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6

CLIMATE RESILIENCE THROUGH WOMEN'S KNOWLEDGE: TOWARDS ETHICAL BIO-ENTREPRENEURSHIP PATHWAYS

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The discussion around development, women and empowerment stands incomplete without the inclusion of what is the most crucial and yet most ignored relationship—the one between nature and women. The role of women is central to household survival strategies in regions where ecological and climatic stress is high, male emigration is a dominant coping strategy due to lack of enough local employment opportunities, and the portfolio of economic and socio-cultural activities is guided by constrained access to factor and product markets[1]. Women-led or managed households are often predominant in such high-risk regions. Their intimate knowledge of biodiversity comes in handy in meeting nutritional and medicinal deficits

[1]Dey, Anamika, Gurdeep Singh & Anil K. Gupta, 'Women and Climate Stress: Role Reversal from Beneficiaries to Expert Participants', *World Development*, Vol. 103, 336-359, March 2018, https://tinyurl.com/yewbkf9b. Accessed on 27 August 2024.

in their households. Women, especially from rural and tribal regions, have over centuries always worked in strong and close correlation with the environment. They have devised and curated their own knowledge systems to cope with the surprises that come with nature. As we have seen in the past decade, the rising intensity of climatic fluctuations have now left us with no option but to adopt a deeper understanding of biodiversity resources which are impacted by these changes. Women are our best bet, moving forward.

The role of women in mitigating risks in other high-risk environments such as rainfed dry regions, flood-prone regions, mountains, etc., is significant[2]. The vulnerability of women in formal and informal scientific systems also warrants attention to their empowerment[3]. Among various empowerment strategies for overcoming their vulnerabilities, in this essay, we share entrepreneurial opportunities-based biodiversity and associated knowledge systems in the specific context of mountain regions. Some of these strategies might work equally well in other regions too. Insights from the field in the Global Initiative of Academic Network's (GIAN) project supported by the Department of Biotechnology (DBT), Government of India, in three mountainous regions of the Union Territory of Jammu and Kashmir, Sikkim and Nagaland, provide the empirical context for this essay.

Livelihood options in the mountains are generally limited to tourism, agriculture and horticulture, and other restricted

[2]Ibid.; Gupta, Anil K., Yugandhar Mandavkar, Amin Surekha & Shah Rekha N., 'Role of Women in Risk Adjustment in Drought Prone Regions', IIMA Working Paper No. 704, 1 October 1987, https://tinyurl.com/h894nac4. Accessed on 27 August 2024.

[3]Gupta, Anil K., & R.A. Mashelkar, 'Women and Formal and Informal Science', IIMA Working Paper No. 2005-05-02, May 2005, in *History of Science, Philosophy and Culture in Indian Civilisation* (Gen. Ed. D.P. Chattopadhyaya), Volume IX, Part 3, *Women of India: Colonial and Post-Colonial Periods* (Ed. Bharati Ray), New Delhi, Sage Publications India Pvt. Ltd, Chapter 10, pp. 208-235, https://tinyurl.com/mtpju73f. Accessed on 27 August 2024.

bioresource-based options like herbal products, crafts, etc. In the wake of male emigration, women, children and the elderly are left behind to take care of households, agriculture and animal husbandry, and also often work as farm labourers[4]. Diversification of the household portfolio is inevitable in the risky environment since no one livelihood strategy would be viable all through the year and in all sub-regions[5].

Climatic fluctuations lead to occasional forest fires, early or delayed flowering, or seed setting of herbs, shrubs, trees, or rejuvenation of pastures and other fragile landscapes. Excessive selective extraction of certain species may disturb the ecological diversity, succession, resilience and regeneration of the desired herbs. Livestock grazing influences the landscape quality, diversity, and density distribution of different edible and non-edible species. A sustainable supply of raw materials for formal or informal bio-enterprises may thus be affected by many of these factors if not attended to carefully through community leadership, not just participation.

