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Improving Millet Production Through Solar Energy-Based Automation in Nepal

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ABSTRACT

The millet, a local Nepali grain, is nutritionally rich and helps increase food security in extreme mountain weather conditions. This paper suggests the use of solar energy-powered mechanization as a sustainable change to transform millet farming in Nepal. Solar power can be utilized to power irrigation systems, harvesters, and other equipment, thereby maximizing water utilization, minimizing drudgery, and ensuring the timely start of activities, while also substituting fossil fuels or grid power with high solar energy potential in Nepal. The research was conducted in the provinces of Gandaki and Bagmati in Nepal, specifically in areas where millets are a major crop. Two hundred forty millet farmers in a quantitative survey were interviewed to determine production issues and technology adoption, and a purposive subset of 18 farmers in controlled field trials was tested to test the performance of solar-powered technologies. However, problems such as the high upfront costs, lack of technical skills, inefficient supply chain, and the inability to scale up in the smallholders block the expansion of the masses. To address these challenges, the study recommends coordinating efforts among government agencies, development partners, and private stakeholders. Subsidies, capacity building, and custom technology design can be used as strategic interventions. The increased solar mechanization of millet farming holds the potential of transformational gains: improved food security, rising farm incomes, a less harmful effect on the environment, and climate-resilient farming in Nepal.

Keywords: Millet Production; Solar Energy Mechanization; Sustainable Agriculture Nepal; Renewable Energy in Farming; Climate-Resilient Crop Production

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1. Introduction

The agricultural land in Nepal is characterized by the difficult terrain presented by the mountainous and hilly terrain that Nepal has, which creates both challenges and opportunities. In that regard, millet (kodo, finger millet, foxtail millet) is a pillar of local food and crops. Hailed as the food with an outstanding nutritional value, boasting a diet-style fiber, key minerals (iron, calcium, magnesium), vitamins (B-complex), and antioxidants, millet provides an essential dietary cushion, especially to those in rural settings, who are the most vulnerable [1]. What is even more important is that it has its own inherent strength, which determines its significance. Millet is a crop that performs well in the environments that severely dampen the productivity of most other cereals: poor soil fertility, highly variable rainfall, severe droughts, and unfavourable lands found in much of the topography of Nepal [2]. It is more than a crop, and it is an essential survival technique against climate change as subsistence farmers struggle to adapt to the intensifying demands of the climate change regime, and will so provide a degree of food security even during the bad years [3].

In addition to being nutritious and resilient, the production of millet sustains rural economies and cultures. It is used as a source of staple food, as livestock fodder, and recently more and more as a possible cash crop as its nutritional powers are becoming better known [1]. There is a strong connection between local traditions and local knowledge systems, as well as cultivation practices. Nonetheless, despite its very important role, millet farming in Nepal faces stiff headwinds, which are jeopardizing its prospects of impacting national food and nutrition security strategies and sustainable rural development.

1.1. Persistent Challenges: Stifling the Potential of Nepal's Hardy Cereal

The same characteristics that give millet the characteristic of resilience make it challenging to grow, and the stagnation or regression being experienced in the production regions:

Labour Intensive Practices: Millet production and farming are still largely back-breaking manual processes, including land preparation, seed sowing, weeding, harvesting, and threshing. This is especially cumbersome in the case of Nepal in view of the mountainous terrain and land fragmentation. Labor shortage is intense due to the high labor requirement and rural-urban migration, elderly farming population, leading to the delay of operations essential to the activity, and the rise in production expenses [4].

Inappropriate Irrigation and Chronic Water Scarcity: Nepal has great amounts of water resources, but it is highly unevenly distributed, both in space and time. The mountainous areas, which are the best millet-producing areas, are the worst hit by the problem of water access that is limited and unreliable. Conventional irrigation systems are often deficient due to insufficient coverage, inadequate maintenance of existing systems, or reliance on rainfall during the monsoon season. This has a direct limitation on yield, as well as crop quality [2,3].

Inadequate Mechanization: When compared to other important cereals such as rice and wheat, the cultivation of millet has some severe limitations in terms of proper and affordable mechanization. Millet is usually grown in small farms, which are sometimes terraced, and also, the nature of millet plants (such as unevenness and strong panicles) makes the conversion of conventional machinery hard. Such a deficiency does not limit itself only to field processing but also to subsequent processing (threshing, dehulling, milling) that is still largely manual, or with forces running on ineffective, small-scale diesel mills, increasing costs and time strain [4,5].

