were asked to fill the form. The survey was made by the use of Google Forms.
1. Open Google Forms website
2. Open a blank document, add an appropriate title, descriptionand multiple choice questions (MCQs). Ensure that the required optionis kept on, so that participants answer all questions.
3. The theme and colour of the survey can be changed and images can be added for visual aid and reference like shown in fig3.

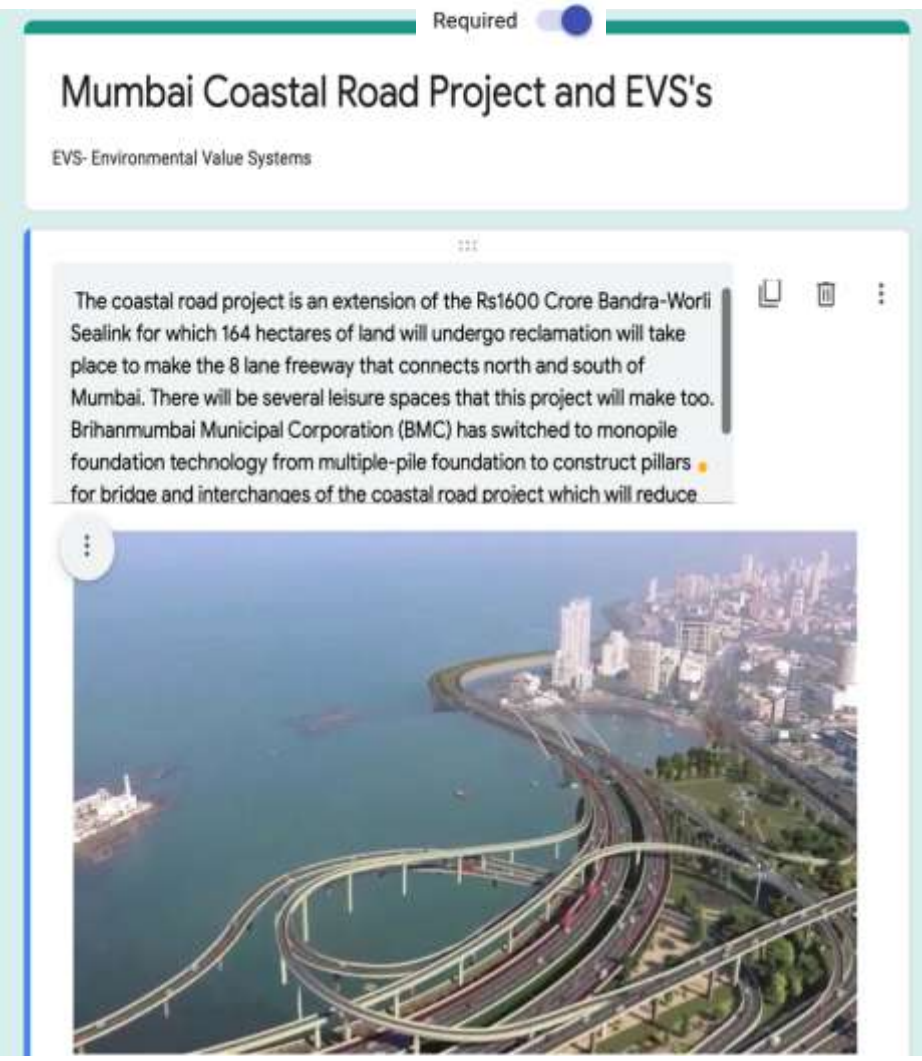


Fig 3:- Image of my Survey.

The survey has been attached in the appendix.

Section A should have a question to identify the age (independent variable) and Section B should include a series of MCQs in order to understand the relationship between age and EVSs in relation to the Mumbai Coastal Road Project.

- Once the survey is ready click on send, shorten the URL and send it to people through WhatsApp and Email as shown in figure 2.

Fig 4:- Link sent on WhatsApp.

A digital survey has been chosen in the form of primary data collection as:

1. It's quick to make a survey and send it to more people
2. It allows more honest answers as participants do not fear judgement that they would on calls or in person
3. It is easy to interpret data

Raw data

Table 1 presents raw unprocessed data.

Key of answers:

1. Ecocentric
2. Anthropocentric
3. Ecocentric

Table 2:- Raw Data.

