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Qualitative Reflexive Research for Bridging the Traditional Agricultural Practices with Contemporary Technological Upgradations in North-Western Himalayas

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Abstract

This study explores the challenges faced by farmers in the Garhwal Mandal region of Uttarkashi district in north-western Himalayas, based on field visits and data collection conducted in 19-20 villages. Using qualitative research methodologies, we identified key issues such as technical difficulties, implementation and adaptation gaps, social challenges and policy-related problems. Our focus was on addressing technical difficulties through design innovation, enhancing traditional agricultural equipment to be more cost-effective, easy to maintain, and sustainable. This approach aims to foster self-reliance among local farmers, improve the sustainability of agriculture in the hilly regions, which may also reduce migration. Our findings highlight the need to integrate modern advancements into traditional techniques to make farming more viable and appealing for future generations. The strengthening of traditional agriculture equipment was decided to be based upon two important aspects: that the strength of the traditional practices should be maintained and further enhanced, and the above-mentioned insight should direct the outcomes of reflexive qualitative research conducted in the Himalayan villages. Being problem identification research, the study had to be based on exploratory research design pursued through reflexive methodology.

Keywords- Himalayan agriculture, design innovation in farming, qualitative research, reflexive methodology, traditional farming practices, technical innovations

1. INTRODUCTION

The work aims to investigate both advantages and disadvantages of technology in agriculture and to make the case that, when utilized responsibly, it may boost output (Devi, Birania, and Chaudhary, 2022). The link between conventional agriculture's technological advancements and efficiency benefits is actually experienced. It implies that there could occasionally be a relationship between the two because of things like familiarity with conventional farming methods and institutional and cultural limitations (Xu and Jeffrey, 1998). Over the last 5-6 years, I have worked on various projects in the Himalayan region. One of our major projects, supported by the National Mission for Himalayan Studies (NMHS), Ministry of Environment, Forest & Climate Change, Government of India., was titled "Socio-Economic Value Creation through Forest Bio Residue with Alignment to UN's SDGs (Design for Rural Development) project reference no NMHS/2018-19/MG55/06 https://nmhs.org.in/success_stories.php).This project, conducted over more than three years, involved designing and developing a briquetting machine, for which we successfully secured a patent. We trained approximately 5000-6000 beneficiaries, including many women, children, and elderly individuals, to promote self-employment.

My visit started with the visit to a village where I had in-depth conversation with the local communities to learn about their needs and gain trust. My prior experience in the forest bio residue project enabled us to build a

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relationship and gain a valuable insight from the local peoples. First, I primarily focused on understanding the cultural traditions and the difficulties that the communities faced in hilly regions. Since these communities had been using their strategies for generations, and since they were naturally suspicious of new initiatives, it was extremely important to earn their trust. To build this trust, we engaged in the local activities, had group discussions, and emphasized problem-listening while totally integrating into the community. Using this strategy, we were able to figure out their issues and deliver suitable technological solutions. We understood that the locals' peoples could only give us their trust if they believed we might honestly be assisting them in enhancing their farming methods. This building of the trust step was necessary for ensuring their willingness to collaborate and embrace the novel technology. With consistent communication and understanding, we had the ability to pinpoint the problems and conduct the necessary research to provide appropriate technological solutions. During the past five to six years of field exploration and project work, this way of interacting with the peoples, developing trust, and evaluating their problems has been an essential aspect of our strategy. From this experience, we have grown to understand how crucial it is to implement successful technological innovations in conventional settings with patience, understanding, and effective communication.

2. THOUGHT PROCESS BEHIND THE RESEARCH

The main goal of this work is to find out how modern technology could enhance indigenous farming methods in the northwest Himalayan region. Understanding the advantage and challenges of integrating modern technology with traditional methods is the explanations. The aim is to enhance the sustainability of traditional farming methods by enhancing and protecting current traditions while integrating development in technology.

Traditional methods of farming are extremely significant to the local beneficiaries in the mountain areas. The prospective benefits of modern technology and how to access and use it may not be known to many farmers, regardless the fact that they are familiar with these approaches. Training sessions, planned teaching, and initiatives to raise awareness were all part of our plan to strengthen these communities' abilities. We can introduce suitable technology developments that are cost effective, environmentally friendly and easy to maintain by learning about their current practices and problems.

3. PROBLEM STATEMENT

The Uttarkashi district's mountain peoples primarily depend on traditional agriculture technologies. However, these methods face challenges due to economic, geographical, and technological limitations. While contemporary technology offers potential solutions, it must be integrated in a way that respects and builds upon traditional practices. Given the dispersed communities, difficult terrain, and limited access to resources, it's crucial to develop self-reliance, sustainable alternatives that can be easily adopted by local farmers.