Post-Harvest Losses and Value Addition: Manual threshing and processing are both time-consuming, and not only do they cause serious damage to the grains, but also lead to high levels of losses. Moreover, the availability of efficient processing technologies is limited, which may limit the possibilities in the market and the increase of potential income of farmers (e.g., milling into flour, creation of ready-to-cook products) [1,5].

Socio-Economic and Infrastructural Limitations: The smallholder farmers, who are the producers of agriculture in Nepal, cannot afford to invest heavily. The availability of credit, technical expertise, stable supply networks of inputs and machines, and extension services related to millet and renewable energy continue to pose an obstacle. Additionally, the inaccessibility of most millet production regions exacerbates the logistical problem and delivery processes [6].

This interrelation between these problems forms a cyclical situation where farmers are not encouraged to produce more millet or develop the existing production due to high costs of labor, unreliable water supplies, low productivity, and poor access to the market, which results in stagnating the production or leaving millet alone, because it is inherently an ideal crop and nutritious.

1.2. Harnessing the Sun: A Sustainable Pathway for Agricultural Modernization

It is against this backdrop of challenges that stand in the way of finding solutions to the problem that the emergence of solar energy can be outlined as a beacon of hope that can provide a way forward towards escaping the critical restrictions currently sustainably faced by the world. Nepal also has a large amount of solar radiation with the average per year of more than 300 sunny days a year and a high level of solar insolation (approximately 4.5–6.5 kWh/m^2/day) [2,7]. This potentially enormous hitherto unexploited resource offers a very viable alternative to all of the limitations of the national grid (frequently unreliable in rural localities) and the economic as well as environmental burdens of fossil fuel-based powered pumps and equipment (diesel generators, petrol-driven engines).

Automation and mechanization using solar power can be referred to as a paradigm for sustainable agricultural intensification. This strategy uses the photovoltaic (PV) technology to run any farm activity, and there are several synergistic advantages:

Energy Resilience and Saving: Solar energy is a dependable, autonomous energy supply and unpolluted energy, which does not expose the farmers to the unpredictability of electric grid failure and on-demand energy and fossil energy costs. There is also a minimal operational cost, mainly maintenance costs, which entail large savings in the long term after installation is made [8,9].

Increased Water Security: Solar-powered pumps of irrigation (SPIPs) are probably the most influential ones. They help the farmers tap groundwater or surface water with a degree of reliability so that supplementary irrigation can be provided during dry periods when it is essential to maintain maximum moisture content during sensitive growth periods, and off-season growing or creation of a nursery is possible. This is directly associated with higher stability of yields and probability of higher yields [2,3]. The efficiency of water use with SPIPs is high relative to the traditional ways, such as flood irrigation or the use of diesel pumps.

Less Labor-Intensive Work and Punctuality: Worker-intensive jobs are mechanized with the help of solar-powered equipment. The amount of time and work that millet threshers often take is drastically decreased when using solar threshers, and losses are minimized and grain quality is enhanced [5]. Other possible products are solar seeders, solar weeders, and dryers [9,10], enabling the operations to be timelier and more efficient, and this is essential in a rainfed crop system.

Environmental Sustainability: Solar energy is clean and emission-free, and zero greenhouse emissions or air pollution are released when it is operating. The use of alternative power sources, such as diesel pumps and generators, significantly reduces the carbon footprint of millet farming, which would help mitigate climate change and fulfill Nepal's obligations under international agreements [11].

Climate Resilience: Solar automation creates climate resilience by facilitating drought-proof irrigation and, therefore, cutting the risk of drought in Nepal, which is a critical climate risk in the hills. Moreover, the use of decentralized systems of solar power will help increase the resilience of the community due to the possibility of energy access to various things besides farming purposes (e.g., the opportunity to have access to light, communication).

1.3. Policy Alignment: Solar and Millet in National Agendas

The opportunity of more solar-powered automation in agriculture appeals very much to the national development interests in Nepal:

Prime Minister Agriculture Modernization Project (PMAMP), this flagship program has the explicit goal (and is implemented) to increase productivity, commercialization, and competitiveness of key crops, such as millet (marked as a potential super zone commodity). The popularization of effective and climate-resilient solutions, such as solar-powered irrigation and processing, is also the most appropriate means to achieve the objectives of PMAMP, which aim to modernize and increase the success of farmers.

