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COMMUNITY MANAGEMENT OF WATER RESOURCES: A CASE STUDY OF SUKHOMAJRI (HARYANA)

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ABSTRACT

This paper attempts to understand the details of the Sukhomajri Watershed Project - one of the most successful watershed projects in India. The cooperation depicted by people in situations where a community is on the verge of collapsing, like it was in the case of Sukhomajri, is a departure from the standard textbook results in games of Prisoner's dilemma. This has been verified in this study by conducting a field survey in Sukhomajri to see how much people understand the importance of the check dams and individual's cooperation even after decades have passed. The paper aims at finding whether cooperation is a common phenomenon when a community demands it. Tools of Experimental Economics have been used – first, to identify the type of the subject and classifying them accordingly. Then a voluntary contribution mechanism has been used to know the cooperative behaviour of the subjects and the last part tries to see how much, knowing the people with whom one has to cooperate affect their cooperation in a PD setting. The results show that people can be cooperative as well as individualistic but cooperative people contribute more for the betterment of the community in which they live. Also, knowing people with whom one has to cooperate, increases cooperation.

INTRODUCTION

In India, watershed development programmes address issues like agricultural productivity, soil and water conservation through mechanisms of institution building, people's participation and involvement of state and organisations like NGOs and research institutes. This is a case study of Sukhomajri, a small hamlet in the Panchkula district of Haryana and it fits squarely into the field of watershed development using people's participation. It lies in a long narrow belt of low hills and rolling land called the Shiwaliks. It is amongst the first and

successful villages in India to test participatory watershed management (Landell- Mills and Porras, 2002) and is still sustaining itself.

Until 1975, the region was characterised with lack of irrigation facilities, erratic distribution of rainfall, unconsolidated small landholdings and severe soil erosion of the undulating topography (Grewal et. al, 1990). Degradation of lands and frequent crop failures compelled the farmers to shift towards animal husbandry and they became professional graziers as they started keeping goats, cows, and sheep in large numbers (Agarwal et al, 2000). Allowing these animals to graze freely denuded one hill after the other and this along with activities of tree felling and land clearance caused massive soil erosion and thus, formation of gullies and gorges during the rainy season (Mittal et al, 2000). Therefore, these people eroded their very base of survival in search of sustenance. Problem of deforestation arises in the absence of any mechanism to control use, making each individual afraid of the fact that if he doesn't extract his share of the resource, somebody else would (Somanathan, 1991). Continuous siltation of sediments in the man- made Sukhna Lake in Chandigarh drew the attention of the Central Soil and Water Conservation Research and Training Institute (CSWCRTI), Research Centre, Chandigarh. Surveys were conducted and it was revealed that the major cause of this sedimentation is the erosion of hill slopes located in the proximity of Sukhomajri and a few nearby villages (Arya et al., 2001).

In response to this, the CSWCRTI along with the Ford foundation developed the village model having the following components: (i) treatment of the catchment area using soil and water conservation measures that consisted of planting of trees and grasses which could hold soil (ii) rainwater harvesting in the earthen dams and channelling this water to agricultural fields, and using it for domestic and other activities (iii) allied activities like rearing fish in the collected water, dairy farming and horticulture were taken up (Mittal et al, 2000). All these efforts resulted into manifold increase in crop yields both for Rabi and kharif, tree stocking in the catchment area of the dams increased tremendously and also the milk yield rose to high levels which boosted their dairy sector (Mittal et al, 2000). This was because composition of cattle shifted from low to high quality animals for milk production. All this was done by mobilizing the local community and engaging them to work for the operation and maintenance of the system using organised societies.

During 1976 and 1985, four earthen dams were built in order to harvest the rainwater and a Water User's association was formed to manage these which later came to be known as the Hill Resource Management Society (HRMS). Its members are representatives from every family in the village who work collectively to ensure equitable distribution of resources (Mittal et al, 2000). Combined investment as well as participation by the village society led to a shift from self-destruction to rejuvenation. Many watershed development projects do not work because those whose interests are harmed are not willing to put in the efforts (Kerr et al, 1998) and this was also a problem in the case of Sukhomajri initially. Later on, the villagers were made aware of the fact that the irrigation water which helped them attain high yields of productivity will no longer be available to them if they continued with the practice of overgrazing and deforestation.

Local or village level common resources like the checkdams and related resources can be managed by the state or private ownership or by the community itself (Baland et al., 1996). The possibility of cooperative behaviour in such cases can be examined in the light of recent developments in the experimental economics literature. In this study I intend to verify that when a common event affects the society adversely, people cooperate in order to mitigate the negative effects arising out of it, thereby choosing socially optimal strategies over the competitive ones. Cooperation can be in terms of contributing money for a cause or putting in efforts to make an initiative or an agenda successful or contributing for a public good which is necessary for the community. In simple words, elicitation of cooperative behaviour is what I aim to look at.

Prisoner's dilemma is a common paradigm to illustrate that there exist conflict between social incentive to cooperate and private incentive to defect. The standard theory suggests elimination of Nash strategies, predicting zero cooperation in a finitely repeated prisoner's dilemma (Talbot et al., 2005). A Bayesian approach shows that cooperation is possible among self- interested utility maximizing individuals if they believe that there may be a few others who are conditional co-operators (Kreps et al., 1982).