Hence, there must be research which focuses on identifying the strengths of traditional practices and improving them with modern technological upgrades. The goal is to enhance traditional technologies while maintaining their core characteristics. We aim to make these practices more convenient and effective without significantly altering their traditional nature. By doing so, we hope to minimize the problems faced by local communities and minimize their reliance on contemporary technologies, ensuring that traditional methods remain relevant and sustainable.

4. LITERATURE REVIEW

4.1 Reflexive research in agriculture

Reflexive research focusses the role of researcher's perspectives and experiences in shaping the research process. This method is crucial for understanding as well as improving conventional practice es in agriculture. Investigator may interact more effectively with the local communities and understand their issues and social circumstances by using reflexive approaches (Alvesson, Sandberg, & Einola, 2022). An enhanced understanding of the participant and respondents result from this method. The benefits of integrating contemporary technology with traditional method of farming have been shown in several articles, which are the result of reflexive research executed by a variety of authors through various endeavours. Sengar et al., (2022) explored the possibility of adopting a qualitative reflexive approach for looking into the possible use of pine needles as a source of energy. They performed in-depth literature review, field research and interviews with farmers, energy experts and policymakers in regions covered by a lot of pine needles to obtain a range of perspectives. The investigator was able to evaluate

their research design and possible indication of bias critically thanks to reflexive methods, which also helped to confirm the validity of their finding.

Finding the social, technological, and financial barriers to producing power from pine needles was the goal of this research. To aid people with developing feasible ideas, Sengar et al. (2020) arranged seminar, integrated case study and delivered practical examples. The comprehensive strategy aligns with the goal of integrating conventional farming practices in the North-west Himalayan regions with modern technologies. As a socially responsible way to reduce forest fires in the pine regions of the North Himalayan, Joshi, Sharma, and Mittal (2015) looked at the potential benefits of forest bio-residue briquetting. Their research started with an in-depth analysis of the literature on forest bio-residues and briquetting techniques as they executed field surveys to understand local factors and limits, they adopted a reflexives method to mitigate potential biases and remark on the study process.

Conversations with experts, participants, and members of the local population revealed more information. The primary goals of the analysis of the information were to identify advantages for both society and environment as well as to determine their impact on reducing forest fire. Meetings have been organized to discuss the result and develop strategies to optimize engagement with the community. This method demonstrates the practical application of reflexive research in resolving problems related to society and the environment.

4.2 Reflexive methodology and its benefits

Reflexive approaches provide significant perspectives into the problems peoples face in farming. They render it potential for researcher to:

- Comprehend Local Needs: Through interacting with farmers and an understanding of their on a daily basis challenge, Investigators might develop solutions that are appropriate and culturally significant.
- Develop Trust: Han et al. (2016) point out that developing trust with the local peoples is crucial to the successful implementation of new technology. By involves farmers in the research process, reflexive research aids in the formation of the trust.

4.3 Case studies and evidence

The application of reflexive research in agricultural innovation has shown promising results:

- **Development of briquetting Mmachine:** Sharma's project (2021) included building a briquetting machine adapted to meet the needs of peoples in the Northwest Himalayan region.
- **Watermill innovations:** Singh's work (2016) Highlights how modern design ideas may be utilised to enhance traditional methods by mean of reflexive research on watermills.

4.4 A paragraph on following patents

These patents address a several kinds of issues in resource effectiveness and environment management by including an extensive variety of advancement in environmentally friendly farming techniques and innovation. The aim of CN104285533A and CN105027909A are to enhance the output of agricultural by using controlled circumstances and soil enhancement methods. The traditional watermill upgrades found in IN201202598IE and IN201202599IE emphasis portability and low maintenance for rural applications. The environmentally conscious wool roving machine for rural workers is shown by IN20150120I3. For high yields for farming, CN205196262U and CN106376432A deliver innovations in irrigation systems and the management of water. Innovation in green house irrigation, biogas monitoring, and cost-effective agricultural test frames are examined in CN207665632U, CN108450301A and CN203812054U. To improve productivity in farming and sustainability, CN211861197U, CN211881320U, and CN108293517A exhibit innovative approaches for rainwater collection and greenhouse planting. CN110269041A for contemporary, highly efficient agriculture, developed circular farming production methods. Promote the travel and leisure sector, and also support the sustainable cycle. These patents reflect ongoing efforts to merge conventional methods with modern technology for developed agricultural farming outcomes.