Sr no	Age (x)	No of responses	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1	15≤ x< 20		1	1	1	3	1	3	3	1
2	15≤ x< 20		3	3	1	1	2	1	2	1
3	15≤ x< 20		3	3	1	3	2	3	2	3
4	15≤ x< 20		1	3	1	3	2	1	2	1
5	15≤ x< 20		3	2	1	3	3	2	2	3
6	15≤ x< 20		3	3	3	3	3	3	3	3
7	15≤ x< 20		1	1	1	3	3	1	3	1
8	15≤ x< 20	14 responses	1	1	1	3	3	1	3	3
9	15≤ x< 20		2	1	1	2	3	1	1	1

10	15≤ x< 20		2	3	1	3	3	1	2	1
11	15≤ x< 20		2	1	3	1	2	1	3	1
12	15≤ x< 20		3	1	1	2	2	3	1	1
13	15≤ x< 20		3	1	1	2	2	2	1	1
14	15≤ x< 20		1	2	1	3	3	1	3	1
15	21≤ x< 30		3	3	3	3	3	3	3	3
16	21≤ x< 30		3	1	1	3	3	1	1	1
17	21≤ x< 30		1	1	1	3	3	1	3	1
18	21≤ x< 30		2	1	1	1	1	2	1	1
19	21≤ x< 30		1	1	1	1	3	1	3	1
20	21≤ x< 30	11 responses	2	3	2	2	3	3	1	2
21	21≤ x< 30		2	1	1	3	3	1	3	1
22	21≤ x< 30		1	1	1	3	3	1	2	1
23	21≤ x< 30		1	2	1	3	1	1	1	3
24	21≤ x< 30		1	2	1	1	2	3	2	3
25	21≤ x< 30		2	1	1	3	3	1	3	3
26	21≤ x< 30		3	1	1	3	3	1	3	1
27	31≤ x< 40		2	3	2	2	3	2	3	3
28	31≤ x< 40		3	1	1	2	2	2	2	2
29	31≤ x< 40		1	2	3	2	2	1	3	2
30	31≤ x< 40		2	2	3	2	3	2	2	3
31	31≤ x< 40	10 responses	1	2	2	3	2	3	2	1
32	31≤ x< 40		1	2	2	2	3	2	3	2
33	31≤ x< 40		2	2	1	2	3	2	2	1
34	31≤ x< 40		1	2	2	2	2	3	2	3
35	31≤ x< 40		3	2	2	2	3	2	3	1
36	31≤ x< 40		2	3	2	3	2	2	2	3
37	41≤ x< 50		2	2	2	3	2	2	2	3
38	41≤ x< 50		1	2	3	3	3	3	2	2
39	41≤ x< 50		3	3	2	2	3	2	3	2
40	41≤ x< 50		2	2	3	2	3	2	3	3
41	41≤ x< 50		2	3	2	2	2	2	2	3
42	41≤ x< 50	11 responses	2	3	2	3	2	3	2	3
43	41≤ x< 50		2	2	2	3	2	2	3	3
44	41≤ x< 50		2	2	1	2	3	2	2	1
45	41≤ x< 50		3	2	2	3	2	2	2	3
46	41≤ x< 50		2	1	2	3	3	2	2	3
47	41≤ x< 50		2	3	2	2	3	2	3	2
48	51≤ x< 60		2	2	3	2	2	2	2	3
49	51≤ x< 60		2	2	2	2	3	3	3	2
50	51≤ x< 60		2	2	3	2	2	3	1	2
51	51≤ x< 60		3	2	2	3	3	2	2	1
52	51≤ x< 60	10 responses	2	2	1	3	2	2	2	2
53	51≤ x< 60		2	3	1	2	2	2	2	3
54	51≤ x< 60		2	2	3	2	1	3	2	2
55	51≤ x< 60		1	2	2	2	2	2	2	2
56	51≤ x< 60		1	3	2	2	3	2	3	2
57	51≤ x< 60		2	2	3	2	2	2	2	3
58	61≤ x		2	2	1	1	2	2	2	2
59	61≤ x		2	2	2	2	2	2	2	2
60	61≤ x		1	2	1	2	2	1	2	2
61	61≤ x		1	2	2	2	3	2	2	3