Experimental economics uses human experiments to answer research questions based on an individual's decisions. By using these experiments, we can identify the type of the individual- cooperative, altruistic, selfish, or competitive. This is done using the Decomposed game technique. Type of an individual along with knowledge about the people with whom he/she has to cooperate can be among a few factors determining a person's decision about cooperation. This is followed by a Voluntary Contribution Mechanism for public goods. And in the last part of the experiment, a four- period prisoner's dilemma game is played with the subjects. This study adds to the literature by presenting results of a field survey in Sukhomajri as well as of an experiment which is conducted to verify if people actually cooperate and to what extent in a similar setting which was faced by Sukhomajri villagers based on their behavioural type.

LITERATURE REVIEW

Sukhomajri is described as a region where sustainability is being practised in an indigenous manner by harnessing rainwater through construction of dams, afforestation, and biomass production from forest areas leading to an increase in grain and milk production (Mittal et al., 2000). Water harvesting dam project at this village in Sukhomajri has demonstrated the technical feasibility, economic viability and acceptability by the society of harvesting surplus monsoon rainwater and its efficient use in the post monsoon period. This helped in moderation of floods and drought in the area (Grewal, 2008). Major concerns which might lead to a setback to such programmes are faulty designing, improper maintenance of the structures, and lack of incentives to people for their full participation. The Sukhomajri model ensured equity in terms of participation by all sections- landless and other disadvantageous sections as well in terms of usage of water along with the above mentioned concerns (Arya et al., 2001).

Mittal et al. (2000) discuss that there are a few lessons which should be kept in mind for proper replicability of a model like the one in Sukhomajri in terms of its success. These include- ensuring peoples' participation from the beginning; identification of the needs and problems of the people; project should aim at meeting their needs, solving their problems and mitigating their hardships in order to be a successful one; organisation of institutions like

village society Hills Resource Management Society and; laying emphasis on sustainability as well as equity i.e. all the common property resources should be available to all sections of the society.

There is a fixed revenue sharing system for the revenues generated from all the activities under this programme. The funds are used for development of the areas managed like the forests, water harvesting structures, and the village itself (Arya et al., 2001). The case of watershed protection in Sukhomajri village is relevant from the point of view of developing market-based approaches for watershed protection services and improving livelihoods (Agarwal et al., 2000). In this particular case, market- like arrangements are observed at two levels simultaneously, one between the downstream city of Chandigarh and upstream villages like Sukhomajri, and secondly through an 'embedded' market for water within Sukhomajri itself (Sengupta et al.,2003).

Arya et al., (2001), characterize watershed projects by involvement of various parties. In case of Sukhomajri, these parties are- the village community (out of which HRMS has been formed), the Haryana Forest Department and the people of Chandigarh who were affected by siltation in the lake. All these parties have been beneficiaries of this project. Beneficiary participation has been an issue in development projects and its importance has increased because real development must include the beneficiaries in their own development (Gran, 1983). Participation implies social interaction and trust.

Baland et al., (1996) see strengths in the communities for managing the local resources. According to them, communities are well informed about local ecological conditions. It might be possible that that they may misjudge the impacts of their activities on environment, but this gap can be filled by the State or the concerned organisations like the CSWCRTI, Chandigarh in case of Sukhomajri. Also, communities make location or community- specific rules, as they are often better able to allow for fairness and equity considerations. Characteristics of self-monitoring, customary conflict- resolution mechanisms, knowledge about local technical, economic and social conditions allow better management. Agarwal et al.,(2000) have discussed case studies from semi- arid and hilly areas of India to illustrate

how participatory democracy in management of local natural resources led to ecological restoration and sustainable livelihoods.

There can be many possible explanations for cooperative behaviour among people living in a society. Mitra et al., (2009) define social capital as a set of informal norms shared and practised by a community. Trust, concern for others and willingness to conform to prevalent social norms of the community are developed by repeated interactions over time among the members.

Since Adam Smith, economic explanations of social cooperation emphasize on incentives that induce individuals to cooperate (Fehr et al., 2007). Sukhomajri can be regarded as an example of participatory watershed management depicting social cooperation. Fehr et al. (2007) showed that self-regarding and norm- regarding actors coexist and the available strategy set determines who dominates the level of cooperation at the aggregate level.

According to Juan et al, in context of watersheds, cooperation can be important where actions of individuals often have widespread spill over effects. For a resource like water, provision as well as appropriation is important for collective action. Because of rival nature of water and asymmetries in appropriation, cooperation needed for its provision can be undermined. So, achieving and maintaining collective action in watershed management is particularly challenging (Swallow et al., (2006). Ostrom (1990) found that communities in which groups are able to organize and govern their behavior successfully have certain features which are respected by external authorities.

The problems of managing common resources are usually represented by a framework of Prisoner's dilemma game (Baland et al., 1996). Cooperation may be shown to emerge even within the framework of Prisoner's dilemma game, provided, repeated interaction over time between different individual's choices is allowed (Baland et al., 1996). The equilibrium of a Prisoner's dilemma game can be changed by working out a contract among players, finding

ones which are most likely to cooperate and create an institution for collective action that benefits them all(Ostrom, 1990).