Table 1: Patent

S. No.	Patent	Assignee and Publication Date	Title
1	CN105027909A	Wu chun-fang, cn xia li-ru, cn liu shui-dong, cn bian xiao-chun, cn lin jing-jing, cn And 2015-11-11	Agriculture and animal husbandry coupling production method for controlled environmental ecological agriculture.
2	CN104285533A	Zhao jun-rui, cn li cheng-cai, cn zhao zhi, cn yin zhi-hua, cn and 2015-01-21	Method for using agricultural straw to improve saline-alkali soil.
3	IN201202598IE	Mangal Singh, 2016-08-12	Bhairan Less Gharat Mangal Turbine Cum Gharat (Traditional Watermill)
4	IN201202599IE	Mangal Singh, 2016-08-12	Portable Gharat (Portable Watermill)
5	IN201500120I3	Kumar, mahesh kar, tapas ranjan and 13/03/2015	The eco-friendly, hand-operated, lightweight, portable, and low maintenance Desi(Indian) wool roving equipment is ideal for craftsmen in rural and mountain region.
6	CN205196262U	Han qiu-hua, cn and 2016-05-04	Modern agriculture plants meta filtration of diving and arranges technological underdrain of improvement water and soil high yield.
7	CN106376432A	Wang sheng, cn and 2017-02-08	Novel crop drip irrigation system.
8	CN207665632U	Li na, zhao yuan, cao shi-bo, and 2018-07-31	Agricultural greenhouse watering device with stirring function
9	CN108450301A	Chen zao-lin, and 2018-08-28	Irrigation device for ecological agriculture.
10	CN203812054U	Zheng zheng-bing, cn and 2014-09-03	Rural biogas digester monitoring and early warning system
11	CN211861197U	Zhang jun-shan, and 2020-11-06	New energy agricultural test planting frame
12	CN211881320U	Yu jian-feng, yu jian-long, and 2020-11-10	Three-dimensional planting frame suitable for agricultural greenhouse
13	CN108293517A	Li na, zhao yuan, cao shi-hao, shen han-yu, and 2018-07-20	Agricultural planting greenhouse with rainwater collecting function
14	CN110269041A	Lan yan-yang, huang jun-yi,and 2019-09-24	Production method for circulating type modern efficient agriculture

5. METHODOLOGY

5.1 Research design

The study utilises a qualitative reflexive research methodology with the aim of blending modern technology advancement with conventional farming practices in the North-Western Himalayan regions. In order to completely investigate and understanding the farming methods and challenges experienced by the farmers in the Himalayan regions, this research methodology integrates primary and secondary data collection methodologies.

5.2 Primary data collection

Field visits

In order to better understand and connect historically practices of agriculture with modern technological developments, extensive field visits have been carried out for this study in about 20-22 clusters in the Uttarkashi District's Garhwal Mandal region. Constant contacts with the local farmers, who varied in age from 15 to 80, were a part of these visits, which continued for seven to eight months. On average, a field visit took three to four

hours, and in order to make sure comprehensive collection of data, separate sessions had been scheduled with the various groups within the clusters.

Interviews and discussions

One of the most common techniques used to obtained primary data was carrying out extensive interview and discussions. Structured and partially structured survey were employed to delve deeply into the specific challenges that the farmers were facing during these interactions. The survey explored a variety of subjects such as:

Daily Challenges: The investigation focused on grasping the common challenges faced by the rural peoples**,** including but not limited to resource availability, problems in infrastructure, and societal issues.
Farming Practices: The talks examined the efficiency of traditional and contemporary technology while examining the techniques and implements used in agriculture farming. The farmers discussed their experiences with the contemporary equipment, including its high maintenance cost, incapacity for Himalayan regions, and lack of adaptability.

Questions concerning policy: The peoples were questioned how their employment was affected by the contemporary agricultural policies. Many issues had been raised, such as the lack of small-scale farmers support, the absence of subsidies, and the absence of the policies geared to the unique requirements of the Northwest Himalayan region.

Managerial Problems: There was also discussion on the techniques and asset management in agriculture. The farmers brought up ineffective leadership plans and unsuitable departmental cooperation.

Social challenges: The interview brought to the light substantial social issues that affect farming communities' ability to prosper and operate smoothly. These problems include the absence of an appropriate framework for community support, limited access to education, and gender inequity.

Technical Difficulties: It was discovered that the people's sustainability and productivity were negatively impacted by the technical barriers. The farmers discussed that how costly new equipment may be how difficult it can be to get maintenance for, and how unsuitable it is for the Himalayan region. The conventional methods were thought to be more dependable but required more work and took longer.

Detailed documentation

During the field visits in Himalayan region, extensive documentation of the meeting and observations was maintained. The documentation of the specific challenges the farmers faced, the tools and techniques they used, and their suggestions for the improvements were all part of this process. In hilly region the expert farmer like Mr. Anil kumar Dangwal and Mr Devender Bahuguna discussed and provided a significant observation, which were meticulously documented. These farmers conveyed the valuable knowledge about growing medicinal plants and vegetables, turning them into commodities, and the grinding grain with a water mill called Gharat they were also skilled at using conventional methods.

