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A Social Dimension of Adaptation and Mitigation of Climate Change: Empowering Local Rural Communities to Confront Extreme Poverty

Farshad Amiraslani [1,*] and Deirdre Dragovich [2]

[1] Scientific and Technical Committee of the International 4 per 1000 Initiative, Tehran 16118, Iran
[2] School of Geosciences, University of Sydney, Sydney, NSW 2006, Australia; deirdre.dragovich@sydney.edu.au
* Correspondence: fami8991@alumni.sydney.edu.au; Tel.: +98-(0)9196262153

Abstract: Climate change impacts occur at varying spatial scales requiring appropriately scaled responses. In impoverished rural areas, adapting to or mitigating the effects of climate change is challenging, with any short-term impairment to precarious livelihoods likely triggering negative community responses even if people are aware of long-term benefits. The paper will discuss a community-based carbon sequestration project in eastern Iran. It started in 2003 and since then has been expanded widely. It was nominated by UNDP as one of 10 transformative projects in Asia/Pacific in 2016. Over the past 20 years, the project has targeted improving the livelihood of the local communities while addressing local measures to adapt to/mitigate climate change. The paper elaborates on the formation of village development groups as pivotal drivers of success by highlighting local income-generating schemes and project documentation. Key lessons for climate change adaptation can be learnt and are applicable to other developing countries. Extreme poverty in rural areas facing climate change could be tackled through implementing bottom-up approaches in which local communities can be respected and engaged in co-leadership and planning.

Keywords: social dimension; adaptation; mitigation; rural communities; poverty; women empowerment

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1. Introduction

The latest IPCC report has highlighted the greater impact of climate change on the vulnerability of local communities in locations "with poverty, governance challenges and limited access to basic services and resources, violent conflict and high levels of climate-sensitive livelihoods (e.g., smallholder farmers, pastoralists, fishing communities)" [1] (SPM-12). This statement emphasises the dual disadvantages of local communities which may already suffer from poverty, dysfunctional developmental systems and social disparities while now also being at the forefront of coping with rising threats from climate change. This scenario is demanding on villagers, who are confronted with economic and social change associated with development. In the meantime, as is evident globally, natural resources are diminishing. Thus, it asks rural communities to take simultaneous actions to adapt to a changing natural resource base and to utilise increasingly limited resources. Many local rural communities do not possess the skills and resources required to manage these multiple major challenges and need assistance from external educational, training and extension enablers to facilitate modest progress in improving livelihoods. This in turn raises potential issues of trust and collaborative engagement between villagers and those implementing change [2]. In considering participatory community engagement, gaining positive responses from local villagers could be viewed within a '3 C's model' involving the themes of collaboration, communication and consultation [3]. These themes are adopted here. In the climate change context, a '3 C's model' will operate within the external influence of human/nature interactions, scale components and the implementation of mitigation/adaptation initiatives.

Most studies on climate change mitigation/adaptation refer to the direct relationship between humans and nature, that is, the ways in which humans have coped/re-acted to changing climate under varying circumstances: in coastal areas (e.g., by erecting sea walls), to changes accompanying deforestation (e.g., by planting trees) or to droughts (e.g., by storing water) (e.g., [4–8]). From this standpoint, such studies can be grouped under the umbrella of 'people/stakeholder participation' in reclaiming degraded areas or actively responding to adverse environmental impacts. Some participatory actions may produce more than one 'direct' benefit, whether planned or unplanned—for example, reafforestation assists in preventing wind and water erosion while also providing improvements to soil health, shelter for farm animals and wood for human use. However, the human–nature relationship could also be indirect, by humans reducing the climate-generated pressure on nature before reclamation is necessary. This requires responses to become prospective and deliberate, whether direct or indirect, rather than being solely reactive to existing impacts.

Climate change impacts occur at varying spatial and temporal scales requiring appropriately scaled responses. In impoverished rural areas, adapting to or mitigating the effects of climate change are both challenging, with any short-term impairment to precarious livelihoods being likely to trigger negative community responses even if people are aware of long-term benefits. Short-term sacrifices may thus threaten continuing community engagement and successful outcomes and require careful planning to ensure the benefits which accrue are apparent, immediate and continuing for the villagers involved. Such a benefit delivery pattern is especially demanding in drylands where pastoralism is frequently associated with land degradation which reflects an imbalance between pasture resources and livestock management. However, if local people are encouraged to become engaged in gaining secondary income, the need to concentrate solely on traditional pastoral activities is diminished. In the long term, the intensity of rangeland use would decrease and natural recovery from a degraded condition may not require a specific short-term action plan. The extent to which the admirable policy of Land Degradation Neutrality (LDN) can contribute to addressing currently degraded land is unclear. LDN has been defined by the Parties to the Convention as "A state whereby the amount and quality of land resources, necessary to support ecosystem functions and services and enhance food security, remains stable or increases within specified temporal and spatial scales and ecosystems" [9] (p. 1). Implementation of such a policy depends partly on the availability of additional land supply, the modification of existing practices, the potential for alternative income-generating activities, or out-migration from degraded areas or a combination of these. However, not all (or any) of these options may be available or feasible in specific circumstances, especially when climate change poses an additional complication.