There is ample of evidence about the critical importance of communication in CPR dilemmas (Ostrom, 1990). Baland and Platteau have laid emphasis on the role of communication among the agents as a determinant for fostering cooperation (Baland et al., 1996). But communication as a factor determining cooperation is outside the scope of this study.

Brosig (2001) conducted an experiment to analyse whether cooperative individuals are able to credibly signal their behaviour and whether their signal is recognisable by their partner. According to her, cooperative behaviour is defined as maximization of the joint payoff by an individual, in lieu of their own payoffs in games of prisoner's dilemma and public goods. The results revealed that cooperative individuals are better at predicting their partner's decisions in one shot PD games than the individualistic ones. Individuals are less exploitative of their partner's decisions after they are allowed to communicate. Cooperative individual's ability to signal and recognise willingness to cooperate depends on the opportunity to communicate. Decomposed game technique and Dictator Game were used to identify the type of subjects.

Fischbacher et al., (2000) studied conditional cooperation in one- shot public goods game. Assuming existence of rational and selfish individuals in public goods experiment, it has been observed that people cooperate much more than predicted by standard economic theory. Conditional cooperation happens when people contribute more to a public good the more others contribute. The experiment entails asking individuals directly their willingness to contribute towards a public good. Also, a strategy method has been followed to ask their contribution for each average contribution level of other people. 50% of the subjects were found to be perfectly conditionally cooperative, 30% purely selfish, 14% were close to perfectly conditional cooperation and the rest showed random behaviour. The total average overall unconditional contribution was 33.5% of their endowment.

Martinsson et al. ,(2009) found that unconditional contributions are similar across locations, the degree of imperfect conditional cooperation and fraction of free riders are important in determining the difference in long-term contribution to public goods, which might call for monitoring.

METHODOLOGY

In order to address the research questions posed in this study, a simple survey has been conducted in Sukhomajri using 30 people belonging to same income class- 15 males and 15 females. An experiment has also been conducted using 30 university students having diverse academic background- 15 males and 15 females.

THE SURVEY

A copy of the survey appears in Annexure 1. The survey aims to know the responses of people of Sukhomajri about the check dams, their utility and related aspects like the issues and challenges which affect collective action towards check dams in the current scenario of 2013. This will ensure that if similar circumstances which were there approximately 35 years ago arise again, these people will cooperate and overcome the situation.

The survey consisted of questions about educational background, household size, ownership of land in the village, sources of water and which source they use more often, utility of check dams for them which might be user benefit of water or the environmental benefits of conservation of water like increase in underground water table level, increased plantation and tree cover, lesser water runoff and soil erosion. People were asked for their contribution out of an income of Rs.100 for the maintenance of these structures in two circumstances. In the first, they were asked to contribute the amount without any knowledge of other individual's contribution and in the second, they were shown three situations in which the average contributions of other individuals are 0, 50 and 100 and for each of the situation his contribution was asked. The first case seeks to know the person's unconditional contribution and the latter, his conditional contribution i.e. contribution which can be influenced by others and depends upon the other person's contribution.

They were asked about their potential response in case a similar situation of water scarcity arises in their village i.e. if they would want to build such water harvesting structures again. This question addressed their perception about the importance of these structures (check dams). The group of people entrusted with the responsibility of operating and maintaining this set up is also of immense importance for ensuring equity in the use of resources and proper upkeep of dams. People were asked whether they want the Panchayat to handle this responsibility or the Hill Resource Management Society itself which is currently doing so.

THE EXPERIMENT

A copy of the instructions and questions appears in the Annexure 2. The experiment was conducted in three parts through a questionnaire which was circulated to the subjects through internet. Null hypothesis for the following experiment is that people follow their Nash Strategy in a prisoner's dilemma game for cooperating in managing a common property resource. Nash strategy is to defect, thereby, not cooperating. Expected result is that the null hypothesis gets rejected as people tend to cooperate and defy the Nash outcome in case of conserving a common property resource.

Assumptions: It is rational to cooperate in a prisoner's dilemma situation if some conditions are satisfied: the same two individuals will play the game many times, they do not know how many times they will play the game, and they consider future payoffs as valuable enough. However, in real life people also meet strangers and cooperate with them even knowing that they will never meet again. A common explanation for this fact is that real people follow social norms prescribing cooperation (Mitra et al., 2009).

PART1: IDENTIFICATION OF AN INDIVIDUAL'S TYPE

All the subjects were briefed that there might be a possibility of an event which might adversely affect the area where they reside and people need to cooperate in terms of putting efforts (non-monetary) or monetary in order to minimise the possible negative effects of that event.

