



MARKETING UNDERUTILIZED PLANT SPECIES FOR THE POOR: A CASE STUDY OF MINOR MILLETS IN KOLLI HILLS, TAMIL NADU, INDIA

by

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1. Introduction

Modern crop production is based on only a few plant species. However, many less well-known plant species continue to be grown, managed or collected, particularly in rural areas of developing economies, thus contributing to the livelihood of the poor and to agricultural biodiversity (FAO 1996). Some of these species, known as ‘underutilized plant species’, can be characterized by the fact a) that they are locally abundant in developing countries but globally rare, b) that scientific information and knowledge about them is scant, and c) that their current use is limited, relative to their economic potential (Gruère, Giuliani and Smale 2006). Most of these underutilized plant species can benefit from marketing development as a means of supporting their sustained use and help foster the conservation of agro biodiversity, while generating sustainable income for the local producers and chain actors.

In South India, minor millets are an example of underutilized plant species being locally important but commercially traded on a very limited scale outside the producing communities. Minor millets are often termed “coarse grains,” and pertain here to finger millet, foxtail millet, and little millet. Furthermore, “minor” refers to the extent of research investment and commercial importance of the crop in terms of area, production, and consumption (Nagarajan and Smale, 2005). In the Kolli Hills of Tamil Nadu, a genetically diverse pool of minor millet varieties are grown by the tribal farming communities to meet their subsistence food needs. Most of these minor crops are not traded outside the farming communities, albeit on a limited scale in the local markets as a result of a recent development intervention. Despite a consumption preference among the farming communities for minor millets, in the recent past the acreage under minor millet crops has declined considerably, due to the availability of substitute crops such as cassava, rainfed rice, pineapple and coffee, which are grown exclusively for market purposes. The M.S. Swaminathan Research Foundation, a leading non-governmental organization that works on sustainable agriculture and development issues, based at Chennai, India, has led targeted conservation-cum-commercialization intervention programs over the last 7-8 years in the Kolli hills, with the objectives of i) increasing the marketing potential of these minor millet crops by adding value to them; and ii) helping the farming communities to maintain the existing diversity among the minor millet crops by providing economic incentives for their conservation efforts (MSSRF, 2002).

In this paper we are conducting an evaluation of the marketing development initiative for minor millets in the Kolli Hills by the concerned non-governmental organization. We analyze the recently-created market chain of minor millet crops along with the major actors involved, through a series of field visits and focus group discussions with the relevant stakeholders. Our main objectives are (a) to identify some of the key factors that

contributed to its relative success; and (b) to study the effect of the development of this market on the livelihoods of participants in the chain and on crop biodiversity. Ultimately, our analysis intends to provide insight into the relative success of conservation cum commercialization interventions for the crops concerned.

Our analysis shows that the market development initiative for minor millets in Kolli Hills can be considered quite successful. The market chain creation has helped create renewed interest in minor millets and provided a new source of income, while contributing to the preservation of crop biodiversity in the Hills. At the same time, the main crop competitor, cassava, is still in expansion, so the millet marketing initiative still faces challenges in the long run. Our analysis also shows the critical importance of collective action in market development for underutilized crops. Unlike in the case of cassava or pineapple in Kolli Hills, the foundation of the minor millet market chain is based on the action of groups of individuals, working collectively towards the same outcome. We argue that collective action is a necessary but not sufficient condition for successful marketing of underutilized species.

The paper is organized as follows. In the first part, we present the context of the study, describing the agricultural system of Kolli Hills. In the second part, we analyze the development of the market for minor millets in Kolli Hills. In the third part, we focus on the outcomes of the intervention, by assessing the effects of market development on income and crop biodiversity. Finally, based on the example of minor millets in Kolli Hills, we draw a few lessons on the necessary conditions for the successful commercialization of underutilized crops - particularly the importance of collective action in market development for these crops - and discuss the potential limits of market-based solutions for the conservation of agro biodiversity.

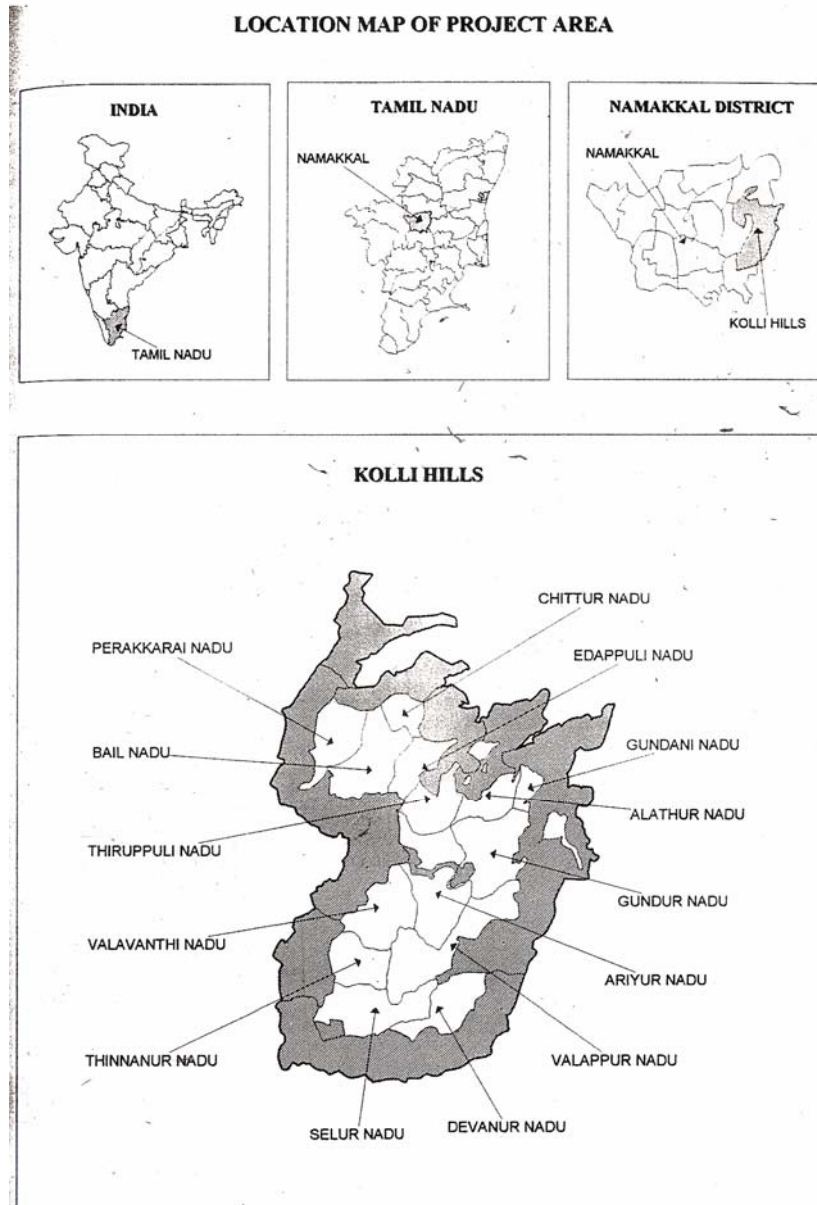
2. Agricultural and Institutional Context