Women develop deep local or indigenous knowledge while dealing with nature and figuring out various uses of the local biodiversity for health, nutrition, food, fuel, furniture, dyes, handloom, and numerous other purposes. It is this knowledge richness, among other sources of grassroots innovations, which Honey Bee Network volunteers have tried to leverage over the last 35 years to expand livelihood choices of communities and

[4]Goodrich, Chanda Gurung, Pranita Bhushan Udas & Harriet Larrington-Spencer, 'Conceptualizing gendered vulnerability to climate change in the Hindu Kush Himalaya: Contextual conditions and drivers of change', *Environmental Development*, Vol. 31, pp. 9-18, September 2019, https://tinyurl.com/22ma5ap4. Accessed on 27 August 2024.

[5]Gupta, Anil K., 'Ecology, Market Forces and Design of Resource Delivery Organizations', in *International Studies of Management and Organization*, 18 (4) 64-82, 1986; Gupta, Anil K., 'Socio-Ecological Paradigm for Analyzing Problems of Poor in Dry Regions', *Ecodevelopment News*, (Paris) No. 32-33, March 1985, pp. 68-74.

individuals[6]. In this essay, we describe a bio-entrepreneurial strategy for leveraging women's knowledge in the Himalayan region of Jammu and Kashmir, Sikkim and Nagaland as a part of the DBT-supported project. It may also have implications for various action research studies in high-risk environments and not just the mountains. There are lessons for policymakers too who often find that strategies that work in well-endowed socio-ecological regions[7] do not seem to work in high-risk regions. For instance, the design of stationary organizations in regions where people are mobile, such as pastoralists, is unlikely to work[8].

The essay is divided into three parts. Part I presents a brief review of various strategies of coping with climatic risk in the Himalayan region. The concept of bio-entrepreneurship is elaborated in Part II. Finally, Part III has lessons for learners which may help all those who wish to leverage women's knowledge for alleviating poverty and conserving biodiversity through ethical entrepreneurship pathways.

PART I
COPING WITH CLIMATIC COMPLEXITY AND FLUCTUATIONS

With extreme climatic events, fluctuations and changes, agriculture and allied sectors in the Himalayas are already vulnerable due to their topographical and ecological characteristics. Changes

[6]Gupta, Anil K., & R.A. Mashelkar, 'Women and Formal and Informal Science', IIMA Working Paper No. 2005-05-02, May 2005, in *History of Science, Philosophy and Culture in Indian Civilisation* (Gen. Ed. D.P. Chattopadhyaya), Volume IX, Part 3, *Women of India: Colonial and Post-Colonial Periods* (Ed. Bharati Ray), New Delhi, Sage Publications India Pvt. Ltd, Chapter 10, pp. 208-235, https://tinyurl.com/mtpju73f. Accessed on 27 August 2024.

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are indicated in the seasonal patterns such as overall decreasing monsoons and rainfall, increase in winter and monsoon temperatures as well as decreasing winter snowfall[9]. Melting glaciers pose another problem for irrigation and livestock water supply as it increases short-term water availability but may cause scarcity over the long term. Hence, the whole cropping pattern and cycle is affected.

With increasing temperatures, agro-climatic zones in the Himalayan region are shifting, impacting the suitability of certain crops for specific areas. Traditional crop patterns may need to be adapted, and new challenges may arise in pest and disease management[10]. Reduced crop productivity can lead to food insecurity and economic losses for farmers. It can affect the well-being of livestock, leading to heat stress and increased vulnerability to diseases. Changes in vegetation patterns can also affect the availability and quality of forage for grazing animals, affecting traditional practices like transhumance (seasonal movement of livestock) and pastoralism.

Climate change-induced disruptions in agriculture and animal husbandry lead to economic hardship for communities dependent on these activities. These disruptions also contribute to emigration and changes in local cultures and traditions. Due to rising temperature, many plant species are moving upwards, which may increase the workload and time required to collect them. To avoid excessive extraction of medicinal plants and ensure their regeneration, development of sustainable extraction protocol is required though this is a rather neglected area of current

[9]Bhutiyani, M.R., V.S Kale & N.J. Pawar, 'Change and the precipitation variations in the northwestern Himalaya: 1866–2006', *International Journal of Climatology*, 9 April 2009, https://tinyurl.com/2w5tvvkm. Accessed on 27 August 2024.