In drylands, rainfall is expected to fluctuate between years and decades, but the anticipated increase in temperatures and accompanying changes to rainfall amounts, intensities and patterns of dry/wet periods will add to existing climatic uncertainties. Drylands in Iran are likely to be affected more adversely than other countries in the Middle East [10], with predictions of increasing frequency and duration of extremely dry periods and extremely hot days [11]. These trends have already been identified in climatic records when comparing the two 30-year periods between 1959 and 2018 [12]. Since 1970 in the arid rangelands of Khorasan (southeastern Iran), annual rainfall variability has increased along with a rising precipitation index, indicating greater risk of droughts and intense rainfalls [13].

Changing weather patterns are likely to exacerbate existing land degradation in drylands unless effective countermeasures are implemented. Precarious livelihoods in already degraded lands are being placed at additional risk by climate change linked to rising CO_2 levels. Carbon mitigation policies, including carbon sequestration, can contribute to carbon capture by increasing vegetation cover which fixes soil carbon [14–16]. This paper describes a successful community-based project in Iran, the "Carbon Sequestration in Hossein Abad rangelands Project" (CSP) co-funded by UNDP/GEF and the Iranian government in a remote rural area. The original project document was formulated under the impetus of climate change but expanded later into broader social and economic arenas,

encompassing a diverse range of livelihood options [17]. From the inception of CSP in 2003, and after years of social and capital investment, the project was awarded global recognition in 2016 as one of the 10 transformative developmental projects in Asia and the Pacific [18]. The CSP represents a unique community-based project carried out in highly degraded rangelands in Iran's eastern drylands [19]. Initially funded as a pilot project to improve soil carbon stocks in a medium-sized watershed, the project has subsequently been re-funded twice [20] while its participatory findings and concepts were initially upscaled to 18 provinces by 2017 [21] and subsequently to a total of 23 provinces across the country [17]. Both the initial and later adoptions were carried out within defined areas of a dryland watershed or administrative unit (province), minimizing potential conflict arising from other herds competing for pasture [22]. The evolution of the CSP from its earlier purely technically based vision of carbon sequestration to subsequently encompass holistic socially enabling and capacity-building targets has been a remarkably positive journey. This review reveals how creating an enabling environment assists understanding of climate change within village communities through social gatherings and collaboration, and thereby provides a key impetus for different perspectives and actions. Islam and Kieu [23] noted that adaptation to climate change requires mitigating its effects. By navigating the CSP story of local communities pursuing new approaches in addressing the effects of climate change, this paper will demonstrate that simultaneous adaptation and mitigation responses to climate change can be accomplished while also addressing rural poverty.

The participatory approaches taken throughout the development and implementation of the CSP project may be a main component of its success which could provide fruitful policy suggestions for other regions. This paper aims to identify reasons for the project's positive outcomes by first contextualising community-based narrations through the lens of the global literature, and then narrowing their relevance to the Iranian case study. Supplemented by internal and official project documentation and reports, local data acquisition relating to the nature and conduct of project activities is based on the first author's extended field observations and involvement in the project. The case study includes a wide range of effective mechanisms to engage local people through collaboration, communication and consultation. The findings from this community-based project will be discussed and viewed within a broader context to generalise its application elsewhere.

2. Community-Based Projects

2.1. Global Perspective

In developing countries, rural areas are typically fragmented, suffer from inadequate public amenities and services and their residents are often poor and desperate [17]. There is no safety net for their livelihoods, yet they are the most affected populations due to unexpected short-term extreme weather events. In the long term, they also remain vulnerable to the more severe impacts of climate change in a more direct way compared to their fellow urban citizens (e.g., [24]). Sustainable livelihoods have been recommended as these can "offer an opportunity to bring together social development and sustainable approaches" [24] (p. 70).

One approach to the development/climate change nexus has been to encourage community-based reclamation projects in which local communities develop their ideas, plan for their village and participate in implementing their plans. These natural resource management (NRM) projects are executed with varying success, although there are no universal solutions. Over the past 40 years, wide-ranging studies have been published on the knowledge and experiences of such community-based NRM projects. Among these reviews, the most recent reports reveal the reasons for the inadequate involvement of local communities and the approaches adopted to enhance their participation and resilience (Table 1).

Table 1. Challenges and possible solutions in community-based natural resources management projects.

