Examining Nuclear Energy Risk Perception in India

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0 Summary

The Indian Government plans to implement large scale expansion of the use of nuclear energy throughout the country. This project aims to study general public risk perception of nuclear energy in India through the use of surveys. In addition, the surveys also capture social, economic, and political information in order to examine if they have an underlying effect on nuclear energy risk perception. Various data visualizations and statistical tests are used to examine the effect of certain factors affecting nuclear energy acceptance.

We see that there is an equal proportion of positive and negative nuclear risk perception. In particular, rural participants have a more positive perception of nuclear energy compared to urban participants. Gender and caste does not seem to affect the risk perception of nuclear energy. Compared to hydropower, nuclear energy is rated to be more risky while coal and nuclear energy have similar risk perception. Higher income groups have a more positive nuclear energy perception compared to lower income groups. There is not enough information to draw conclusions about the underlying effects of land insecurity and political beliefs on nuclear energy risk perception. Overall, the data is detailed and is a great resource to examine public perception of nuclear energy in India.

1 Introduction

The Indian Government plans to expand the use of nuclear energy throughout the country. Prior to carrying out this plan, it is important to determine the general public's opinion on the riskiness and advantages of such technologies. This project aims to study the risk perception of nuclear energy and comparing it with other energy sources like hydro or coal using survey data. In addition, this project also captures participants' economic status and political beliefs in order to examine what factors affect people's acceptance or rejection of nuclear energy. This is a unique project because it collects thousands of responses from a representative sample of the Indian population which allows for a thorough exploration of various factors that affect risk perception.

The project aims to answer the following questions:

1. How might acceptance of nuclear energy in India vary with different groups of people?
2. How are the perceptions of nuclear power different from that of other conventional sources of energy like coal or hydropower?
3. How do positions on trade-offs between land insecurity and income insecurity affect perceptions of risk?
4. Do political-economic values influence people's perception of energy technologies?

The rest of the report summarizes the datasets used for analysis (*2.0*), describes the proposed statistical methods and results (*2.1-2.4*), discusses some limitation (*2.5*) and lastly concludes the results and discussion (*3*). Please note that all the visualizations can be viewed in the *Statistical Appendix*.

2 Statistical Methods (and Results)

2.0 Data Description

The data comes from two surveys both of which summarize the risk perception of nuclear energy as well as other energy sources using a 5 point Likert Scale. In addition, both surveys also contains information about sex, age, religion, and caste. The first survey contains an equal proportion of male and female participants, while the second contains more male than female participants. The biggest age group is between 25-34 years olds with 35-44 years old being the second. The first survey details information about income and livelihood security. The second survey contains information on political and economic opinions. There are 1062 participants for the first survey and 1099 for the second survey.

2.1 How might acceptance of nuclear energy in India vary with different groups of people?

We examine the risk perception across urban and rural India by visualizing the proportions of responses between urban and rural participants. In addition, we perform a test to compare if there is a difference between the proportions for "Agree" (positive perception of nuclear energy) responses between the two groups. From the visualization, there seems to be a higher "Agree" proportion responses with the rural group compared to the urban group (figure XYZ). Furthermore, the test signifies that the proportion of rural participants is significantly higher than the urban participants (section XYZ).

In addition, we also examine the risk perception across various castes and genders. From the visualization, the proportion of "Agree" (positive perception of nuclear energy) responses seem to be slightly different between the genders and castes (figure XYZ). However, when performing a test to compare if there is a significant difference between the mean of the *nuclear scale*, there does not seem to be a statistically significant different between the various castes and genders (section XYZ). This means that the risk perception between the castes and genders are not significantly different. Note that *nuclear scale* is a number that rates positive perception of nuclear energy for each participant. Further details of how this value is calculated per participant can be found in section XYZ of the appendix.

2.2 How are the perceptions of nuclear power different from that of other conventional sources of energy like coal or hydropower?

We first examine nuclear risk perception by visualizing the response proportions across all the different technologies. Nuclear power seems to have a higher "Very Risky" response proportion compared to solar, wind and fire wood (figure XYZ). To compare the risk perception of nuclear energy to coal or hydropower, we implement a test to determine if the proportion of "Risky" responses is higher for nuclear energy compared to coal and hydropower. There is no significant proportion difference in the "Risky" response between nuclear and coal (section XYZ). However, there is a significantly higher proportion of "Risky" response proportions for nuclear energy compared to hydropower energy (section XYZ).

2.3 How do positions on trade-offs between land insecurity and income insecurity affect perceptions of risk?

To evaluate the effect of income, we visualize the proportion of positive nuclear perception responses across the different income groups and see that there is some variation in the proportion of responses with "Agree" and "Disagree" across the income groups (figure XYZ). Furthermore, we use a test to compare the mean *nuclear scale* between the "<1 M Rupees/year" vs ">1 M Rupees/year" income groups and find that those in the higher income group have a higher positive perception towards nuclear energy (section XYZ).

Furthermore, we visualize the *nuclear scale* across the job insecurity groups and find that the distribution is mostly the same across those who are secure and not secure in their jobs. We perform a test to see compare the mean of the *nuclear scale* between the two groups. We that there is no significant difference in the positive perception score of nuclear energy between those who are secure and not secure in their jobs.

More than 70% of the land property was empty so it is difficult to get an accurate evaluation of the effect of land security of nuclear energy acceptance. However, with the ~30% of the responses, we visualize the distribution of land property value across the different responses for nuclear energy acceptance and observe that the distribution of land property value is somewhat the same across the different nuclear acceptance levels.

2.4 Do political values influence people's perception of energy technologies?

We examine the relationship between the political beliefs and nuclear acceptance by comparing *nuclear scale* and *political scale*. Note that *political scale* is a number that measures positive government opinion where a higher number represents a more positive outlook of government control (section XYZ). According to result XYZ, having a more positive outlook of government control may lead to a riskier perception of nuclear energy. However, note that the results from XYZ is not statistically significant so this conclusion is not that accurate.

2.5 Limitations

A potential limitation lies in the construction of the *nuclear scale* and *political scale*. These values were arbitrarily set and so there may be a better way to construct these values so that it better captures the positive perception of nuclear and positive perception of government control correspondingly. In addition, although a linear model was fit for 2.4, the values for *nuclear scale* and *political scale* do not follow the assumptions and so a linear is not strongly recommended.

3 Conclusions

Our goal is to examine the underlying effects of various social, economic, and political factors on the risk perception of nuclear energy in India. We find that rural participants have a more positive perception of nuclear energy compared to urban participants. Gender and caste does not seem to affect the risk perception of nuclear energy. Coal energy and nuclear energy have similar risk perceptions. However compared to hydropower, nuclear energy is rated to be more risky. Those in higher income groups have a higher positive perception towards nuclear energy compared to those in lower income groups. There is not enough information to draw conclusions about the underlying effects of land insecurity and political beliefs on nuclear energy risk perception.

Overall, we see a variety of factors affect risk perception of nuclear energy in India. We recommend further investigation of how to evaluate political scale through the lens of political expert. The data obtained from the survey is very detailed with a lot of potential to uncover even more underlying factors affecting nuclear risk perception.

4 References

Gupta, Prerna. 2022. "Nuclear Risk Perception in India." *GitHub Repository.* https://github.com/prernagupta05/nuclear-risk-perception-India; GitHub.