Ring measure of the Decomposed game technique (Brosig, 2001) has been used in order to identify the cooperative behaviour of an individual. At the beginning of the game, subjects were assigned unique identification numbers and provided written instructions about the problem prevailing in the area. Subjects played 24 decomposed games in each of which they were asked to choose between two own-other payoff combinations. Each of these payoff combinations assigned a certain amount of money to the subjects themselves, the own payoff x, and a certain amount to the other subject, the other payoff y. The monetary values of these payoffs were determined such that when plotted as ordered pairs (x, y), in a two-dimensional own-other payoff space, they would be located at 24 equally spaced points on a circle, centre at the origin (0, 0) and with an arbitrary radius of 15 monetary units. Subjects were asked to choose between two own-other payoff combinations that were located at two adjacent points around this circle. And this was repeated 24 times.

The payoffs received by subjects were determined by the 24 decisions that they made themselves and by the 24 decisions that were made by their partners. Subjects did not get any information about the identities of their partners. Adding up the amounts of money chosen by the subjects for themselves and for their partners separately, an estimate of the importance given by the subject to the own payoff and to the partner's payoff was obtained. These vectors are then plotted in an own-other payoff space representing individual's type. Vectors lying between 67.5^0 and 112.5^0 are altruistic, i.e. people who maximised the other person's payoff; 22.5^0 and 67.5^0 are classified as cooperative, i.e. those who tried to maximise the joint payoff; between 292.5^0 and 337.5^0 are classified as competitive, those maximising the difference between the own and other person's payoff and; between 0^0 and 22.5^0 or between 337.5^0 and 360^0 as individualistic, those who maximized their own payoff. The length of the vector serves as an index for a subject's consistency. Subjects who have a very small vector length will not be considered for the experiment as this depicts randomness in their behaviour.

PART 2: VOLUNTARY CONTRIBUTION MECHANISM PUBLIC GOOD GAME

Fischbacher et al. (2001) developed a one-shot public goods experiment in which individuals were asked how much they are willing to contribute for the public good out of a sum of

rupees 100 (any arbitrary sum can be taken). Under the standard theory, not contributing anything is the Nash outcome so that everyone free rides. For simplicity, the size of the public good or the benefits arising out of it is the sum of all the contributions collected. Subjects were asked to make two types of contribution decisions. The first type of decision is called unconditional contribution and second is conditional contribution. Both decisions were made without knowledge of actual contribution by the other individuals.

After this, there is a little departure from the actual experiment discussed by Fischbacher as it has been modified to suit this study. The unconditional contribution was just a single decision about how many rupees out of 100 the subject can give for the public good. After this, subjects were shown a vector (0, 50 and 100). These are the average contributions of other individuals and for each of this value of contribution by the others, subject has to make his contribution decision. This vector is just a subset of the many contribution possibilities by other subjects, out of which only three values have been taken. Subjects were told that their payoff will be determined by a random mechanism. The actual payoff of the individual will be randomly decided out of the four contribution decisions made by him- one for the unconditional contribution and three for conditional contribution. Hence, for rational and selfish players, contribution should be equal to zero and thus, free riding, independent of the other persons' contributions and thus, assuming common knowledge of rationality and selfishness also the players who have made simultaneous contributions for the public good will give zero for it (Fischbacher et al., 2001).

This experiment is a one period experiment, in comparison to other generally conducted public goods experiments as it aimed at knowing peoples' elicitation of preference for a public good and will not address any inter temporal consideration of strategies. This characteristic of the experiment has been retained from Fischbacher et al., 2001.

PART 3: PRISONER'S DILEMMA GAME

Cooperation is not rational in the prisoner's dilemma game, but people in real life do cooperate. Hence, the prisoner's dilemma game must be modified if we want something more

similar to what really happens in the society. Interaction and cooperation require that one takes risk, hence, trust judgement is a necessary condition for interaction (Arya et al., 2001) and this is what I have tried to model in this experiment.

This experiment has been inspired by similar Prisoner's dilemma games by Charles A. Holt. The same thirty people who played the earlier two parts also attempted this part of the experiment. All the subjects were given two cards-one red and one black, an instruction sheet and a payoff sheet. They were asked to make their choice four times depicting four rounds of game signifying four periods. Subjects were asked to choose between the two cards they have after announcing that choosing a red card will add 3 points to their payoff and choosing a black card will add 5 points to the payoff of the other individual. Although the dominant strategy is to choose red but subjects can increase their payoffs by cooperating and choosing black cards. Subjects will be asked to reveal their choices and will be randomly allotted a partner at that point of time only. This way both of them can affect each other's payoffs. The same procedure was repeated for the second round. After the second round, subjects were told that they know their partner and were asked to make a choice now. Also they were told that for the third and the fourth period they will have the same and known partner. This way we are trying to model possibility of trust between two individuals in the prisoner's dilemma game and to what extent it can affect their decisions. Repetition with the same partner will allow for increased cooperation over time as well as it can act as a motivation to deviate from the cooperative behaviour in the last period and thus, making gains from non-cooperation.

RESULTS

SURVEY RESULTS

The main aim of the survey is to understand the mind-set of the people of Sukhomajri about the checkdams which is a key component of their water harvesting system. The average household size of the sample of people surveyed is approximately 6.4 and all of them belonged to same income class. Since, the number of males and females was kept equal, therefore, there are no gender wise biases in the results.