62	61≤ x		2	2	1	2	1	2	2	1
63	61≤ x	11 responses	1	2	2	2	1	2	2	3
64	61≤ x		2	2	1	3	1	2	2	1
65	61≤ x		1	2	2	3	2	2	2	2
66	61≤ x		1	2	3	1	2	2	1	2
67	61≤ x		3	2	2	2	3	1	2	2
68	61≤ x		2	2	1	1	2	2	2	2

Results per Question:

15≤ x< 20

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1- Ecocentric	5	7	12	2	1	8	3	10
2- Anthropocentric	3	2	0	3	6	2	5	0
3- Technocentric	6	5	2	9	7	4	6	4

21≤ x< 30

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1-Ecocentric	5	8	10	3	2	8	4	7
2- Anthropocentric	4	2	1	1	1	1	2	1
3- Technocentric	3	2	1	8	9	3	6	4

31≤ x< 40

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1-Ecocentric	4	1	2	0	0	1	0	3
2- Anthropocentric	4	7	6	8	5	7	6	3
3- Technocentric	2	2	2	2	5	2	4	4

41≤ x< 50

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1-Ecocentric	1	1	1	0	0	0	0	1
2- Anthropocentric	8	6	8	5	5	9	7	3
3- Technocentric	2	4	2	6	6	2	4	7

51≤ x<60

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1-Ecocentric	2	0	2	0	1	0	1	1
2- Anthropocentric	7	8	4	9	6	7	7	6
3- Technocentric	1	2	4	1	3	3	2	3

61+

	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8
1-Ecocentric	5	0	5	3	3	2	1	2
2- Anthropocentric	5	11	5	6	6	9	10	7
3- Technocentric	1	0	1	2	2	0	0	2

It can be seen from early observation that ages 15-30 support ecocentric viewpoints and gradually the numbers decrease as there are many 0's for option 1's until 60+. Anthropocentricism is high for 31-60+.

Overall results data

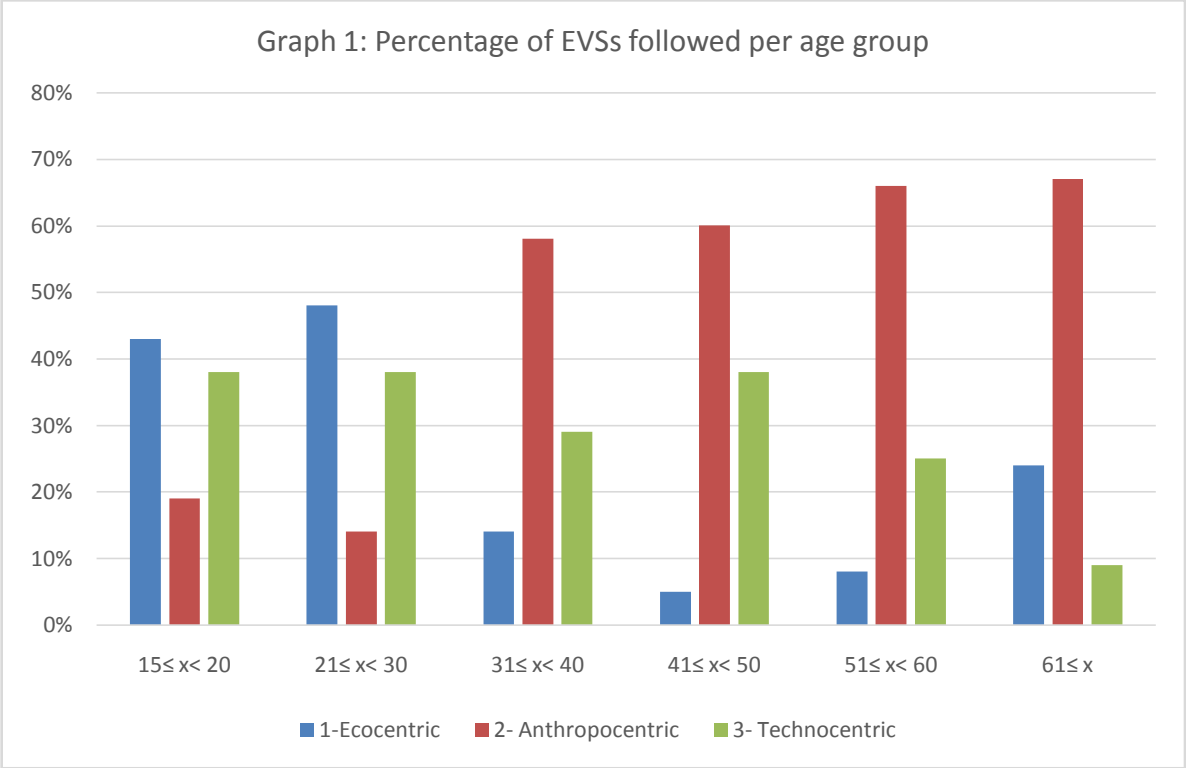
Total number of times options were selected per age group.

