

Understanding Technology Adoption: A Case of ICS in Sindhupalchowk, Nepal

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Abstract

Many villages in high mountainous areas of Nepal are facing problems of cooking due to lack of indigenous resources of fuel for cooking. The history of ICS development program in Nepal backs to 1950s but progress seems to be very little in terms of adoption and sustained use of ICS despite many energy efficient and smokeless designs. Over the past few decades, many efforts have been made around the world to substitute open fires with efficient wood burning stoves, also known as ICS, which reduce both smoke and wood consumption. These Efforts have had mixed results, and several studies have attempted to identify the benefits and the barriers to widespread ICS dissemination. Primary survey was conducted through household questionnaire survey in Sindhupalchowk. Both qualitative and quantitative data were collected. Qualitative data were analyzed through reasoning and authors' own observation during site visit in Sindhupalchowk as well as Mustang where the author conducted his project on the concept of co-design of ICS, as a part of his thesis. Quantitative data were analyzed through data analysis tool of SPSS. It explores the complex factors behind using and not using ICS. Further, it analyzes the current status of ICS use in two villages of Sindhupalchowk District of Nepal. Though around 72%, 80%, and 83% of respondent feel satisfactory performance in reduction of wood consumption, in reduction in smoke, and on improved health respectively; 36% of respondent never used the distributed ICS and out of people who used ICS at least once, only 76% are still using this, and the frequency of use shows unsatisfactory usage. Availability of more advanced technology, incompatibility of distributed ICS with the cooking needs of large family and use for other purpose which shows the socio-cultural aspects of that particular area seems to be the barriers of adoption.

Keywords

Improved Cook Stove (ICS) – Adoption – Sindhupalchowk – SPSS

1. Introduction

1.1 Background

Fuelwood is the largest energy resources in Nepal providing about 77% of the total energy demand in the year 2008/09. Of the total fuel wood, 99.2% is consumed in residential sector [1]. The shift in technology from traditional stove to ICS (Improved cooking Stove) has always been in high priority in energy planning by different Government and non-government organizations working in Nepal. A variety of stove designs with different dissemination strategies are promoted by government as well as Non-government organizations [2]. Despite numerous data available and different model of ICS for climate

change mitigation and sustainable development, the failure to adapt the technology locally have become the greatest problem for energy planners and national and international organizations working in this field. Despite the long history of cook stove programs, very few have been successful, often only in areas where biomass is purchased or there is a biomass shortage [3]. Jan et al. report adoption rates of less than 20% for a random study of 100 households in rural northwest Pakistan [4]. [5] report an even smaller adoption rate of 15% for a particular cooking stove project in Mexico. Other studies have found similar results for various parts of the world [6]. Examples such as these demonstrate that an improved cook stove's ability to burn cleaner and more efficiently does not guarantee its

adoption. Adoption as can be defined with the help of following factors in my case of study as [7] describes: Intact adoption of stoves as the combination of 1. Daily use of the Hotpoint/Greenway cook stove 2. No parallel use of less efficient cooking methods; and 3. No efficiency reducing alterations of the stove design on the part of recipients. As an action for remedy to the cooking problems caused due to massive 7.8-magnitude earthquake on April 25, 2015, improved cook stoves were distributed to different households from different districts, but no information was found on adoption after post distribution. This study selects Sindhupalchowk District - one of the most affected district due to earthquake - as case study.

1.2 Objectives of the Study

The main objective of the research is to find the factors which influence household decisions to adopt (or not) improved cook stoves. However the specific objectives are as follows:

1. To find the potential reasons which makes people not to use improved cook stove
2. To find factors that are worth considering for better adoption.
3. To find the current status of ICS adoption

2. Methodology

To understand why there exists adoption issues of improved cook stove even which are distributed free of cost, a qualitative case study approach was employed. The choice of conducting a qualitative study was more suited to me as contrasted to conducting a quantitative study, because I desired to understand the “why” behind the factors influencing adoption of cook stoves from a user’s perspective which I would not have been able to capture if I had followed the later. A qualitative case study is deemed more suitable, further, because the study is about the user’s subjective perceptions with in a bounded reality. This approach enabled me to have a direct interaction with the people and the place where the issue at hand is experienced which as per [8] enables a detailed understanding of the topic being explored.