[10]Vedwan, Neeraj, & Robert E. Rhoades, 'Climate change in the Western Himalayas of India: A study of local perceptions and response', *Climate Research*, 19 (2), pp. 109–17, 2001, https://tinyurl.com/yka6xmb2. Accessed on 27 August

research in the region. Women's knowledge is being harnessed for the purpose of minimizing the effect of climatic fluctuation and consequent disturbance in the community ecology of plants.

We need to build resilience in these communities to address their needs. Adaptive measures like diversification of the portfolio of sustainable livelihood options along with diversification of food and nutritional choices for humans and livestock may help. Another strategy may be to characterize the nutritional richness of different varieties of cultivated and uncultivated foods.

The socio-economic and ecological resilience of communities depends largely on available policy, institutional and market-based options. These may help in tiding over lean periods exacerbated by climatic fluctuations. The extent to which biomaterials can be stored during the winter period when much of the higher altitude villages are covered in snow, also influences the way communities use their idle time for crafts, household necessities, weaving, and processing of stored herbs for food, medicines, aromatic oils and powders, dyes, other colours, beverages, etc.

PART II
BIO-ENTREPRENEURSHIP: LEVERAGING STRATEGY FOR BIODIVERSITY AND ASSOCIATED KNOWLEDGE

The term 'bioresource-based entrepreneurship' refers to businesses that use renewable biological resources as inputs or raw materials to create new products and/or services. Numerous natural resources including plants, animals, microbes, and agricultural waste are included in these bioresources. These bio-enterprises or green businesses frequently have a lesser carbon impact, attracting environmentally-conscious customers. These come in a variety of forms, including a) enterprises that create new goods using biological creatures or processes such as biofuels, medicines and biodegradable plastics; b) agricultural enterprises that concentrate on sustainable farming methods,

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organic products, or recycling agricultural waste for a variety of uses like composting, biogas production, or creating biodegradable packaging; c) start-ups and farmer producer organizations (FPOs) or companies engaged in the manufacture of products such as biofuels made from renewable plant sources, such as biodiesel and bioethanol, food products and beverages, etc.; and d) businesses that make organic food and drinks, processed foods, herbal oils, drugs, aromatic substances, etc., from sustainable harvesting methods[11].

Local markets are not much developed in most remote areas, particularly in the mountains, because of low population density and rough terrain. But a few women try to access weekly markets for selling some of the bioresources, pickles and a few other products. There is no certainty of demand and also, they lack too many opportunities for value addition. Under state livelihood missions, self-help groups of women have been provided some resources for making progress, but with mixed results.

Women face several challenges while delving into this field: they lack access to financial, technological and various other institutional resources. While shouldering the greater burden of managing households, taking care of children and the elderly in the families due to frequent emigration of males from the mountains, they also have to contend with various other vulnerabilities. But given their deep knowledge about local biodiversity resources and rich experience of food processing, local health traditions and crafts, women can amplify their skills and aspirations if they can get sufficient support. Several dilemmas arise in sustaining community-based bio-enterprises run by women:

a) **Sustainability of extraction:** When it comes to collection of biomasses of medicinal or other plants, studies have shown that pregnant women or mothers carrying young

[11]Biotech Consortium India Limited (BCIL), '28th Annual Report 2017-2018', 2018, https://tinyurl.com/bdf93wyv. Accessed on 27 August 2024.

child cannot go very far. This causes concern when the plants are collected from the roadside and if these roads have traffic, then effluents of these vehicles may affect the quality of the plants. During a visit to Trinity County, California, local communities allocated other tasks to such women such as drying the plants, sorting them or making bundles of them, etc. Groups of women need to pay attention that both the quantity and the quality of the extracted biomass do not impair the quality of the outputs as well as sustainability of the landscape.