According to the survey, there are two sources of water in the village- the checkdams and tube wells which were built by the government as well as by the villagers themselves. Agriculture being the main source of livelihood for these people, everybody owns land, big or small. Earlier, checkdams used to be the major source from which the villagers drew water but now with the installation of tube wells, major proportion of water used is from the tube wells. Usage of water from the checkdams has reduced because the site of these dams i.e. the area around the dams along with many other sites have been acquired by the government. This has led to a fall in the water used from these dams. Also, topology of the area is a concern when water from these small dams has to be used. Those who owned lands in the high lying areas could not extract water from these structures to their fields. Distance of an agricultural land from the dam site is also a determinant of use of dam water.

When asked about the utility they derive from the dams and its water, the villagers well understand that in addition to the user benefits provided by the water like irrigation, drinking by animals, and other domestic uses, water has provided them environmental benefits also. These include- rise in the underground water table level, increased plantation and tree stocking in the village and areas around these dams.

The amounts contributed by people for the dams- unconditional and conditional are given in table 1 below. Out of the 30 people who were surveyed, 15 were females and 15 males. Their responses were same for unconditional and conditional questions. But there exist differences in the average contributions made by males and females. In spite of zero contribution being a possible choice, nobody chose to contribute nothing. The maximum amount contributed is 100 and the minimum is 25, out of an endowment of 100 rupees. Males contributed more than the females, on average for maintenance of the dams. The average unconditional as well as conditional contribution (under all three conditions of 0, 50 and 100) for females is 57.33%. Males contributed 74.33% of their endowment on an average and when conditions were told, this average fell to 73%. Since, there is no significant difference between the conditional and unconditional contributions, it can be said that peoples' willingness to put in efforts and money for the upkeep of dams in Sukhomajri is not influenced by other's willingness or their cooperation is not influenced by others. This can also be interpreted in the opposite manner where an individual's cooperative behaviour does not get motivated by

others cooperation. So, the whole sample consists of people who depict unconditional cooperative behaviour. Although, this result cannot be generalised for every individual in the village, as we surveyed only 30 people but this behaviour is prevalent more or less in all.

The question regarding their potential response in case a situation of water scarcity arises in their village again, their response was common. They were willing to build such structures again but only if they are provided with lands which were acquired by the government, otherwise, there are no lands to build dams. Operation and maintenance of dams is currently the responsibility of the Hill Resource Management Society of Sukhomajri. When people were asked if they would prefer the Panchayat to handle this task of management, they did not respond in affirmative. They wanted the society to be the one handling this task. This might be because the society members have gathered their trust over time, also they have been managing the dams well.

EXPERIMENTAL RESULTS

Among the 30 subjects who participated in the experiment, there exist different types- cooperative, altruistic, competitive and individualistic. Using the Ring measure of the Decomposed game technique, 16.67 % of the total subjects are classified as altruistic, 63.33% as cooperative, 6.67 % as individualistic and 13.33% as competitive. For simplification of the analysis, 5 subjects classified as altruistic are assigned to the cooperative group and 4 subjects classified as competitive are assigned to the individualistic group. Now, 80% are cooperative subjects and 20% are individualistic.

In the second part of the experiment, our main concern was to know individual's elicited willingness to cooperate by looking at the amounts contributed by him/her for the public goods. The average unconditional contribution by the 30 subjects is 31.08 % of their income. The average conditional contribution when there is zero average contribution by others is 22.03 %, contribution when condition is 50 % average contribution by others is 33.53% and when the condition is 100% average contribution by others is 39.03%. So, there is a rise in an individual's contribution for the public good, when he sees that others are also contributing

more. It can be said that as the average contribution by others increase, an individual is motivated to contribute more for the good.

Since, the same set of people whose types were identified in the previous part of the experiment, attempted this part as well, average contributions can be studied on the basis of types. As a general conjecture, cooperative subjects should contribute more on average in comparison to the individualistic ones. These results are given in the table below.

Average contributions of others(Conditions)	**Average contribution of cooperative subjects (%)**	**Average contribution of individualistic subjects (%)**
0	24.20	13.33
50	34.42	30
100	40.46	33.33

Table1: Contributions of different types for each condition.

The average contributions of both the types increase with the increase in the average contributions of others. This shows that both types- cooperative and individualistic are motivated by others' contributions. Despite being of individualistic nature, these subjects tend to contribute more for the betterment of the society when they see others contributing more. This kind of effect can generate benevolent behaviour among people and thus, can be utilized by the social activists and government authorities for bringing changes in the society. The unconditional contribution of cooperative subjects is 32.54% on average and for the individualistic subjects it is 25% of their income.

The outcome of the prisoner's dilemma game is given in the table below.

Round	No. of subjects who cooperated	No. of subjects who defected
1	5	25
2	5	25
3	22	8
4	20	10

Table2: Classification of Subjects on the basis of decision for each round

The above results show that most of the subjects chose to defect in the first two rounds of the game when they did not know who their partner is. But when they were told that they will have a known partner, the rate of cooperation increased. Now, most of the people choose to cooperate and thereby choose black. The rate of cooperation increased from 16.67% in the first and second rounds to 73.33% and 66.67% in the third and fourth round. Since, in the first two rounds, subjects were assigned partners whom they didn't know beforehand, defection was a common phenomenon. The rate of cooperation has fallen in the fourth period because of a possibility of some players playing their Nash Strategies. As we know, Nash strategy is to defect in the final period because there is no chance of punishment after that and one can gain by defecting if he expects his partner to choose black. In the situations demanding social cooperation, knowing the person with whom one has to cooperate, increases the chances of cooperation among people. Such as in the village of Sukhomajri, as it is a small village, it was easy to organize people and cooperate and cooperation flourished because of trust among people.