The designed questionnaire survey was conducted among sample number of houses there by collecting

various data. The questionnaire included both structured and semi-structured questions and were modified while conducting the survey itself to meet the deep understanding of the situation which is called as emergent design technique in data collection and is defined as data collection methods based on what is learned earlier in the data collection process. Among the data collected, quantitative nominal and numerical data were analyzed through statistical data analysis tool SPSS (Statistical Processing for Social Sciences) while qualitative data were analyzed on my own construction as well as referring to the various literatures on qualitative data analysis. So the product of data analysis is richly descriptive.

Unit of analysis in my case are Indrawati Gaunpalika and Melamchi Municipality of Sindhupalchowk district where interview with both the ICS users as well as non-users was conducted. Here users and non-users refer to the people who used the distributed ICS at least once and the people never using the ICS. The methodological framework is shown in Figure 1.

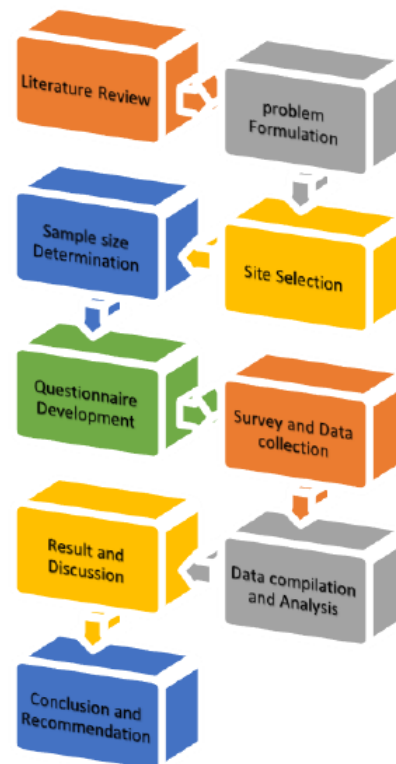


Figure 1: methodological framework

2.1 Sample size determination

The minimum number of Households was calculated to be 96 from the formula for sample size calculation. Survey was conducted on 100 households of Sindhupalchowk district, 50 from Melamchi Municipality and 50 from Indrawati Gaunpalika.

$$SS = (Z^2 * P * (1 - P)) / C^2$$

Where

SS = sample size for infinite population

Z = Z value (e.g. 1.96 for 95% confidence level)

p = percentage picking a choice, expressed as decimal (.5 used for sample size needed)

c = confidence interval, expressed as decimal (e.g., 0.04 = ±4)

2.2 Questionnaire Development

Questionnaire was developed as per the objective of the research to find the current status of adoption and the factors that led to abandon of ICS. For this purpose survey question was made to find various factors and perceptions from user was taken. The main questions included family size, use of ICS, continuation in use of ICS, frequency of use of ICS, benefits perceived and modifications needed to be made on the stove, person using the stove for cooking, available time for cooking, monthly income, time taken to cook compared to traditional open fire stove, perception on reduction in fuelwood consumption, reduction in smoke and improvement in health, intention of user to use it on long term etc.

3. Result and Discussion

One of the respondent expressed “ *what me and my family needs is that food is ready on time and we are indifferent towards the type of stove and the method of cooking*”

From this and other similar accounts during this study, it can be inferred that people may not give energy resources and devices the kind of attention stove promoters or energy product innovators suppose they do which is an important element in understanding the dynamics in adoption of stove technologies and

therefore both the consequences of stove uptake. Since the main goal of the stove user is to prepare food and not the utilization of the cooking stove in itself, in light of the above argument, it can be argued that at a household, the level of innovation of being introduced is not only the stove itself but a new or modified set of the energy service i.e. cooking practices. For instance, one of respondent acknowledged that he is not able to cook certain foods. A stove user in his words says “ *it was easier to roast jackfruit seeds, and maize, but now I can’t. And this is the reason I use both open fire and this (ICS) chulo*”

These findings are similar to the findings in [9] study which found that improved cook stoves sacrificed some important functional and cultural needs in rural Guatemala. By inspecting closely and thoroughly the issues of cooking with basic stoves, it can be deduced that the problem is a social as well as a technical one.