Challenges	Solutions
Ownership	Ownership
➢ land and asset ownership	➢ devolution of more power to local communities and local authorities
➢ ownership of processes and outcomes of governance	➢ collating the views and priorities of local communities
➢ unequal access of certain groups to resources and information	➢ building trust among users
➢ local norms and contexts not considered	➢ social learning
Power	Power
➢ inequity in power relations among local users	➢ enabling local-level governance
➢ power imbalances among higher level and local level authorities	➢ local institutions to become central to the process
➢ unclear rights and responsibilities	➢ encouraging collective actions
➢ lack of mechanisms for equitable benefit sharing	➢ integrating the social networks
Economics	Economics
➢ lack of market linkages and incentives	➢ increasing access to resources and opportunities to overcome weather or financial shocks
➢ lack of attention to economic concerns of local communities and gender issues	➢ supporting social and cultural inclusion
➢ limited access to non-farm employment opportunities	➢ supporting community innovation and local initiatives
Project	Project
➢ poorly defined goals for projects	➢ clear communication
➢ poor project performance	➢ enhancing people–place connections
➢ poor monitoring of project	➢ developing community mobilization and aspirations

Classifications and orderings are arbitrary and made by the authors for this paper only; Sources: [25–27].

Here, we have highlighted only a few factors, but many other internal and external factors could be mentioned. For instance, certain villagers are socially 'isolated' due to their inability to cope with environmental stressors [23], so such people may not be well prepared for specific developmental tasks. Distrust of government departments or regulations may also engender reluctance to engage in new cooperative activities [2].

The 'power' factor affects the delivery and success of any NRM project. Principles of empowerment, participation and collective actions can bolster community development [24]. In recent years, the concept of community-based NRM has been intertwined with the global notion of climate change adaptation and mitigation. Climate vulnerability and adaptation policies, societal organizations and collective action and social movements in climate policy have become components of the relationship between social science and climate change [28]. Such a relationship can encourage society to make sense of the interaction between itself and nature [28]. Moreover, "When people observe climate threats to their in-group they appear more likely to accept the need for adaptation to sustain the continuity of their communities" [29] (pp. 5–6).

2.2. Carbon Sequestration Project (CSP): Diversification of Livelihood and Capital Investment

Water is a key resource in drylands. Historically, Iran was one of the earliest places to adopt innovative approaches to address climate change impacts, especially droughts. The country's strategies in earlier times were to develop interconnected underground water canals, called qanats, that could retain water throughout the year at the landscape level. These reliable water resources were essential for meeting the water needs of ancient societies and their lands across the central arid and semi-arid plateau in Iran. Additionally, archaeological evidence points to the construction of large water storages to retain surface water for irrigation. The remains of these structures can still be found in a few locations

in southern Iran [30]. However, the ancient and literary manuscripts refer to eastern Iran (adjacent to Afghanistan and Pakistan) as a critical crossroad of civilisation almost unmatched anywhere in the world for its importance in global trade (the Silk route) and human settlement dating back to the early 5th to early 3rd millennium BCE [31]. These areas are still well-known but, sadly, for the less admirable reasons of their high poverty rate, drug smuggling and water challenges.

Our case study, the CSP, is located in one of these eastern areas. During the 1990s, the eastern parts of Khorasan province were impacted by a series of droughts, which exacerbated the existing hardship of daily life for local rural people who were literally 'forgotten' societies in accessing regular living amenities at that time. They had already been experiencing a high level of deprivation, poverty and illiteracy almost unseen in other parts of Iran. The CSP, as will be delineated in this paper, is an example of the perception of threats among local communities and experts. The first contacts between local people and the provincial headquarters of the then Iran Forest and Rangeland Organisation highlighted the changing environment based on more prolonged droughts and degraded rangelands [17].

3. Materials and Methods

3.1. Data Search Strategy

For years, CSP had a dedicated website in the Persian language to digitally release the project's information, news and reports. Most of the information used for analysis in this paper was retrieved from this website. The limited amount of research published in Persian language journals has also been accessed. Moreover, the first author had archived other domestic social and technical field reports when he served for the first three years of the project's inception (2003–2005). Other reliable CSP data and information were collated from various reliable resources: for instance, the first project document [32] was used to extract the earlier attempts and objectives set for the project. Mainly qualitative information is used, as detailed quantitative data relating to, for example, changes in individual farmers' incomes, are not available. Participatory natural resources management has been assessed from various aspects and within different regions at the global level. As such, a variety of recent scientific papers and reports were used here for further technical comparison (e.g., [25–27]).

3.2. Field Observations

The first author served as the project coordinator and liaison officer during the first three years of the CSP life cycle (2003–2005). Field observations were used to record interviews with local people, personal field notes and communications. Each mission to visit the study area was based on a scheduled timeframe, which allowed coordination with local authorities and communities. These field observations were necessary to compile relevant information for the UNDP and national organisations which based their funding decisions on this information. Each interview or informal communication explored the link between the people's experiences/expectations and project goals. The first three-year period was a critical timeframe in the CSP's success for various reasons. It is safe to say that conceptualisation of the social mobilisation of CSP was possible due to constructive steps taken during this phase, when key local, national and international CSP staff and human resources were recruited. For instance, the initial international project member was recruited to deploy, for the first time, the novel concepts of people participation and alternative livelihood approaches in the region [17]. Essential participatory workshops to inform and publicise the CSP goals were held during this period. Also, the engagement of local communities, especially women, was pursued by convening a series of training and participatory workshops. In sum, this three-year timeframe defined a multi-layered managerial system in which actors and stakeholders in every layer became aware of their roles and responsibilities. Such an approach clarified the contributions involved in creating new responses to climate change in an environment of poverty.