	15≤ x< 20	21≤ x< 30	31≤ x< 40	41≤ x< 50	51≤ x< 60	61≤ x
1-Ecocentric	48	47	11	4	7	21
2- Anthropocentric	21	13	46	51	53	59
3- Technocentric	43	36	23	33	20	8

Ratio of options chosen per age group

	15≤ x< 20	21≤ x< 30	31≤ x< 40	41≤ x< 50	51≤ x< 60	61≤ x
1-Ecocentric	0.43	0.48	0.14	0.05	0.08	0.24
2- Anthropocentric	0.19	0.14	0.58	0.60	0.66	0.67
3- Technocentric	0.38	0.38	0.29	0.38	0.25	0.09

Data processing



With reference to graph 1, it can be discerned that EVSs are greatly distinctive per age group.

For group 15-20, ecocentrism is the highest at 43% and Anthropocentricism is less than half of ecocentrism. For 21-30, ecocentrism has increased by 5% but the gap between ecocentrism and anthropocentrism has increased more as there is a decline in anthropocentrism. Techno-centrism is the same for both these age groups. Matching the hypothesis, it can be drawn that younger generations are more ecocentric due to increased awareness through schools and social media, and show high levels of technocentric views in comparisons to other generations due to greater and easier exposure to technology.

The common trend in the rest if the age groups is that anthropocentrism is the highest for each group and continues to exponentially rise per age group. An increase in anthropocentricism in the older generations can be a result of more knowledge of the government and political parties which would result in greater reliance, belief and trust in the government and that they're methods to mitigate or control the impact is the best method.

Ecocentrism sees a significant decline in group 30-40 comparative to group 20-30. This trend continues to fall for 40-50, but rises for groups 50-60 & 60+. This could be because the older generations have not witnessed most conventional modern technological inventions in their youth and this could result in them being more sensitive towards the environment.

A decline in techno centrism in older generations (50-60+) could be justified by the lack of awareness, access and slower adaptability towards technology. This would limit their awareness and acceptability towards Brihanmumbai Municipal Corporation's (BMC) attempt to improve efficiency of constructing pillars for bridge and interchanges of the coastal road project by switching to monopile foundation technology from multiple-pile foundation to construct pillars (Kadri).

Figure 5, shows that Mumbai has 70% of its citizens travelling by foot or public transport, and less than 10% of users using cars, projects like the coastal road may be not as successful and effective as BMC expects.

	Work	Shopping	School	Social Visit	Enterta-inment	Health Care	Personal Business	HH Average
On foot	45.10	82.20	55.50	52.40	51.60	66.90	47.90	52.50
Bicycle	3.50	0.40	0.40	0.40	0.00	0.80	1.20	2.20
Rail	20.90	1.50	15.30	13.80	3.50	1.20	13.20	15.40
Public Bus	15.10	6.10	22.40	13.10	16.00	12.80	18.30	14.60
Auto-Rickshaw	2.10	5.40	3.30	7.50	7.00	13.20	6.60	4.30
Taxi	0.30	1.40	0.10	6.30	3.40	3.10	0.80	1.10
Two-Wheeler	8.60	2.40	2.30	3.10	8.00	1.20	8.30	6.40
Own Car	3.20	0.40	0.30	1.60	4.30	0.40	3.30	2.40
Others Car	0.40	0.20	0.10	1.50	6.20	0.40	0.40	0.60
Other	0.80	0.00	0.30	0.30	0.00	0.00	0.00	0.50
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00

Fig 5:- Percentage Distributions of transport Modes in Mumbai.
Source: Research gate.