Out of 100 household where the ICS was distributed by AEPC (through CDECF - Sindhupalchowk (Community Development and Environment Conservation Forum) in Melamchi Municipality and through Red-cross in Indrawati Gaunpalika), 36 household never used the distributed ICS i.e. they have still the ICS in seal packed condition. The number of people never using the ICS was significantly high on Melamchi municipality as compared to that in Indrawati Gaunpalika (50% vs 22%) (figure: 2,3,and 4).

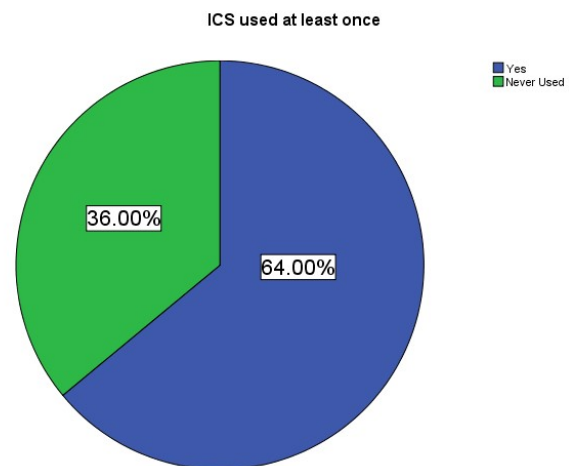


Figure 2: ICS use at least once - overall

Average available time for cooking is high in Indrawati

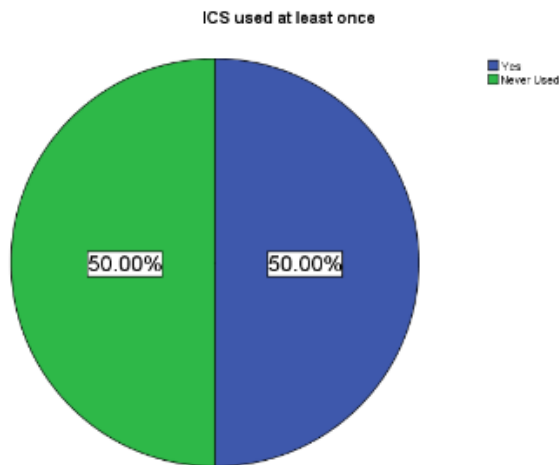


Figure 3: ICS use at least once - melamchi

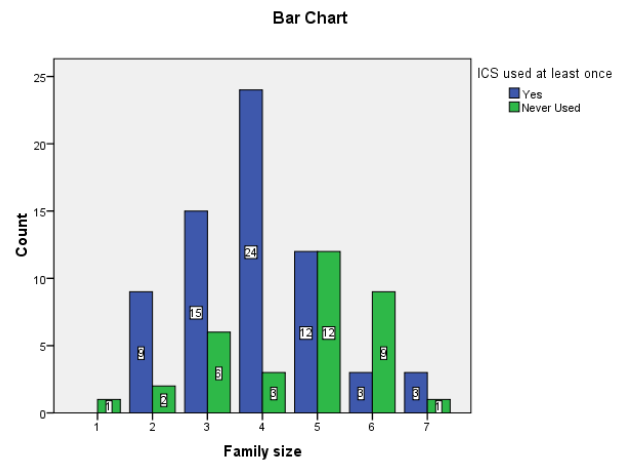


Figure 5: ICS use vs family size

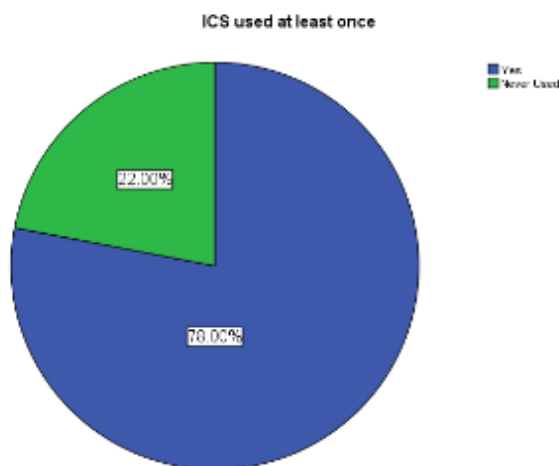


Figure 4: ICS use at least once - Indrawati

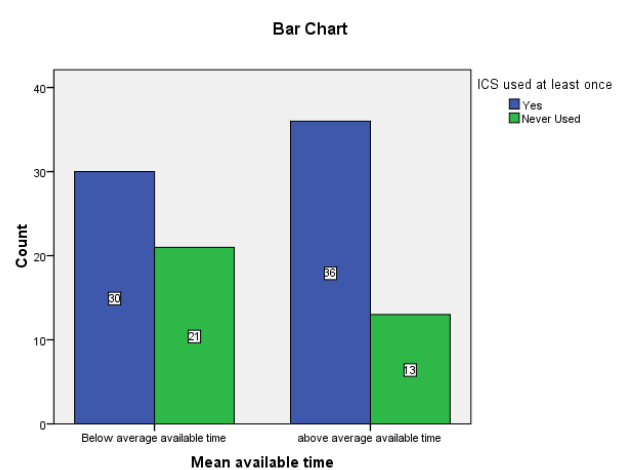


Figure 6: ICS use vs mean time available for cooking - overall

Gaunpalika, which may be one main reason for more use of ICS in these region compared to Melamchi. ICS use seems to be decreasing with the increase in family size. In all cases, the number of households never using ICS is decreasing with the increase in family size(Figure: 5).

For people having available cooking time more than average value, the use of ICS is much higher compared to people having low available cooking time than mean cooking time available(Figure 6, 7, and 8).

Out of people who used the distributed ICS at least once, only 76.56% are still using the ICS in different frequencies. In Melamchi municipality that value decreases to only 64% while in Indrawati the percentage

is high to the value of 84.6%. Since the number of households never using the ICS is already in significance and the people who used ICS at least once also seems to discard the use of ICS, the adoption of ICS seems unsatisfying (Figure: 9).

Out of Households using the ICS, parallel use of ICS was also observed in significant amount. This parallel use of ICS cannot meet the objective of ICS dissemination programs because people continue to use the traditional stove for a long time even after the distribution of ICS. More than 85% of people using traditional stove parallel shows the poor adoption of ICS (Figure : 10).