4. Results

Results will first be reported for the early phase of the CSP project. Following the positive outcomes from this phase, the project then shifted from being primarily focused on carbon sequestration to a broader concern with socio-economic improvement in disadvantaged areas. An expanded project model then continued uninterrupted under the CSP designation.

4.1. CSP Documentation

"Documents increase our understanding by describing events and environments, as well as providing instructions and guidelines for the present and future and are effective for sharing data and information among large groups" [33] (p. 128). One of the significant achievements of CSP has been documentation of almost all events, financial and work plans, study tours, visits and related activities (Table 2).

Table 2. CSP documentation.

Type of Document	Level * of Application	Timeframe	Language *	Remarks	Examples
Financial reports	P	quarterly, annual	F, E	limited distributions among project funders (FRWO, UNDP)	
Workplans	P	quarterly, annual	F, E	limited distributions among project funders (FRWO, UNDP)	
Annual reports	P	annual	F	limited distributions among project funders (FRWO, UNDP)	CSP annual report (2016) (F)
Brochures	N	regular	F, E	limited distributions among CSP visitors only	
Booklets/ pamphlets/ guidelines	N	regular	F, E	limited distributions among CSP visitors only	'Micro-credit fund: A way toward sustainable management of rural areas' (F)
Website	N	on-going	F, E	irregularly updated; incomplete menus; no links to FRWO website	http://www.ircsp.ir/
Articles	N and I	on-going	F, E	scientific analyses	Author, 2021
Technical reports	N	on-going	F	surveys	
News items	N	on-going	F, E	on diverse range of issues related to the project	local and national newspapers
Children books	C	one-off	F	limited distributions among local people only	'Curious swallow'; 'A hare in a plain with no grass'; 'Hidden treasure'; 'Smoke of oven'; 'A seedling for my mother, Fatemeh'; 'Let's be kind to nature' (F)
Children puzzles	C	one-off	F	limited distributions among local people only	

* C: Community; E: English; F: Farsi (Persian); I: International; N: National; P: Project; sources: various CS project reports.

4.2. Marketing of Local Products

Before the commencement of CSP, a handful of local people were involved in scattered pastoralism and animal husbandry and there was no record of local production at any medium or large scale. As such, no marketing, packaging or brand-developing efforts had been considered. Nevertheless, rural people had traditional knowledge of the medicinal impacts of rangeland herbs and limited traditional carpeting and sewing skills. New entrepreneurship activities were initiated with the gradual involvement of rural people in the CSP's activities, including training workshops and study tours and engagement of skilled trainers.

In the years since the inception of CSP, numerous local marketable edible and non-edible items have been produced, such as local dairy products (especially from camels), herbal medicinal essences or derivatives, handmade carpets and scarves, cotton towels and shawls and dolls. Two native edible fruit species have been cultivated across degraded rangelands in the region for decades: berberis (*Berberis vulgaris*) and jujube (*Ziziphus jujuba*). Packaging and food safety standards and regulations have been considered for better marketing and sale of these fruits. Of local products such as these, medicinal plants already make an important contribution to national export income [34] and represent a potential opportunity for income diversification within development projects. However, successful larger-scale production and marketing may require technological and equipment inputs [35,36] that are not readily available. In contrast, Iran has had a long tradition of women producing highly marketable handmade carpets [37,38] for both local and international markets [39].

4.3. Training Workshops

The deprivation suffered by villagers in the project area and the high level of illiteracy among local communities were two noticeable challenges before the commencement of the CSP in the early 2000s. These two issues were general phenomena across all rural areas in Iran. The project area resembled other rural areas as decades of governmental neglect had created social and economic vacuums in rural areas, leading to mass migration to Iranian cities [40].

The CSP document proposed funding a series of training workshops to elevate the level of skills and knowledge of local people. As a consequence, a total of 249 training workshops on numerous topics were held by 2020 [41]. These training sessions improved participants' practical skills and techniques, which were required to enhance the marketability and saleability of rural products and services. Topics included rangeland insurance, fruit-drying (local berry), glasshouse horticulture, carpet-weaving, cultivation of medicinal herbs and other small-scale production activities.

4.4. Patent (Traditional Doll)

Developmental projects generally do not seek patents. Perhaps the most exciting component of this climate adaptation and mitigation project has been the expansion of its original field-based rehabilitation assignment to include registering a patent for locally produced dolls. With the help of a national patent, introduced during an official ceremony, these dolls have become distinct products produced by local women and sold in the market outside the local area. The dolls are associated with a registered brand, logo and brochure. In 2014, a total of 4036 dolls were sold. In 2016, 43 women from 6 village development groups became involved in doll-making activities (various CSP annual reports in Persian). Dolls form an important part of national tradition and are also a tourist attraction [42–45].