CONCLUSION

This paper addresses the importance of cooperative behaviour of individuals for success of projects like watershed development and other projects which rely on community participation. Utilities arising out of such projects are of the nature of utility of a public good. The degree of community participation is determined by the behaviour of people participating

among various other factors. From the above analysis, cooperative people contribute more for the society. In other words, people who are cooperative by nature, have ability to put in more efforts or money for the success of such initiatives. This has been verified using the Voluntary Contribution Mechanism Public goods game. Also, in situations demanding social cooperation, knowing the person with whom one has to cooperate, increases the chances of cooperation. There exists a scope of enhancing the results of this study. The Voluntary Contribution Mechanism Public goods game used in the experiment is a one- shot game. Increasing the number of periods will enable us to see peoples' behaviour over time. This dynamism might answer the questions about sustainability of projects involving community participation.

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ANNEXURE 1: SURVEY SHEET

1. Name:

2. Age:

3. Education:

4. How many people are there in your household?

5. Do you own land in this village?

6. Have you used the water from check dams?

What are the other sources of water in the village?

Which one do you use more often and how large is your need met by the check dams?

7. What kind of benefits do these dams have for you?

a. The water has utility for you

b. It is good for the village to have such water harvesting structures for the sake of the environment

c. It has no utility at all for you

8. If you have Rs.100 as your income, how much are you willing to pay for the maintenance of these structures?

What will be your contribution if the other person is paying (0, 50, and 100)?

9. If similar kind of situation of water scarcity, rainwater runoff and thus, soil erosion arises in your village, would you build structures like check dams again?

10. Whom do you want to handle the maintenance of the existing structures? - The Panchayat or the Hill resource management society (currently handling this task).

ANNEXURE 2: EXPERIMENT SHEET

Name:

Gender:

Age:

Instructions for Part1

You are a member of a society. You will be given 24 decision problems and will be randomly paired with another person whom we refer simply as other. Both of you will work together for a community project. I am interested in knowing which of the two payoffs, you as an individual prefer the most in each of the problem. Each pair say, (x, y) will mean x points for you and y points for your partner. Out of the 2 pairs you have to select one.

You can either choose to maximize your own points, **or** you can choose to maximize your partner's points **or** you can choose to maximize the sum of your and your partner's points. So, please make choices you think are the best.

Before you begin, it is important to know that these points have monetary value to you and for the other person as well. Also imagine that the other person knows the same about his own points. For each of these 24 combinations, make the choice you consider the best. Please mark the choice by highlighting it or by changing the font.

1. (0 , 15) or (3.8 , 14.5)

   {**Note on interpretation**: In the first option: you get 0 and your partner gets 15 and in the second option: you get 3.8 and your partner gets 14.5 and same kind of explanation holds for rest of the decision problems.}

2. (3.8 , 14.5) or (7.5 , 13.1)
3. (7.5 , 13.1) or (10.6 , 10.7)
4. (10.6 , 10.7) or (13 , 7.6)
5. (13 , 7.6) or (14.5 , 4.1)
6. (14.5 , 4.1) or (15 , 0)
7. (15 , 0) or (14.5 , -4.1)
8. (14.5 , -4.1) or (13 , -7.6)
9. (13 , -7.6) or (10.6 , -10.7)
10. (10.6 , -10.7) or (7.5 , -13.1)
11. (7.5 , -13.1) or (3.8 , -14.5)
12. (3.8 , -14.5) or (0 , -15)
13. (0 , -15) or (-3.8 , -14.5)
14. (-3.8 , -14.5) or (-7.5 , -13.1)
15. (-7.5 , -13.1) or (-10.6 , -10.7)
16. (-10.6 , -10.7) or (-13 , -7.6)
17. (-13 , -7.6) or (-14.5 , -4.1)
18. (-14.5 , -4.1) or (-15 , 0)
19. (-15 , 0) or (-14.5 , 3.8)
20. (-14.5 , 3.8) or (-13.1 , 7.5)
21. (-13.1 , 7.5) or (-10.7 , 10.6)
22. (-10.7 , 10.6) or (-7.6 , 13)
23. (-7.6 , 13) or (-4.1 , 14.5)
24. (-4.1 , 14.5) or (0 , 15)

Instructions for Part 2

You reside in a locality where an event has come up which can adversely affect your survival (such as basic needs of life). But community participation can minimize these negative effects and thus, help everyone to lead a quality life.