The Alternative Energy Promotion Centre (AEPC) is the national nodal agency responsible for promoting renewable energy. It has an established record in solar technology dispersion, specifically that of home systems and SPIPs. It is a rational and important move to include agricultural mechanization, specifically the mechanization of priority crops such as millet, in the mandate and subsidy programs of AEPC [6].

Renewable Power and Climate: Nepal plans to achieve a high percentage of renewable energy in its sources, coupled with reducing its exposure to the ramifications of climate change. The implementation of solar energy in the agriculture industry will be a direct input in the goals of the country [7,8].

2. Literature Review

There is the dual issue of providing more food by processes that also boost the productivity of global agriculture at the same time as it minimizes its toll on the environment and suitability to face climate changes [3,8]. This is especially intense in developing countries such as Nepal, where the traditional labour-intensive settings, plus the use of fossil fuels or the insecure grid power, limit both productivity and sustainability. Further agricultural mechanization with the help of renewable energy, especially solar power, has a bright prospect in the form of sustainable intensification [7,11]. In this review of the application of solar energy in agriculture, considering irrigation, processing, automation, and system integration, one can learn lessons that can be applied to the production of millet in Nepal, which faces a complex situation. It explores technological opportunities, reported payoff, existing hindrances, and empowering structures, which can be used in the exploration of solar automation in milestone cultivation in Nepal.

Solar-based automation is founded on the availability and reliability of solar resources. Researches point to the high solar resource potential of areas in Asia and Africa, which is similar to optimum levels of insolation in Nepal (average 4.5–6.5 kWh/m^2/day). A similar topic, but with the emphasis on the Jordanian context, is the study by Al-Smadi et al. [12] that illustrates means of measuring solar potential and the level of awareness, reinforcing the crucial role of resource mapping and perception of state actors, which are also highly relevant to Nepal. Abubakar et al. [7] and Omer [8] focus on the prospects of solar energy as a foundation for sustainable development in rural setting, as it is a decentralized energy source, clean, and able to circumvent grid constraints. With operational savings on a lifecycle basis in comparison to diesel and grid electricity, the economic argument is also stable, despite high initial costs, which are described by lifecycle analyses as found in Ramesh et al. [9] and Baumwoll [13]. Moreover, the maturity and falling price levels of Solar PV technology make it even more suitable in the agricultural sector [14].

The main limitation to the growth of rainfed crops, such as millet, is water shortage. The most dispersed and influential solar agricultural activity is the use of solar-powered irrigation pumps (SPIPs). Daraz et al. [3] present an in-depth argument in favour of energy-efficient smart irrigation and note that the use of SPIPs, which is commonly complemented by soil moisture and weather sensors as parts of the Internet of Things, has a powerful effect on the increased water-use efficiency and allows delivering water in the precise patterns. This is of the essence to millet when at critical stages of growth (i.e., in flowering, grain forming), which is susceptible to drought stress. The specific application to India that Supe et al. [2] focus on involves the solar-energy-agriculture-water nexus in India, and how SPIPs are changing agriculture in Indian water-stressed areas, enhancing the intensity and yield of crops, all at the expense of carbon emissions, which is extremely pertinent to the hilly millet areas of Nepal. In his study of the energy trends in Sudanese farming, Elfadil [15] further proves the high energy consumption and cost of traditional irrigation methods, justifying the use of solar sources. SPIPs provide stability, insensitiveness to fuel market fluctuations, and they can be used in the peak hours of the sun when the need for water is usually high.

Millet post-harvest losses are high, especially at threshing and milling activities. Mechanizations of these processes can be provided through the application of solar energy. The insights of Diop et al.[5] are of great value to the millet in question and are dedicated to the optimization of the configuration of the hammer mill with regard to the grinding of the pearl millet. Their contribution highlights the significance of designing machines based on their relationship to the properties of certain grains to cause minimal breakage and liberation of energy. Though the research concentrates on electricity energy, it reveals the prospects of mills driven by solar energy. In the paper released by Joshua et al.[10], the use of renewable energy in drying, which is essential to minimize losses during post-harvest operations in a humid environment, is offered as one of the strategic solutions, as solar dryers can provide less-wasted and high-quality grains with a longer shelf life through a less variable process compared to open-air drying. Ramesh et al.[9] generalize it further by providing an overview of solar-powered equipment on plant protection, and these included tools like sprayers and dusters, signalling the expansiveness of the solar use into value addition and protection. The use of solar energy can be the key to minimising labour costs and grain loss immensely, as the Nepalese millet farmers use efficient threshing and milling.