4.5. Extension

4.5.1. Study Tours

As part of activities envisaged by the CSP, study tours at various levels from provincial to international have effectively contributed to enhancing the knowledge and practical skills of local beneficiaries and project staff. In addition to a few international study

tours arranged for local and project staff, other study visits have targeted local people. By observing demonstration fields or successful farming systems, local beneficiaries can analyse a real situation and adopt the best scenarios for their purposes. Moreover, such a group visit can ignite new ideas, establish mutual understanding and create innovative thinking for participants. Based on consecutive CSP annual reports, a diverse range of field-based visits have been accomplished, including to a field equipped with drip irrigation systems, a vermicompost workshop and a goat fattening farm.

4.5.2. Rubbish Bins

The installation of rubbish bins may seem irrelevant as an extension activity, but the area lacked any such facility before the start of CSP. Waste management in rural areas is problematic, but it became apparent in the project area partly due to the project itself. The project offered to oversee the operation of local shops as one of the service-rendering jobs granted chiefly to women. At the same time, more visitors to the project site and rural people commuting to the adjacent cities carried new rubbish, in terms of scale and materials, especially non-recyclable items, to villages. As a promoter of sustainable development, the project installed these bins across several villages to educate local people, directly and indirectly, to dump their wastes properly (the first author's observation). Nevertheless, there is a lack of a recycling process on the project site.

4.5.3. Other Extension Activities

Over the past two decades, many exhibitions, ceremonies and other promotional activities have been pursued by the CSP (Table 3). These are critical events for broadcasting and publicising the CSP's achievements, encouraging other villagers or stakeholders to join the project, and consolidating their efforts and thoughts. Such group gatherings and ceremonies can act as catalysts and synergies for future local plans as well. As some of these events are held in other locations and provinces, they can connect local communities and producers with new partners, collaborators or customers in various villages or even cities across the country.

Table 3. Examples of wide-ranging extension schemes accomplished by the CSP (based on various annual reports of CSP in Persian).

Scheme	Stakeholders	Remarks/Examples
Village competitions/ceremonies	Pupils, villagers	
Exhibitions		Various exhibitions held at provincial and national levels
Awards	Villagers, pupils	Awards offered to villagers active in reclamation schemes; pupils active in reading books/papers or in painting activities related to environmental conservation
Distribution of promotional items		Hats, pens and other items tagged with the CSP logos
Promotional events	Lectures, painting activities	Held in various places such as local schools or village gathering places
Promotional video broadcasting	Pupils, villagers, village council members	Topics such as "How to protect our environment"; "Rubbish collection in our village"; Commemoration of Natural Resources Management week
Promotional billboards and signages		
Television/radio interviews		Promoting the CSP's objectives and achievements
Supporting research	University students	Promoting the technical and socio-economic achievements of the CSP by funding MSc and PhD theses

4.6. New Direction for the CSP

Over the past two decades, the CSP has broadened its objective from targeting soil carbon sequestration to a more holistic mandate, aiming at revitalising the socio-economic status of disadvantaged villages. Based on data acquired from the CSP website in 2021, the project has renewed strategies in response to this wide-ranging and inclusive vision (Table 4).

Table 4. Renewed CSP strategies.

Strategy	Objectives	Remarks
Organization and creation of rural groups	Social mobilization	Village Developmental Groups (VDGs)
Financial-credit generation	Financing entrepreneurial, welfare and NRM activities	
Capacity-building	Improving individual and group capacities	Through providing inclusive and targeted training
Community-based rehabilitation	Rehabilitation of degraded rangelands	e.g., reducing soil erosion
Infrastructure development	Local networking	
People participation	Men and women	
Making profit	Helping local people to earn money from non-pastoral activities	
Alternative and sustainable jobs		A wide range of alternative income-generation activities have been proposed and implemented
Marketing and branding	Enhancing local products	Such as herbal infusions, dairy products
Service provision	Improving local health and education	

Modified based on the CSP website.

4.7. Conceptualising New Approaches to Rural Planning

The CSP introduced two key concepts to the area and the country for the first time, namely project administration and community organisation (Table 5).

Table 5. Key managerial and conceptual shifts in rural visioning through introducing new approaches by the CSP over the past two decades.

Themes	Activities	
Project administration	1. book-keeping 2. communications 3. documentary production 4. English language 5. extension	6. gender analysis 7. leadership 8. marketing and branding 9. publications 10. website development
Community organisation	1. business planning 2. community mobilization 3. convening exhibitions 4. establishing local cooperatives 5. expansion of green spaces 6. financing unexpected household costs	7. local supermarket 8. local bakery 9. micro-credit fund 10. management skills 11. village planning 12. VDG * organisation 13. workshop facilitation

* VDG: village developmental group.