b) **Renewability of biodiversity:** This requires extraction to be pursued within sustainable limits. But when contractors compete with local community bio-enterprises, the prisoner's dilemma-like situation arises. In such situations, collective assurances and regulation of contractors' behaviour by the village council and the forest department can help sustain local control over excessive extraction. The weak position of women in village councils and forest bureaucracies exacerbates the tension.

c) **Knowledge and practice differentiation:** Not all who know the uses of bioresources have the capacity and competence of using them, or practising the knowledge adequately or effectively. While creating a portfolio of incentives for local communities, some differentiation is needed among people having general information vis-à-vis those who have expert knowledge. Once during a *shodhyatra* (journey for the search of knowledge, creativity, and innovations at the grassroots) in Malnad region, Karnataka, a young person was upset that all *yatris* (travellers) were paying a lot of attention to an elderly knowledge expert. The young person also knew the specific uses of the plants the expert was talking about. Then a question was asked: When the need arose, whom did the community consult? The young person

who knew the uses of the same plant or the expert who knew how to dose it, relate it to the conditions of the patient? The answer became obvious from the laughter of the group.

d) **Benefit sharing:** There are several exchanges through which local community members and an enterprise, whether local or external, can share benefits: procurement price of raw biomaterials; opportunity for local women groups or individuals to sell final products at discounted price in local markets; share in profits; investment in conservation of landscapes; investment in capacity building, etc. Under no circumstances should the local biodiversity resources become extinct or out of reach of local communities because of external demand. In the first issue of the *Honey Bee Newsletter* (HBN), we had shared the dilemma expressed by a young friend; whether the HBN strategy of conservation, characterization and commercialization will make local resource so costly that they go out of reach of the local people who have conserved them so long. The example of tea was given in which the best tea is sold at London and cannot be afforded by the poor tea garden workers. This should serve as a constant reminder in every entrepreneurial venture that local access to raw materials to meet their basic needs is not hampered by the improvement in market access—certainly not an easy goal.

There are several other dilemmas such as dealing with trade-offs between managing family duties and balancing these with entrepreneurial duties; tensions between the role of daughters versus daughters-in-law; gender discrimination in risk-taking allowances; freedom to deal with market and external customers; balancing economic interests of biomaterial collectors and customers, etc.

PART III
LESSONS FOR LEARNERS—MANAGING TENSIONS

Here are a few lessons we have learned while working with communities in the Himalayas in Jammu and Kashmir, Sikkim and Nagaland as part of the project sponsored by the DBT, Government of India. Given the ability of women to handle multiple tasks, and balance domestic and external duties, responsibilities and opportunities, their strengths can be leveraged through micro- and macro-entrepreneurial support systems.

a) **Respect for local norms:** Respecting the norms and traditions of the community is of utmost importance. This does not mean that we need to endorse some of the superstitions that are still followed in many communities. Disrespect to their customs and traditions is often not well taken. For example, in one of our meetings with community members, the members offered us some biscuits with eggs. One of our colleagues is vegetarian and declined this. When the community insisted, he grew increasingly impatient, which would eventually have upset them. Hence, we informed them about his religious beliefs, which they understood. In Assam, local communities would offer *tamul* (betel nut) and betel leaves served in a special utensil called *bota* to guests, which some do not consume due to health reasons. Hence, we have to communicate to the community our diffidence in certain matters without being disrespectful. There are sacred groves in the North-Eastern Himalayas and rituals surrounding them. We need to be aware not to step into such areas without the permission of the locals. Protected herbs cannot be collected from these areas unless under specific conditions that have been laid down by the communities[12].