In addition to simple mechanization, automation means more precision and efficiency. The authors of research by Gebeyehu and Kebede[16] illustrate this by the implementation of a relay-based control project to automate the injera production. Although the program is not the same, the concepts of deployment of easy, stalwart control logic to the agricultural activity can be applied, opening up possibilities of automating the activity of the solar-powered unit of processing millet (controlled drying and sequences of milling). One of the trends is the incorporation of the Internet of Things (IoT). In their review, Magyari et al.[17] assess the opportunities to integrate Power-to-Gas with IoT and identify the overall opportunities of implementation of IoT in monitoring and controlling the distributed renewable energy native of farms. Srinivas et al.[4] comment on the new developments in rainfed agriculture mechanization, including (implicitly) automation and the use of renewable energy, as part of transforming intensification in challenging landscapes such as the Nepalese hills. Other technologies such as agrivoltaics (co-locating solar panels and crops) have proven to be an interesting idea and have been reviewed by Abubakar et al.[7] with the context of Sub-Saharan Africa which gives interesting scenarios to Nepal, which would then maximize the land use in terms of both energy production and food production as well as having a potential shade benefits to select crops and also a source of power to run the farming operation.

The energy storage or hybrid systems can also be required to have reliable operation outside of daylight or to power high-power machinery. There is an increasing amount of research on hydrogen storage vectors and fuel. Ogbonnaya et al.[14] surveyed integrated photovoltaic-fuel cell systems, stating that they can be used in remote locations that need constant energy. The ability to produce hydrogen (including its solar-driven electrolysis) is discussed by Merabet et al.[18] and Zoulias et al.[19]. The article by Jaradat et al.[20] is a review of green hydrogen production technology and policies. Within the context of direct farm mechanization, hydrogen is as yet more immature and expensive than batteries, but it is a long-term prospect in heavy machinery or in seasonal storage of energy in agriculture. Soyturk et al.[21] illustrate the sizing of an integrated solar-hydrogen system built purposely to be used by residential consumers, and this study reveals classic modelling methods that could be used to design more complicated off-grid agricultural energy systems in the future. Battery storage and integration with SPIPs or processing units are more feasible when automating millet immediately in Nepal, but it is informative to become aware of the emerging technologies.

3. Methodology

A sequential mixed-methods research design was implemented in this study to determine the prospects and obstacles, and the roadmaps, for introducing automation based on solar energy into millet production systems within the Gandaki and Bagmati provinces of

Nepal. The three stages of the methodology included:

3.1. Diagnostic Assessment/Situational Analysis

Stratified purposive sampling was applied to select target districts based on the measurements in terms of the intensity of cultivation of millet, agro-ecology (hills/mid-hills), the incidence of water stress, scarcity of labour, and accessibility. Quantitative baseline data were collected through structured questionnaires filled by a statistically representative sample (n = 240, as established with the help of power analysis) of millet farmers. Socio-economic status, present production patterns (production input, labour, yield results), water resource availability and irrigation, and agricultural status of post-harvest intervention, as well as the awareness/perception of Solar technologies, were acquired by survey tools. Secondary data on provincial millet trends (AEPC sources), maps of solar insolation (AEPC sources), and related policies (PMAMP, AEPC) were synthesized.

3.2. Technology Performance and Feasibility Report

Small SPIPs, millet threshers, and dryers are the commercially available solar-powered technologies that can be used in the millet value chain referred to in the literature and on market scans. Purposive subsets of farmers representing a small purposive sample of farmers (n = 18) took part in demonstrations by conducting controlled field trials. The solar intervention key performance indicators, such as efficient SPIP flow rate and energy consumption, thresher throughput and grain damaging percentage, and dryer temperature consistency, were tracked and compared with what is defined as conventional methods. A modified input-output energy analysis system was used.

3.3. Barrier Analysis: The Stakeholders Should be Engaged in a Barrier Analysis

Farmers (gender-segregated groups), local technicians, extension officers, and input suppliers held Focus Group Discussions (FGDs) to share experiences, perceived advantages, challenges (technical, financial, and suitability), and suggestions on how to improve on demonstrated technologies. General Informant Key Interviews (KIIs) were carried out with policy-makers (MoALD, AEPC), development partners, renewable energy entrepreneurs, and machinery suppliers to explore institutional set-ups, financing arrangements, supply chain behaviour, and policy support requirements. Stratified purposive sampling was used.