At the project level, new approaches have been followed such as proper documentation, improved communication between managerial staff and local people and marketing of rural products. At the community level, a new concept of rural revitalisation through

the involvement of local people, as the main stakeholders, became possible. For the first time, village developmental groups (VDGs) were formed. These were composed solely of local stakeholders regardless of their age, gender, occupation, etc. By 2016, a total of 63 VDGs (men, women, and mixed) had formed compared to none in 2004 (Figure 1). Such a horizontal management structure created a favourable environment for decision-making, implementation of local schemes and obtaining financial gains by local people. The project's staff acted as facilitators only in the earlier stages, paving the way for the future presence of local facilitators and organisers.

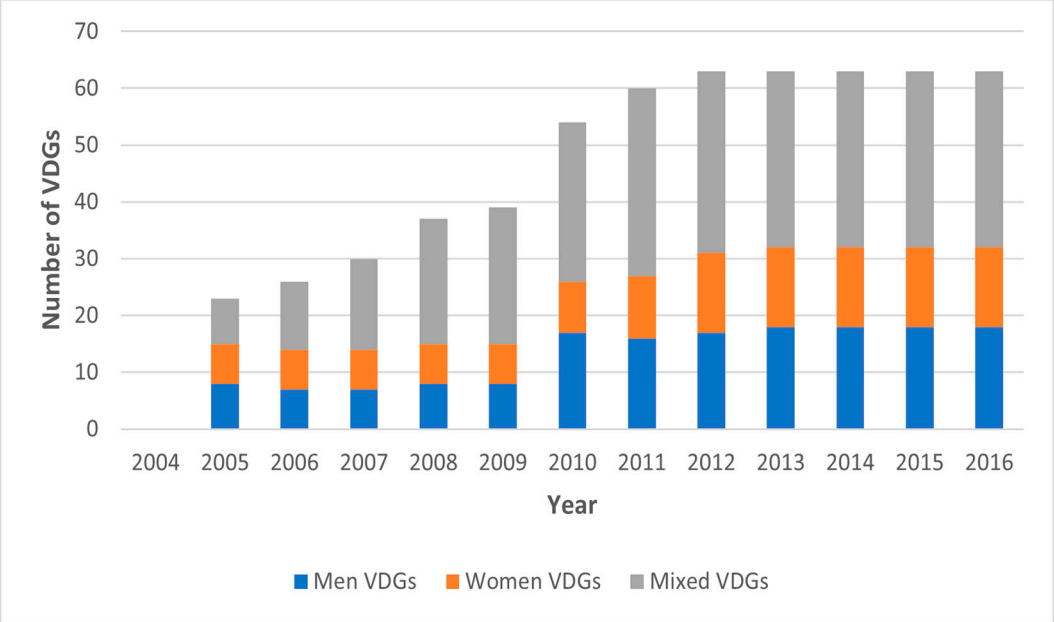

Figure 1. The composition and number of VDGs in CSP between 2004 and 2016 (based on data extracted from various CSP annual reports).

Almost all CSP interactions with local communities and the proposed executive agenda have become feasible through these VDGs, to which members have been voted and selected by local people. From personal and family financial needs to those of the community, decisions have been made by these VDGs. For instance, whether for ratification or operation, loans and financial support have been channelled via VDG meetings and their local leading teams. Notably, these loans and the group financial backing they provide have been well-patronised by local communities over the past decade. Given the absence of financial banking systems, personal credits/savings or private assets for paying insurance in that region, vital loans have been made for covering unexpected events and emergencies (e.g., illness) or for purchasing income-generating inputs (e.g., tools) for the members. The VDGs have been recognised as critical in the success of community involvement [46], facilitating the availability of micro-credit to women which has been an important impetus to female empowerment [47].

4.8. Income-Generation Schemes

The earlier objectives of the CSP targeted the reclamation of degraded rangelands by enhancing soil carbon stocks through planting, seeding and irrigating the affected areas. Shrub-planting became an income-generating activity which had land management benefits by reducing soil erosion [48], as these and other farming activities needed local personnel for a diverse range of field-based actions. However, additional new and varied job opportunities were developed, with the total number of income-generating schemes reaching 66 (Table 6). Although some schemes were based on existing traditions (e.g., handicrafts, medicinal herbs), the CSP created a favourable environment for upgrading skills,

providing intensive training and encouraging consultative processes for local communities to re-define their proactive sharing in the area's development.

Table 6. Diversified income-generation schemes pursued by the CSP over the past two decades (many of these activities were associated with specialised training courses and micro-finance distribution).