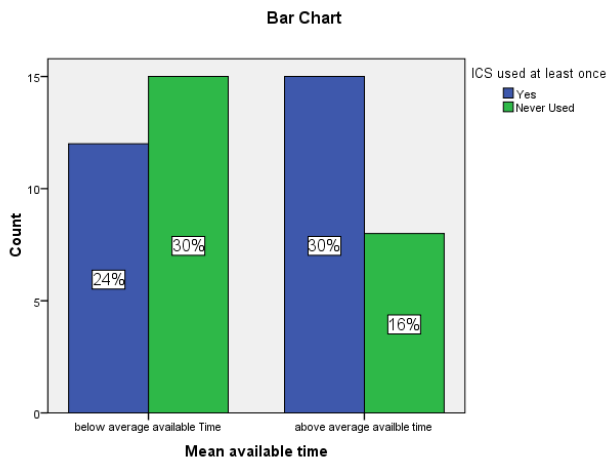


Figure 7: ICS use vs mean time available for cooking - melamchi

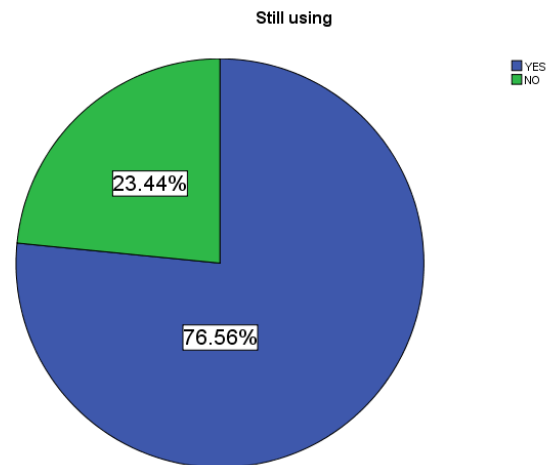


Figure 9: Number of people still using the ICS

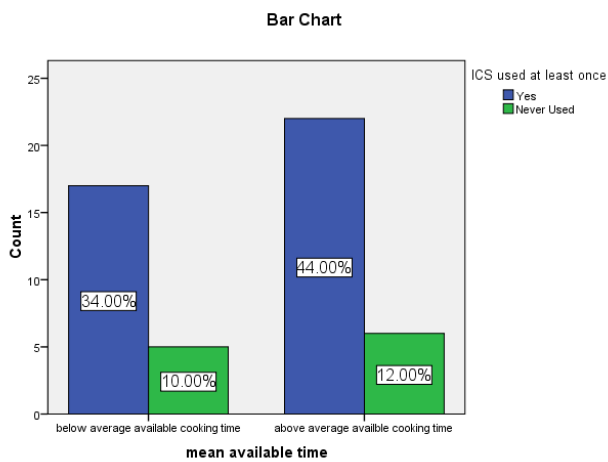


Figure 8: ICS use vs mean time available for cooking - indrawati

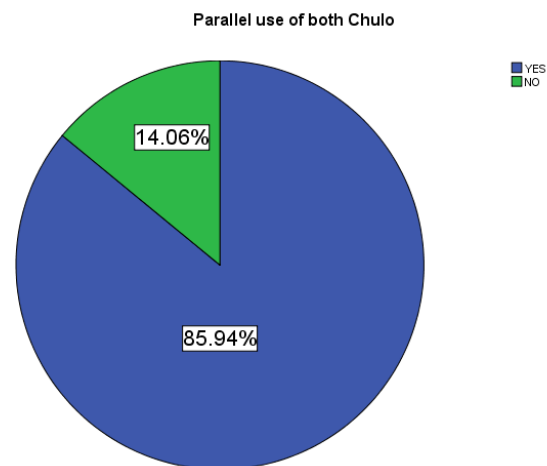


Figure 10: Parallel use of traditional stove

Only 39 percentage of people use ICS on daily basis for most of food. This shows the dependence of people on other cooking devices; mostly LPG on Melamchi municipality and open fire in Indrawati Gaunpalika (Figure: 11).

People who used ICS at least once, found that ICS takes almost same time for cooking as compared to traditional stove as opposed to the claim of the stove disseminators that ICS are for faster cooking.

When asked about the reduction in fuelwood consumption, many people responded a high reduction

in fuelwood consumption i.e. they found the claim of the ICS dissemination programs of saving of fuelwood was true. Similarly, around 80% of the people found the reduction in smoke either very satisfactory or satisfactory. Out