You have Rs.100 as your initial endowment. You will be required to contribute some money (any amount between or equal to zero and Rs.100) from this money towards a common fund. This Rs.100 belongs to you and contribution is optional. However, the total group money collected will be invested for the development of your locality and this will incur utilities which will be of nature of a public good. Thus, your earnings consist of the amount of money that you have not contributed plus an equal share in the utility you derive from improved surroundings plus the payoff you receive through a random mechanism. In this mechanism, your actual payoff will be determined by a random choice among the decisions you made in question 1 and question 2 below.

1. How much out of Rs.100 do you want to contribute towards the common fund?

2. How much out of Rs.100 do you want to contribute towards the common fund if the average contribution by other members of the society is given as 0 or 50 or 100? Please write your decision for each of the three values.

Instructions for Part 3

You are given a red card and a black card. You have to choose a card. In this game, you will be randomly paired with some person who is unknown to you. Choosing a red card will add Rs.3 to your earnings and your partner's earnings will not change and choosing a black card will add Rs.5 to your partner's earnings and your earnings will not change.

If you play your red card, then your earnings in rupees will increase by Rs.3, and the earnings of the person matched with you will not change. If you play your black card your earnings do not change and earnings of the person matched with you goes up by Rs.5. If you each play your red card, you will each earn Rs.3. If you play your black card and the other person plays his or her red card, then you earn zero and the other person earns the Rs.8. If you play red and the other person plays black, you earn the Rs.5, and the other person earns zero. If you both choose black, then both of you get 5 rupees each.

You have to make choice between red card and black card 4 times in the following game considering this to be a 4- period sequential game.

Period 1: Which card - red or black do you want to play when you do not know who your partner is?

Period 2: How does your answer change, if it does, in the second period if your partner is unknown again?

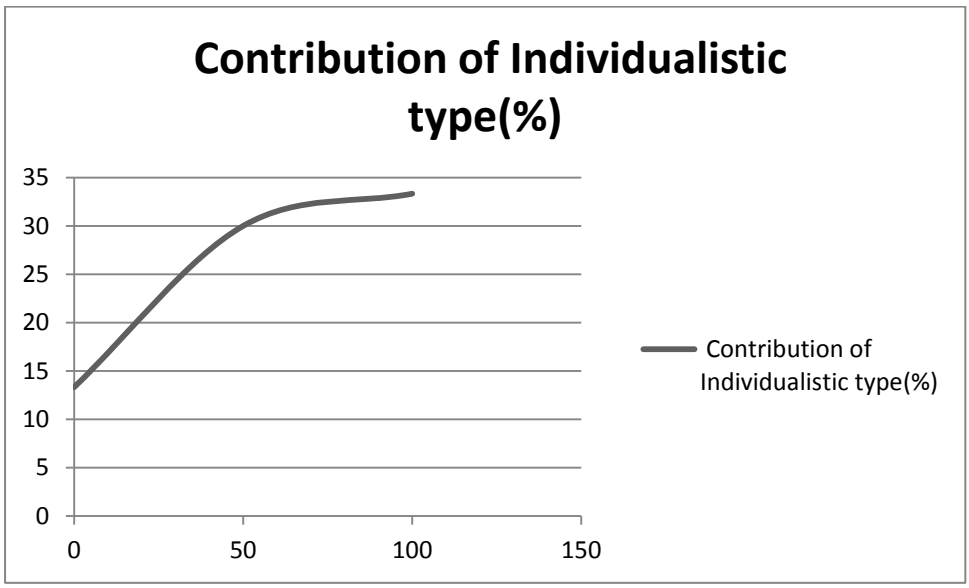
Period 3 and **4**: For these two periods you are assigned a known partner, now which card do you want to play for each period 3 and 4?

Please mention your answers below the questions.

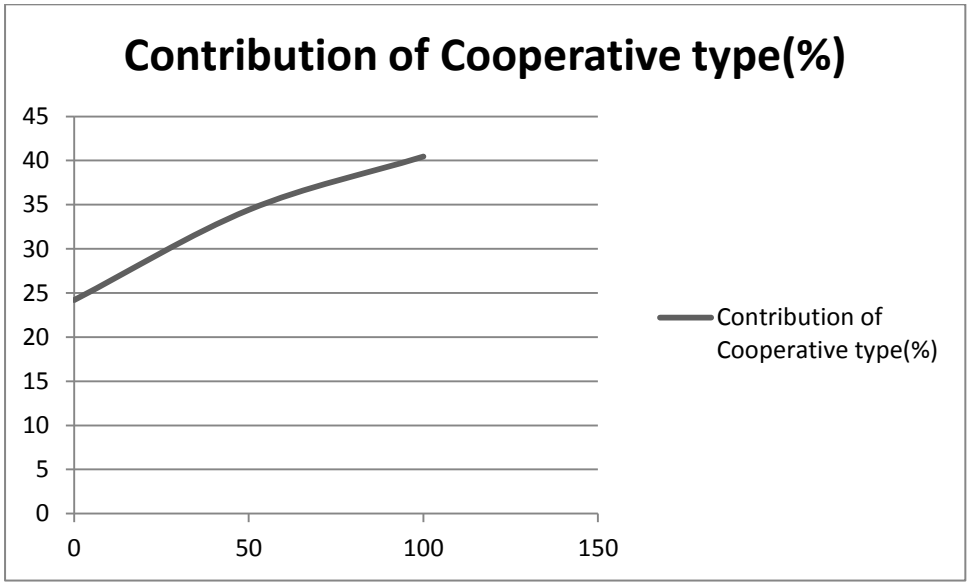
Thank you.