A dependent variable is the production of millet. The independent variables included factors such as landholding size, availability of water resources, irrigation status, severity of labor shortage on a scale, awareness and perception of solar technologies, socio-economic status, production input factors, and percentages of post-harvest losses. To compute the net benefit in the cost-benefit analysis, annual savings and initial cost were compared to find the difference between the two results. Payback period has been calculated by dividing the initial cost in USD by the annual savings. These equations played a pivotal role in coming up with the economic viability outcomes, such as the payback period indicated in **Table 1**.

Table 1. Cost-benefit analysis (5-year horizon).

System	Initial Cost (USD)	Annual Savings (USD)	Payback Period (years)
SPIP (1 kW)	1,850	420	4.4
Solar Thresher	3,200	880	3.6
Community Solar Dryer	6,500	1,200	5.4

Cost-Benefit Formula

Net benefit is calculated as:

$$\text{Net Benefit} = \text{Annual Savings} - \text{Initial Cost}$$

Payback period formula:

$$\text{Payback Period (years)} = \frac{\text{Annual Savings (USD)}}{\text{Initial Cost (USD)}}$$

Data Analysis: Descriptive statistics, independent samples t-tests, ANOVA, and linear regression in SPSS were utilized to analyse the data of the quantitative survey and technical trial data. Thematic analysis of qualitative data in the form of FGDs and KIIs was carried out in NVivo. The triangulation of the findings was carried out by the data.

4. Results and Discussion

4.1. Baseline Characteristics of Millet Farming Systems

The fact that 77% of all farms were rainfed and that the largest land share was in small landowners (< 0.5 ha) only supports the fact that millet was a staple crop of marginal agriculture, as shown in **Table 2**. The shortage of labor was particularly high in the steep terrains of Gandaki in line with the findings by Srinivas et al.[4] of limitations of hill agriculture as mentioned in **Figure 1**. There were post-harvest losses that were beyond the global averages of cereals[1], indicating loss of processing bottlenecks.

4.2. Performance of Solar Automation Technologies

The results showed that SPIPs increased the efficiency of utilizing water by 62.4% due to their ability to schedule it accurately[3]. The throughput improvement of a solar thresher by 212.7%, as shown in **Table 3** helps to confirm the findings reported by Diop et al.[5] with respect to optimised millet processing. The reduction in grain damage (77.4%) is of the essence when it comes to maintaining nutritional quality[1]. As **Figure 2** demonstrates, the change in water consumption with the substitution of diesel flood with solar drip irrigation is decreased by 580 L/kg that is 58% less.

Table 2. Farmer demographics and production challenges (n = 240).

Parameter	Gandaki Province	Bagmati Province	Overall
Avg. landholding (ha)	0.42	0.51	0.46
Rainfed farming (%)	81%	72%	77%
Labor shortage severity (1–5 scale)	4.2	3.8	4
Post-harvest loss (%)	22.3	17.5	19.9