of people who never use ICS, 61% of people intend to use ICS on future. This, at first, seems encouraging, but when they were asked the reason behind not using now and intention to use in future they reported to use ICS only when there is shortage of LPG.

People who have noticed the reduced time for cooking comprise the largest number who intend to continue the use of ICS in long term. So the perception towards reduced time has significant influence in adoption of ICS

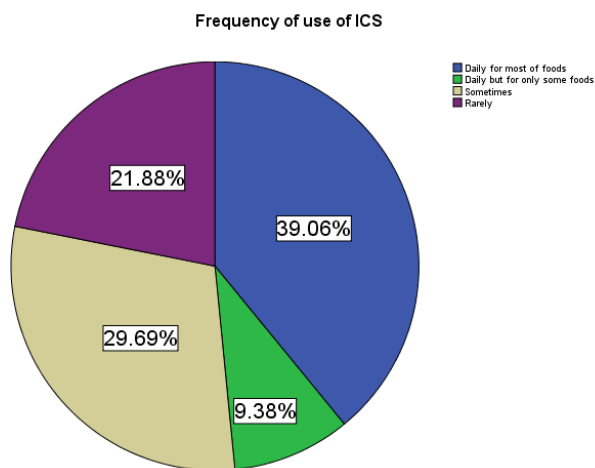


Figure 11: Frequency of use of ICS

(Figure: 12).

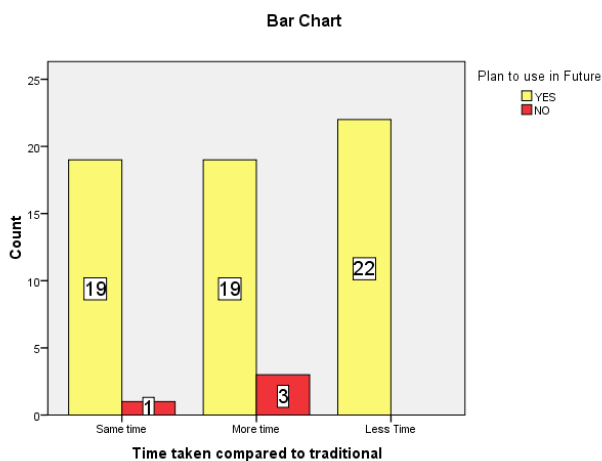


Figure 12: Reduction in time taken for cooking vs plan to use ICS in future

Benefits found on the stove distributed and modification needed to make it better were two open ended questions that were asked to the respondent. The main benefits found were easy to handle, light weight, portable, can simultaneously do other work while cooking, and less chance of burning of foods. Among these benefits portability and ability to cook while simultaneously doing other works were popular with the frequency of 6 and 7 households.