[12]Kandari, L.S., V.K. Bisht, M. Bhardwaj & A.K. Thakur, 'Conservation and management of sacred groves, myths and beliefs of tribal communities: A case

Such care will ensure respect for new norms being evolved among communities.

b) **Initial disclosure of purpose:** Telling people about the intention, aim and objective of the project, or simply put, 'Why are we doing this?', is very important[13]. At times, intermediary organizations do not share the bigger picture with the communities, doubting the ability of the communities to understand or know about such scientifically written proposals. However, if we make our intentions clear, it is possible that the village community will not only trust us, but also suggest to us better ways of achieving our goals. Our intentions need to be communicated in the local language to the extent possible. In the absence of such a practice, the communities' trust of outside agencies may become shaky and impair long-term prospects of viable outcomes.

c) **Legitimizing entrepreneurial interventions:** Meeting the gram pradhan or village head/gram budha or village elder is of utmost importance in situating entrepreneurial plans focused on women. These leaders, often conservative men, know the customs, traditions and limitations of the community and its resources. People listen to them, helping us gain their confidence. It should be recognized that most communities are factionalized. Thus, contending parties may need to be kept in the loop. One should also meet innovative farmers, teachers, healers, and others who are generally respected in society. This has to be done knowing fully well that many local community leaders do not like women being empowered or given independence to make autonomous market-linked decisions. There is a risk that involving local leaders may

study from north-India', *Environmental Systems Research*, 16 (2014), https://tinyurl.com/2hrdw3pt. Accessed on 27 August 2024.

[13]Pew Research Centre, 'Energized Democrats Backing Clinton: The Buck Doesn't Stop Here...', 14 November 1995, https://tinyurl.com/bdd7crsr. Accessed on 27 August 2024.

make our selection of participants/suppliers/entrepreneurs biased in favour of those closer to the leaders. To ensure that real creative and knowledgeable people are not ignored, one needs to balance conflicting interests through prudent participatory processes.

Transforming Knowledge for Markets

1. **Leveraging grassroots innovations ethically:** Meeting innovative farmers, traditional knowledge holders, healers, centenarians, existing entrepreneurs, knowledge holders, artisans, craftsmen, etc., helps discover local problem-solving potential. When the aim is to get value from bioresource-based products, interaction with some herbal healers and other knowledge experts would make sense. Much of the oral knowledge of the healer is generally passed down inter-generationally. But due to changes in biodiversity and climate fluctuation levels, contemporary knowledge is also produced through diverse experiments. Much of this knowledge is buried or cremated with the passing away of the elders since hardly anything is documented. More knowledge is being lost in the current generation than in the entire history of humanity. Local experts may not trust us in the beginning. It is advised not to pester them into saying something they are not yet ready to share, like a complete list of ingredients and dosage in case of herbal practices. Once we have the Prior Informed Consent (PIC) in place and we have built a rapport, they may wish to share more details. If the person is willing, we go to different parts of the villages from where they collect plant materials and samples for the herbarium, and see the habitat as well.

It is important to declare the following that as per the HBN philosophy: a) Their name will be acknowledged in all products/publications; they will not be made anonymous; their contribution will be identified on the labels of the

products; their Intellectual Property Rights (IPRs) will be protected if their knowledge is found to be unique. b) They will receive a copy of the knowledge collected from other communities as a part of the cross-pollination. c) They will also receive a summary of the findings of the research in the local language besides products at discounted price to sell locally. d) They will get a share of the profits made through the commercial utilization of their knowledge, besides other intangible benefits, including capacity-building and free access to databases.

It is very important that acknowledgement, attribution, appropriation and benefit-sharing norms are spelt out in the beginning for total clarity on mutual expectations and obligations.

Mapping Aspirations, Expectations, and Collective Understanding

2. **Rise in mutual expectations and community aspirations as interactions progress:** Sustained augmentation of livelihoods through continuous experimentation requires constant upgradation of competencies on both sides. Also, the calibration of expectations and aspirations is needed so that market realities and risks and chances in the value chain are properly understood and appreciated. Mapping out the dreams and aspirations of the communities may help them cooperate to realize a bigger common goal. Connecting their aspiration with a proposed action plan will bring clarity and also avoid the pessimism of members when unavoidable delays happen.