Category	Sub-Category	
Handicraft	1. carpet weaving 2. cloth weaving 3. ornamental stitching 4. dress weaving 5. embroidery 6. flower weaving	7. doll-making 8. carpet weaving 9. suede 10. tailoring 11. tapestry 12. towel weaving
Farming	13. beekeeping 14. livestock vaccination 15. medicinal plants 16. mushroom farming 17. quail farming 18. poultry breeding	19. sheep fattening 20. sugar beet farming 21. turkey farming 22. vegetable gardening 23. vermicomposting 24. wheat cultivation
Foodstuffs	25. distillation of herbal essences 26. fruit-drying 27. herb processing 28. jam/pickle-making 29. nut packaging	30. pastry cooking 31. professional cooking 32. vegetable drying 33. whey production
Health and personal hygiene	34. hair cutting 35. desalination 36. drinking water piping 37. household sanitation facilities	38. public bathroom 39. water filtering
Natural Resources Management (NRM)	40. construction of earth/check dams 41. construction of glasshouses 42. construction of troughs 43. construction of water storage facilities 44. desertification control 45. drought management 46. grazing exclosure 47. irrigation 48. land rehabilitation 49. permaculture	50. pest control 51. pitting of soils 52. Qanat restoration 53. rangeland insurance 54. runoff control 55. seed-gathering 56. seeding 57. seedling plantation 58. seedling nursery management 59. soil and water conservation
Renewable energy	60. biogas development 61. installation of solar panels	62. installation of wind-driven water pump
Services	63. carpentry 64. machinery services	65. guarding plant nurseries 66. rubbish bin collection

Sources: various annual CSP reports in Persian.

5. Discussion

The Power of Effective Communication

Documentation has been a critical instrument in transmitting and sharing knowledge and ideas across generations throughout the past. The documents may be composed of inexpensive materials, but their value comes from their creators and authors and the associated ideas [33]. From the outset, the CSP has regularly produced a diverse range of documents to promote crucial but straightforward knowledge and to counter misconceptions. Targeted groups across villages included people of various ages, educational, gender,

social cast and village rank (Table 2). Dialogue and proactive communication are important for tackling climate change [49] and thus such documentation, ceremonies and workshops were effective mechanisms for transmitting essential knowledge to local people.

"Adaptation to climate change is inescapably influenced by processes of social identity—how people perceive themselves, others, and their place in the world around them" [29] (p. 1). There could be a direct relationship between exposure to calamities and later perceptions of the associated risks and remedial/preventive actions and policies taken in response to climate change (e.g., [50]). Through the CSP, local rural residents who had earlier experienced severe droughts, agricultural loss, water shortages and dust storms could transfer their personal experiences to other members of society during workshops and meetings; otherwise, such experiences could have been lost from the collective memory. Moreover, knowledge of such experiences encouraged people to take prompt action.

Generally speaking, the CSP's demonstration rural area had meagre participation of women in any external rural activities and decisions before the commencement of the project. At the village level, the cultural and religious beliefs and under-developed infrastructure and challenges contributed to a low involvement of women in local activities. At the personal/family level, the high poverty rate and illiteracy of both men and women complicated the participatory roles for local women. Because of these social circumstances, workshops and meetings in early 2003–2004 were held without or with the minimal presence of women due to contact restrictions made by their family men. Likewise, local women had no options to participate in village decisions or any income-generating activities. Over the last 20 years, this situation has changed, with women gradually becoming involved in VDGs and domestic income-generating activities such as beekeeping, doll-making and carpet weaving. The earlier meetings with local women primarily sought to establish their skills and desires for income-generating activities. For instance, local women highlighted their traditional knowledge of carpet-weaving during these earlier workshops and CSP then provided introductory training workshops to hone their weaving skills. Further training workshops targeted women's knowledge of the consumer market and business fundamentals. Those subsequent workshops gave them directions to explore new initiatives (e.g., using cottons having bright colours) for weaving high-quality and attractive carpets that could be sold in niche urban markets. After 8 years of the project's operation, a survey conducted among 262 women in 6 villages found that 62–88% considered family welfare, income and job opportunities had improved and 50% of respondents felt that individuals' incomes had improved [51].

As part of the project earlier plan, monitoring was defined and implemented by a local university to evaluate changes in ecological variables, notably soil carbon, for the first several years. The significance of this sequestered carbon was twofold: the area had been hit hard by frequent droughts which had further depleted already low levels of soil carbon, and sequestered carbon was simultaneously highlighting the role of local communities in replanting and preserving existing vegetation. Through collaborative negotiations and discussions, local people were convinced to take part in monitoring and collecting data. If no local participation had been possible, costly alternatives could have been envisaged for the project. The contribution of local participation will become even more critical in future years, when initial enthusiasm for collaborative involvement will need to be maintained in the face of potentially flagging interest and changes in participation and networks, at the village level and beyond. The importance of continued monitoring and recording of information at the project level needs to be emphasised, as monitoring provides the opportunity to assess previous approaches/outcomes and, where desirable, to modify approaches to ensure future improvements.

The CSP was initiated externally through communication and consultation between institutional and national authorities. Once agreed at this level, regional personnel and local people became involved in the consultation, communication and collaboration processes and the initial 'top down' incorporated a reverse 'bottom up' flow before 'both ways' flows became entrenched. However, potential disconnections within the collabo-

ration system may develop both between various governmental instrumentalities and between the government departments and local communities (e.g., [2,52]). The strength and direction of flows and actions between involved entities likely changed over the life of the project, with both central and local flows dominating at different times. Project success depended on strong collaboration towards agreed goals based on high levels of consultation and communication, with objectives being implemented within the defined project area. Such collaboration involves substantial social change which may have been superficially achieved during the initial 3 year period but was able to be strengthened during the subsequent extensions of the project. This allowed for a continuing presence of external stakeholders and provided time for the new activities and approaches to gain common acceptance as the 'new normal'. Although positive outcomes have been achieved, monitoring of resource use and continued financial and government support are essential for positive outcomes to be maintained.