ANNEXURE 3: GRAPHS and FIGURES

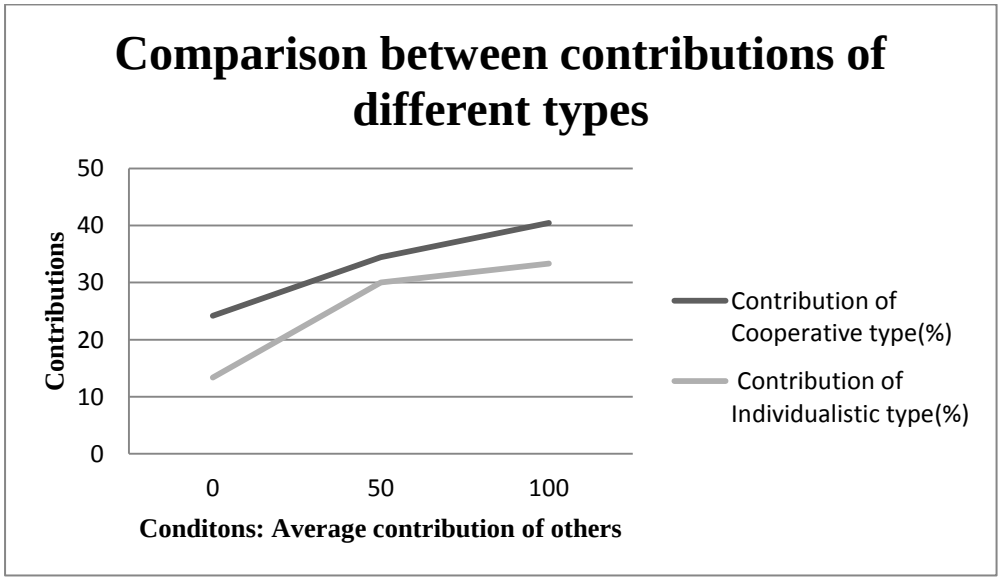
1.



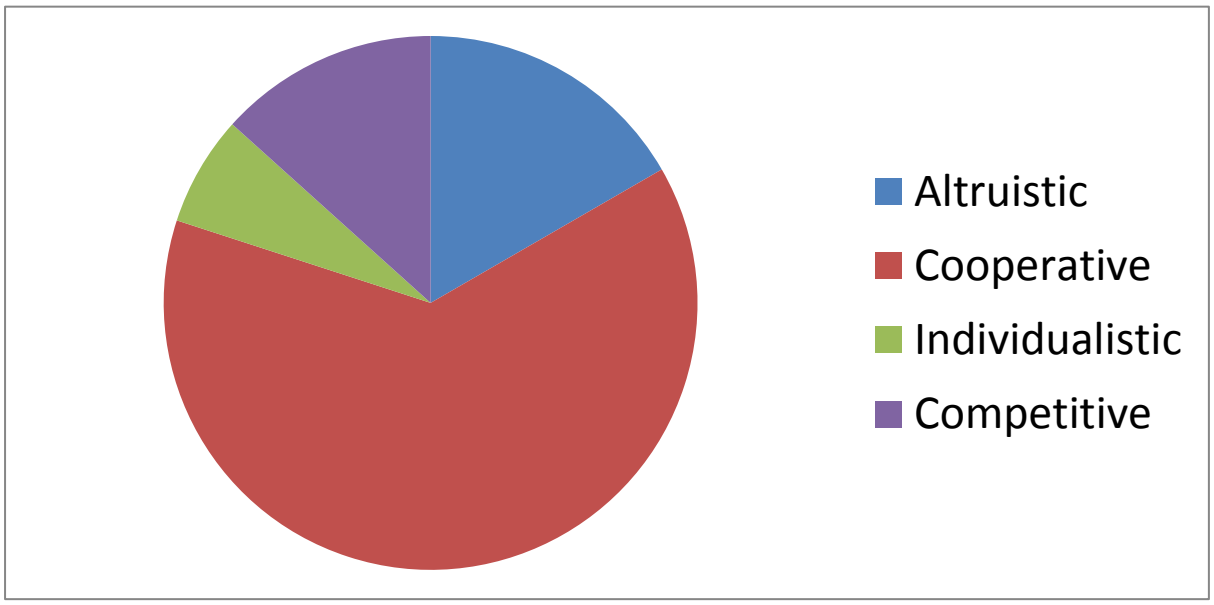
2.


Contribution of Cooperative type(%)
45
40
35
30
25
20
15
10
5
0
0
50
100
150
Contribution of Cooperative type(%)

3.


Comparison between contributions of different types
Contributions
50
40
30
20
10
0
0
50
100
Conditons: Average contribution of others
Contribution of Cooperative type(%)
Contribution of Individualistic type(%)

4.



PIE CHART SHOWING DIFFERENT TYPES OF SUBJECTS IN THE EXPERIMENT