Out of 36 households never using the stove, 13 different reasons were found behind not using the stove. The

reasons are not mutually exclusive and so many of them are intersecting sets. The most reported reason (21 out of 36 reported this) was availability of LPG gas stove for cooking which is more advanced technology than improved cook stove and as we know technology always advances in forward direction, it is almost impossible to shift from LPG to ICS unless it becomes necessity due to unavailability of LPG. One of the respondent never used the stove because he heard that a massive amount of smoke is emitted with wet woods. Other reasons as per respondents are time consuming, not cozy, not user friendly, difficult to handle, extra time needed to chop the woods into smaller pieces, and no space available to put and use it inside house.

4. Conclusion and Recommendation

4.1 Conclusion

The attempt to understand the adoption process of improved cook stoves considering the perspectives of the local users has revealed some perceived factors that play a crucial role in the diffusion and adoption process. Such factors include benefits of stoves, ability to cook traditional dishes, and competing priorities among others and influence the decision to adopt as a barrier or as an enabler. From this study, the importance of users' perceptions in design of cookstove technologies is revealed. Opposed to the views of some stove promoters, the cooking needs of stove users are not simply the reduction in smoke and wood consumption, they are diverse and sometimes broader than those delineated by stove promoters.

Out of 64 % who used the stove at least once only around 77% still continue to use and only 48% of this population use it on daily basis. So the current status of ICS adoption does not seem to be satisfactory. Family size, availability of more advanced technology, lack of awareness, lack of monitoring programs come to the factors that resulted in decreased use of ICS. On technical factors; all of the factors i.e. reduction in smoke, fuelwood consumption, and improvement in health are found to be satisfactory by most of the respondent, however, 36% people never used the distributed stove. Training and follow-up visits, technical reliability and socio-cultural factors are dominant barriers to adoption of innovation. In this

case, small size of chamber and small stove size are main technical barriers as faced by people. Only a minority of respondents (30%) use the stove on a daily basis. This value is not an encouraging outcome and is not commendable compared to other ICS programs running worldwide. One of the reason may be the familiarity of people with more advanced technology like liquefied petroleum gas and induction cooker. Another identified factor is parallel use. Out of the 64% people who used ICS at least once, around 86% reported parallel use of other stove which compromise the successful achievement of distributed ICS.

4.2 Recommendation

Since the initial acceptance of ICS was not satisfactory, implementation should focus to ensure training and follow-up, ensure women participation in Dissemination program, and identify a champion before the dissemination of the programs. Insufficient training often results in abandonment of stoves by users. On technical factors many of the people seem not to understand the purpose of small entrance and complain small size of wood required as a technical problem, therefore before dissemination the emphasize has to be given in the purpose of the small entrance. Instead of providing ICS free of cost, users should have been made to bear a portion of the stove in order to encourage responsibility and stove ownership; past studies have noted this characteristic as critical to effective stove-dissemination programs.

A number of considerations may limit the interpretations that can be drawn from this study. Respondents may have adjusted their answers or behavior due to the fact that they were being studied. The study drew conclusions based on results aggregated at some local level where many participants were already familiar with more advance technologies. It would be useful to continue this research with a more in-depth analysis of the data collected from extremely remote areas where people use only traditional stoves. Further research is also needed on the accessibility of firewood in different regions and to explore the impact

of increasingly difficult access to firewood on the acceptance and usage of stoves. This study only focused on household level, however, further study can be done on community level like community organization and possibility of ICS in schools. Also, inclusion of stakeholder methodology during ICS dissemination can prove advantageous.

Finally in regard to the issue of parallel use of stove, further studies should distinguish between cooking and non-cooking use of parallel stoves and provide correspondingly different policy recommendations.

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