6. Conclusions

Here, in a rare research attempt regarding Iran and its neighbouring countries, we attributed a reduction in rural poverty to a diverse range of participatory activities addressing climate change adaptation/mitigation. The limitation of this research was the need for greater access to annual quantitative datasets, especially those data covering recent years. Such data would assist in monitoring, maintaining and building on previous gains. Nevertheless, we could integrate field-based observation records, formal datasets released by the project office (some documents in Persian, some in English), and activities/achievement summaries issued by UNDP.

The CS project has had positive outcomes on environmental, social and economic aspects within its relatively short life. It has met its social and economic objectives to the broad satisfaction of participants. These outcomes of the project's initiatives and vision are summarised in Table 7.

Table 7. Overall outcomes of the CS project.

Initiative	Environmental Outcome	Social Outcome	Economic Outcome	Reference
Extension schemes	+	+	n/a	Table 3
New project inclusive strategies and vision	+	+	+	Tables 4 and 5
Income-generating schemes *	+/−	+ (indirect)	+	Table 6

* For income-generating schemes, if not monitored well, there would be a chance of deteriorating environmental conditions through more pressure being exerted on limited land and water resources.

Rural areas in Iran are losing their population to out-migration [40]. Young rural generations are leaving villages and seeking better education, health and lifestyle in cities after witnessing their older generations suffering from droughts, water shortage, poverty and health issues. Decades of developmental and revitalising plans have not convinced these new generations to continue living like their parents. Therefore, projects such as the CSP represent a new dimension of rural developmental plans that can retain local people by improving and conserving the local environment while simultaneously enhancing their skills and lifestyle.

Social identity, and its sub-dimensions of distinctiveness, continuity, self-esteem and self-efficacy, affect climate change adaptation [29]. Over the past two decades since the initiation of CSP, the demonstration area has witnessed major changes in social, ecological and economic aspects [17]. Field observations and project reports confirm that soil carbon improvement and the expansion of vegetated areas have assisted other ecological components to thrive: wildlife has been re-established in the area, flora (diversity and density) have increased, soil erosion has declined and a long-lasting socio-ecological connection re-established.

The CSP has explicitly demonstrated that extreme poverty in rural areas could be addressed through implementing bottom-up approaches in which local communities can be respected and engaged in co-leadership and planning. The themes of collaboration, communication and consultation applied within the project resulted in enhanced self-esteem and self-confidence among local stakeholders by encouraging them to utilise their skills, capacities and capabilities. Many unseen and previously unused personal abilities and skills flourished with proper training arrangements and financial support provided by CSP funds. People tend to adjust their behaviour toward the norm [49], and such adjustment became a foundation for individual contributions within local communities. In CSP, cascades of cooperation and self-help stories have been narrated over the past decades.

The CSP case study shows that more than 66 jobs/entrepreneurship activities have been introduced and implemented in less than 20 years. While local people were involved in the reclamation of degraded rangelands by shrub plantation, they were also trained to prevent further soil degradation (from wood removal for fuel) by installing solar panels on their roofs, a change that people recognised would benefit pastures [53]. Importantly, women have been involved in land rehabilitation and income-generating activities such as beekeeping, doll-making and carpet-weaving. These economically rewarding activities have partly substituted for the previous destructive pastoralism practices which have been undertaken for generations.

The CSP has strengthened self-confidence and family/community bonds among local people through participatory workshops which gave local women a platform to raise their concerns and attitudes for the first time. They were encouraged to see matters beyond their previous imaginations and thinking by engaging in rural planning and group activities. Fortunately, such attitudes have now permeated through different generations in the region after almost two decades since the project's inception. More of the younger generations have returned and initiated entrepreneurship activities.

Key potentially transferrable attributes which contributed to the overall success of the CSP project include

- Collaborative administrative personnel (international, national, regional, local);
- Local power-sharing in decision making;
- Monitoring of progress/initiatives;
- Ensuring diverse activities/employment opportunities;
- Social inclusion (especially relevant for women);
- Generating a shift towards acceptance of, and response to, change;
- Provision of micro-finance;
- Accountability of administration to villagers.

Finally, the CSP is a successful model of partnerships between the local, provincial and national authorities and local communities. Such a mutual partnership had not existed before the CSP commenced. In addition, despite a few pitfalls [17], the CSP could be considered a realisation of a national–international mode of cooperation in which financial and administrative regulations and rules have been generally observed with only minor frictions. The CSP has acted as a catalyst between local people and national authorities while, at the same time, the project has been a proactive intermediary between Iran and international bureaucracies and financial systems.

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