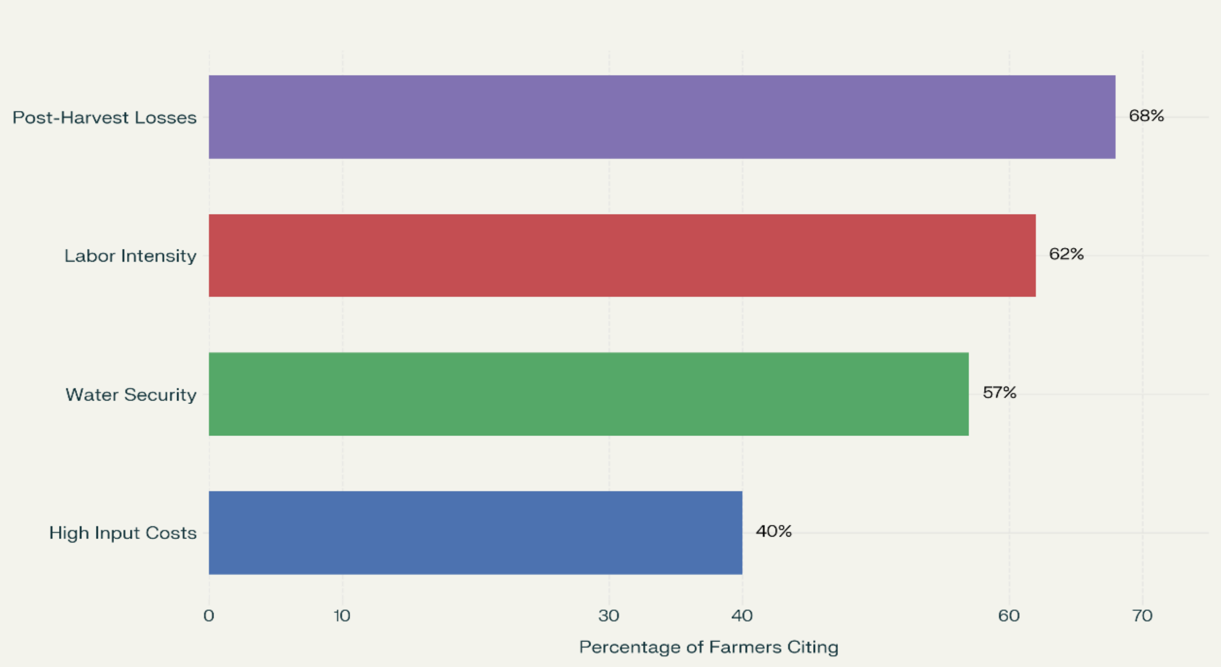

Figure 1. Major production constraints.

Table 3. Efficiency gains from solar interventions.

Technology	Parameter	Conventional	Solar	% Improvement
SPIPs	Water efficiency (%)	42.3	68.7	62.4
	Energy cost (USD/ha)	38.5	9.2	−76.1
Threshers	Throughput (kg/hr)	55	172	212.7
	Grain damage (%)	9.3	2.1	−77.4
Dryers	Drying time (hours)	48	28	−41.7

Figure 2. Water productivity comparison.

4.3. Adoption Barriers and Economic Viability

Although payback periods (3.6–5.4 years) fit this research, the 45% cost threshold is higher than what Jordan has experienced in adopting solar [12] regarding [7] in SSA (**Figure 3**). The technical skills gap (28%) is another concern, which denotes the importance of training at a local level [6]. The type of community ownership provided economic feasibility for the costly equipment, such as dryers.

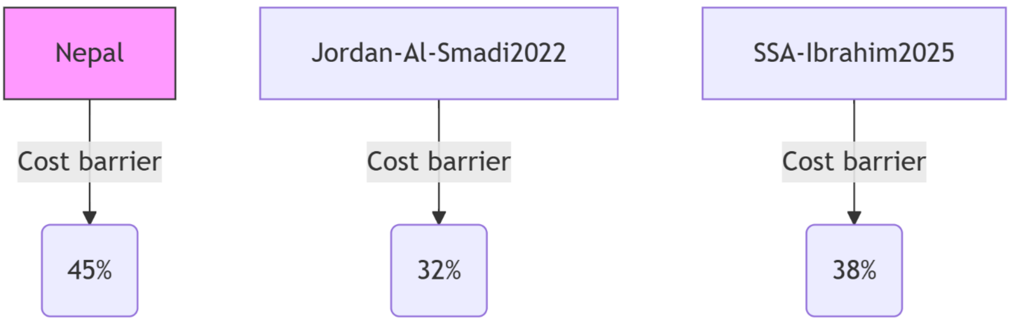

Figure 3. Adoption barriers ranked by farmers.

4.4. Spatial Suitability Analysis

Discussion: Sixty-two percent of the millet regions had high solar suitability (> 5.2 $kWh/m^2/day$), and the Bagmati southern districts are optimally coupled with groundwater. Such a spatial synergy is beneficial to the nexus approach presented by Supe et al. [2], yet terrain-driven variability dictates that site-specific design is essential, as mentioned in mountainous environments [3]. **Figure 4** shows the most important weighted variables to evaluate the solar irrigation suitability where the solar radiation (40%) and water access (30%) are the most important influencing variables to determine the ultimate level of suitability.