5.3 Secondary data collection

Literature review

A comprehensive review of the literature on the farming practices in the hilly regions had been done. This make it simpler to see how farming methods have changed over time and how their past context had been impacted by the modern technology.

Government reports and policies

Relevant government documents and policies were looked into in order to better understand the support network for the farmer and the gaps that need to be rectified.

Previous research studies

In order to identify feasible options and ongoing issues, we looked into research on agricultural innovation, sustainability, and rural development in the North-West Himalayan region.

5.4 Data analysis

The information was evaluated using a qualitative reflexive research methodology. With the use of this methodology, it will be feasible to completely understand the observation of the farming as well as the outside influences on agricultural procedures in the region. The analysis's goal was to identify themes and patterns in the issues that farmers faced and consider how design innovation might be able to assist in finding solutions.

Key insights and implications

An extensive grasp of the agricultural difficulties in Uttarkashi's mountainous regions was made possible by the primary and secondary data collections strategies. The goal of the project is to develop sustainable solution that increase productivity, encourage farmers to be self-sufficient and draw in the next coming generation of farmers by fusing contemporary innovations with traditional ways. In addition to serving the immediate needs of farmers, this approach supports the long-term viability and profitability of rural peoples.

Method

There were various methodical steps in the reflexive research process. First, we spent some time learning about and interpreting the information that had been collected. Next, we clearly defined the specific agricultural practices and interventions studied in the Himalayan region. The data was then segmented into initial codes representing different traditional and contemporary agricultural practices. Qualitative data was gathered through group discussions, reflexive studies, and interviews to identify recurring themes. This data was analyzed to identify significant quotes and themes related to traditional versus contemporary agricultural practices. Identified themes, such as "Traditional Agricultural Techniques" and "Contemporary Agricultural Innovations," were consolidated with clear and descriptive labels. Finally, the findings were compiled into a comprehensive report detailing the comparative analysis of agricultural practices in the Himalayan region.

5.5 Data collection and analysis

Data collection process

Data collection was done in approximately 20-22 villages in the Garhwal Mandal region of Uttarkashi District through field visits. The purpose of these visits was to communicate with local farmers- men,women, and children- in order to learn more about the challenges they face on a daily basis.

We were able to identify four primary problems categories from this interaction:

Problem associated with policies: Farmers have difficulties since insufficient policies fail to take into account their distinctive needs and situation. This addresses issues such as lack financial resources, lack of assistance for small-scale farmers, and policies that are not adapted to the unique characteristics of the Himalayan region.

Managerial issues: The management of the agriculture resources and strategy is extremely flawed. Farmers complained about inadequate leadership strategies, poor departmental cooperation, and challenges obtaining access to basic services.

Social challenges: It was determined that there were a number of social challenges, including inequalities in gender, constrained access to education, and a lack of community support systems. The well-being and productivity of farming peoples are severely affected by these social dynamics.

Technical difficulties: Modern farming technology is expensive, difficult to maintain and not appropriate for the local environment, which makes it difficult to adopt. Conventional techniques are labor and time-intensive, but they are dependable. Among these, technical difficulties were identified as having a particularly profound impact on the farmers' productivity and sustainability. Therefore, I have decided to address these technical challenges through design innovation. All farmers, even those with low financial means, can profit from our

solution if we improve traditional agricultural equipment to make it more affordable, easier to maintain, and sustainable.

This strategy seeks to increase the sustainability of farming in Uttarkashi's mountainous regions, decrease the migration, and enhance independent living among the local farmers. We seek to enhance farming's attraction and viability for the next coming generation by fusing new technologies with time-honored methods, therefore supporting the general growth and sustainability of rural peoples.

6. CONCLUSION

The study highlights the importance of blending modern technology advances with traditional agricultural methods to boost farming production and sustainability in the Northwest Himalayan region. In order to produce feasible, affordable, and environmentally sustainable concepts, this study focusses on the unique challenges faced by the local farmers, such as administrative, technological, and legal problems. Invention of the fully manual operating plough, which was influenced by the local peoples, is an example of how modern technology design innovations may considerably strengthen traditional expertise. The approaches promises that agricultural technology advancements respect and maintain the core ideas of the conventional approaches, even as they tackle the real-world problems that farmers face.

The finding demonstrates how important it is for academic, policymakers, and farmers to collaborate in order to promote sustainable agriculture development. In order to maintain their adaptability and benefits to the specific circumstances of the Hilly region. These integrated approaches must be continuously explored and improved. This will help to assure a resilient and fruitful agriculture future.

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