Conclusion:-

The results shown in the graph closely depicts what the hypothesis states, but the hypothesis doesn't state meticulous details portrayed in the graph. As stated in the hypothesis, the results match that ecocentrism and techno-centrism is highest for teenagers and young adults. An ecocentric viewpoint regarding the coastal road project is highest in age groups 15-20 and 21-30, with technocentric perspective as a close second for both. Furthermore, anthropocentric viewpoints about the coastal road project are clearly high and continue to increase for age groups 31-60%. While it was expected that technocentric viewpoint will be present for middle aged groups, there was a revelation in the results that was not expected in the hypothesis; ecocentric viewpoint that was declining suddenly rose for age group 60+. As expected 60+ age group portrayed the smallest interest in techno-centrism. In conclusion, there is a weak relationship between age and EVSs in relation to the Mumbai Coastal Road Project that shows that Ecocentrism is more prevalent in young adults and teenagers of ages 15-30, techno-centrism is slowly declining with age with an exception of age-group 41-50 and anthropocentricism tends to be high for ages 41+.

By the use google forms I could make an eco-friendly questionnaire that was easily sent to 90 people. Data in the survey was collected from the same educational and religious backgrounds thus these controlled factors enable a fair analysis to an extent . Moreover, MCQ's allowed data analysis and exploration to be easy and effective. Despite strengths of collecting data, weakness in the experiment exist too which could impact the accuracy of the results.

Peoplewith no internet access could not be part of the study. Despite sending the survey to 90 people only 68 people completely answered, the sample size could cause an accuracy error anddespite mentioning the controlled variables in the message sent to participants, there is no method to confirm this.There is a risk that all participants may not have answered all the questions honestly and there is no way to validate the extent of their honesty. Age groups were grouped differently (15-20, 21-30, 61+), due to the distinctive age gaps the data and conclusion's reliability could be affected. Despite sending the survey to 90 people only 68 people completely answered, the sample size could cause an accuracy error. People may be of different income groups or may change their EVS through the stages of building the coastal road, these factors could result in unfair analysis.

The questionnaire could be distributed physically and digitally to allow more people with and without internet access to answer the survey which will improve the sample size to improve the accuracy. Free choice of age or reducing the gap between groups would enhance the accuracy. Controlling the income groups will also improve accuracy and reliability of the study.

To understand how different external factors affect EVSs in relation to the building of the Project the research question, "To what extent does the income of a person play a role in deciding EVSs in relation to Mumbai Coastal Road Project?" could be explored.

Appendix
The questions asked in the survey are as follows:

What is your age? *
15-20
21-30
31-40
41-50
51-60
60+

Q1. Please complete the following sentence. This project will *
1. Cause extreme harm to the environment
2. Benefit humans life as traffic congestion will be reduced
3. Be a great project for India's technological advancement

Q2. Which do you think is the most important impact of this project? *
1. Loss of biodiversity
2. Convenient transportation routes
3. Technological developments like this project will be beneficial for futuristic development

Q3. What do you think should be considered most in the making of this project? *
1. Environmental impact that it will cause
2. Amount of time saved in travelling by this road
3. Efficiency and quality of technological processes involved in planning and construction

Q4. 1% of the total mangroves that are responsible for flood protection and maintaining water quality will be destroyed by this project, how do you think the problem should be solved? *
1. Stopping the project because it's depleting mangroves
2. We need better and faster roads, so let the project continue but let the government be involved to reduce impact
3. Allow scientists to research and make technological changes to solve the problem

Q5. Since the project causes marine species to deplete what is the most effective solution? *
1. Signing petitions to stop the project/ control impact
2. Setting legal limits on amount of polluting discharge
3. Creating technologies after research and development (R&D) to reduce impact

Q6. What do you think will be the ultimate impact of this project? *
1. Negative impact on mangroves, other organisms and fishermen
2. Help ease humans life
3. Boosting economy through technological methods (eg: creation of leisure areas for tourism, better infrastructure)

Q7. What do you think is the benefit of switching to better technology for the construction of pillars for bridges of the coastal road project? *
1. Reduce time by 3 months so damage may be reduced minutely
2. BMC will save Rs.120 million which can be used for the benefits of society
3. Allows construction to be efficient and of better quality

Q8. BMC says that 5 times the trees that were cut during the building of the roads will be planted in Mumbai. What are your views on this? *
1. There is no space in Mumbai to plant those many trees, thus the project is even worse
2. The government will mitigate and control the damage, and the project must continue
3. Technologically modern methods, machinery and strategies are the best solutions

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