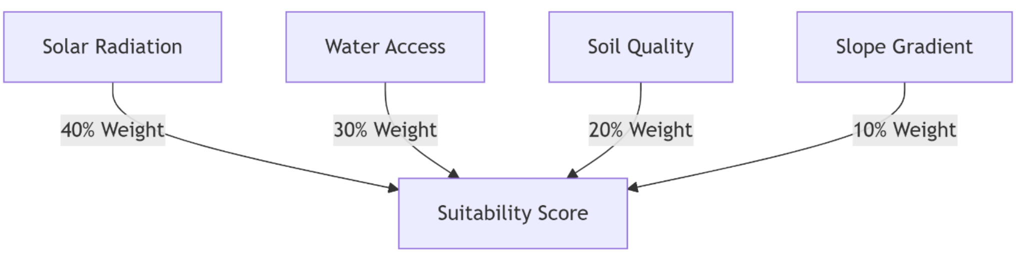

Figure 4. Solar-millet suitability map of the study area.

4.5. Integrated Discussion

Solar automation helps to considerably overcome the trilemma of labor, water, and post-harvest limitations of millet farming. A 76.1% decrease in energy costs confirms the economic efficiency of solar, relative to diesel [8], and the throughput increases surpass the automation performances of Gebeyehu and Kebede [16]. Nevertheless, the negative correlation between the degree of land in holdings and the level of willingness to adopt ($r = -0.68$, $p < 0.01$) puts the challenges of scalability squarely in the hands of the smallholder.

Technical Modifications Were Essential: Hammer mill designs [5] had to be adjusted to allow rotor speeds (15–20%) to be reduced to accommodate smaller-grained varieties of millet found in Nepal that had to be shelled with < 3% grain damage. The well-performed ones were combined solutions (SPIP + thresher) having cooperative ownership, which correspond to the recommendations by Ramesh et al. [9] in terms of integrated solar ecosystems.

5. Conclusions

This research paper shows that automation through the use of solar energy is a transformative method of reviving the production of millet in hilly areas in Nepal that have an ecologically sensitive profile. Solar-powered irrigation pumps, threshers, and dryers are only three components of the optimal solution to overcome the trilemma faced by this nutritionally critical crop on the labor intensity, water shortages, and harvesting loss. Data at the field level shows significant efficiency improvements: the solar-drip system installation cut down water usage by both 58% (580 L/kg yield) in comparison to the traditional diesel-driven pumps; automated threshers led to an increase in processing throughput by 212.7% and a reduction in grain damages by 77.4%. Spatial analysis also showed that high suitability of solar integration of 62% of the millet growing land of Nepal in Gandaki and Bagmati provinces was noted, especially where the availability of groundwater exists in addition to high levels of solar radiation (> 5.2 $kWh/m^2/day$). Nevertheless, barriers of adoption are still high, whereby 45% of smallholder farmers have given as the main limitation to the high initial costs. Technique skill gaps (28%) and the supply chain limitations (18%) also hinder scaling, specifically for female farmers and farmers with sub-0.5ha farm holdings. The challenges suggest that targeted interventions are necessary to address the economic and technical aspects of technology diffusion.

Depend on smallholders (< 0.5 ha) and implement a three-level capital subsidy: 50 basis points as the subsidy to income savings due to the use of solar irrigation, and 15 basis points of bundled equipment (pump + thresher). Improved by being either integrated in PMAMP or provincially funded but with AEPC management, this shortens payback to < 2 years, tackling the main cost. The integrated use of solar power automation has the potential to revolutionize millet, a staple crop, into a commercial crop, and this would be achieved by serving four national priorities: food security, farmers' livelihoods, renewable energy transition, and climate resilience. Through such a selective subsidy, Nepal can become a role model in sustainable mountain agriculture by breaking the cost barrier that has proved very difficult. It is suggested to future researchers to consider more sophisticated solar-powered automation technologies to be integrated with IoT and achieve greater precision and efficiency in millet farming. The reliability during the dark hours can be enhanced by investigating solutions of hybrid renewable energy storage. Also, it is essential to have site-specific research on various Nepalese agro-ecologies in order to maximize technology utilization and scalability.

Author Contributions

Conceptualization, H.P.J. and H.P.G.; methodology, H.P.J. and S.R.K.; software, S.R.K.; validation, H.P.J., and S.R.K., and H.P.G.; formal analysis, H.P.J.; investigation,H.P.J.; resources, H.P.G.; data curation, H.P.J. and S.R.K.; writing—original draft preparation, H.P.J.; writing—review and editing, H.P.J. and S.R.K. All authors have read and agreed to the published version of the manuscript.

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Data Availability Statement

The data was collected from Nepal Rastra Bank, CBS of Nepal, and the World Bank. We will provide the data upon request.

Conflicts of Interest

The authors declare that there is no conflict of interest.

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