   At times, the aspiration may be low while the natural resource base may be high. People collectively may not extract the best potential out of the local resources while a few might be able to extract rent from them. This has happened in several regions. When women are conditioned

to have low aspirations, their self-esteem suffers and their resilience also goes down. Their aspirations can be raised by providing wider exposure and opportunities for market encounters to learn and grow. Failures in the marketplace is a part of life and the less the experience, the higher are the chances of being taken advantage of. Investment in failures is an important part of developing entrepreneurial abilities.

When aspirations are high and natural resources are limited, the community can sometimes become very entrepreneurial. When both are low, there is widespread inertia. Often, resources are high, but aspirations are low, or maybe the manifestation of aspirations is low, as in many cases. Women fall into this category due to various social and cultural limitations, like in Kashmir, or the aspirations as a community can be hindered due to low accessibility to technologies or infrastructure, like in Nagaland. The ideal case is when aspirations and natural resources are available aplenty, but that may not always be the case.

Collective aspirations may pave the way for collective action along with individual enterprises. High aspiration and low resources may pose problems for peace and security if community order and stability are destabilized. This is a delicate issue and must be handled with care, responsibility and clarity.

Taming Young and Diverse Talent

3. **Harnessing young bio-geniuses:** Organizing biodiversity competitions has been a very useful means of discovering young talent during *shodhyatras*, and otherwise. Children are asked to bring samples of plants they know, and list their uses. They are allowed to seek the help of elders if they wish, but time is limited. Sometimes, children are able to discover by the age of 10–12 years almost half the number of diverse plants the elders knew. But there is no career

path for such bio-geniuses. They are not given a chance to become bio-entrepreneurs or foresters. Sometimes, girls have less knowledge than boys because they are not allowed to roam as far as the boys. Constrained opportunities, however, do not always imply lifelong lesser learning. Paradoxically, among adults, many women know much more compared to men about nutritious weeds, uncultivated plants products for pickles, medicines, dyes and aromatic purposes. Recipe or food formulation competition among women helps uncover very useful insights about how they manage the nutritional needs of the family by tapping into wild biodiversity and weeds. Discovering young talent can be harnessed for grooming future conservators and bio-entrepreneurs. Socially constrained opportunities among young girls may distract attention from their higher potential at the adult stage. Thus, there is a need to build the capacity of girls along with other deserving children through forest and pasture walks, advising them to seek the guidance of elders and bridge the gender gap if any.

Seeking Consent of Knowledge Providers

4. **Ethical exchange of knowledge and resources through prior informed consent:** Prior Informed Consent (PIC) is an important tool for ensuring that the rights of the knowledge provider(s) are protected under relevant provisions at different stages of knowledge collection and sharing. If the knowledge is relatively novel, one can also file a patent/intellectual property (IP) in their name. While the process is lengthy and time-consuming, the knowledge provider(s) may give permission to share the formulation for validation and value addition. While exploring commercial returns on the knowledge, it is imperative to seek permission from the knowledge holder(s). One has to specify under which conditions the formulation can be shared and how the knowledge provider(s) will be

compensated in case monetary value is generated from the IP. Way back in 1989–90, a letter was given to every knowledge provider while seeking their knowledge, assuring them of their rights and seeking their permission to publish it in the *Honey Bee Newsletter*. This was the seed which was elaborated in detailed PIC guidelines in SRISTI[14], NIF[15] and GIAN.

It helps to build trust with the community as they are now assured that one is not trying to steal their knowledge. Their knowledge will be shared with third parties as per their preferred conditions. This can be recorded if signing forms is not possible.

By implementing these adaptive measures and fostering sustainable social and bio-entrepreneurial practices, the Himalayan region can enhance its resilience to climate change impacts and support the portfolio of livelihoods mediated by women in high-risk environments.

[14]Society for Research and Initiatives for Sustainable Technologies and Institutions.

[15]National Innovation Foundation.