2.1. Kolli Hills

Kolli Hills (*Kollimalai* in Tamil) is a preserved mountainous area of the Eastern Ghats located at the Eastern border of the Namakkal District of the Indian State of Tamil Nadu. Figure 1 provides a map of Kolli Hills and its relative location in India. The elevation of the central region of the hills ranges from just under 1,000m to 1,350m above mean sea level. Thanks to this elevation, the region benefits from relatively low temperatures in the area, compared to the remaining part of the state of Tamil Nadu: the maximum temperature ranges from 20-30°C, while the minimum lies between 10-20°C. The average annual precipitation in the region is about 1,440mm, which also exceeds the State average (MSSRF, 2002; Kumaran, 2004).

Kolli Hills itself can be divided into two main physical components: the periphery and the central part. The periphery is covered with uninhabited preserved national forest lying on more or less steep slopes and largely contributes to the rich biological diversity attributed to the region. The central part is inhabited and is covered mostly by agricultural

or agro-forestry area, as a replacement for what used to be only forests. Overall, according to Kumaran (2004), forests occupy 44% of the total area of 28,293 ha, while agricultural activities take place in 52% of the area, leaving 5% for other activities.



Source: Kumaran (2004)

Figure 1. Details of project area.

The estimated population of the Kolli Hills is 50,000, distributed in fourteen *nadus*³ or *panchayats*, or administrative village clusters, as indicated on the lower map of Figure 1. More than 95% of the inhabitants are tribal people from the Malayali community (MSSRF, 2002). The whole region is linked to the rest of the Namakkal district by one paved road on the South west of the Hills that leads to the hamlet of Semmedu in the Valavanthi nadu. Semmedu is also where the governmental departments are located, including the education and primary health offices for the whole region. As a result, the inhabitants often have to travel to Semmedu. There is only one secondary school in Kolli Hills, located at Semmedu. The local literacy rate in the Hills is about 31%, while the female literacy rate is only 23 % (Pradeep and Rajasekeran, 2006). There is no hospital in the Hills and infant mortality is 30%. There is no means of transportation in several parts of the Hills, so people have to walk from place to place. Roads cover a large part of the area, but some hamlets remain isolated from any road infrastructure. Every village is led by a Gounder (the village head man), who supervises the *panchayat* president.

2.2. Minor millets and other crops

Historically, the Hills were covered with pristine forests and inhabited by nomad tribes who would change their settlement from year to year. In the last 30 years, forest areas have been quickly replaced by cultivated land, prompting the State government to protect the boundary forest, so as to avoid the complete depletion of the forest ecosystem. At the same time, deforestation led to the stable settlement of the tribes in the central area of the Hills. Despite the almost complete depletion of the forest in the central area, certain patches of forests have persisted, due to the will of inhabitants to preserve them voluntarily as sacred groves. Currently, the State forest service inspects the boundary of the central area to enforce the strict conservation regulations, but despite their efforts the arable land is slowly expanding from year to year. Because of the recent past of this forest area, most land in the central part is covered with red soils that are rich in bauxite and other minerals, and allow for a number of crops to thrive.

The land is now divided into different strata that also correspond to their respective uses. Kumaran (2004) classifies land used for agriculture in Kolli Hills into three types: first, the land of the valleys with springs, primarily used for the cultivation of wet land crops such as paddy rice; second, the dry lands with rainfed cultivated land allocated mainly for growing millets and cassava; and third, the land on the fringes of the valleys devoted to the cultivation of pineapple, coffee, pepper and other condiments. In recent years, most of the dry lands in Kolli Hills have shifted their focus towards cassava cultivation. Pradeep and Rajasekeran (2006) estimate that cassava land now represents about 75% of the total dry lands. Overall, irrigation facilities are available to less than 15% of the area, through springs and wells; the remainder is under rain-fed farming (MSSRF, 2002). In order to show the diversity of the agricultural landscape, we are indicating the cropping pattern as seen in Padasolai, one of the typical settlements in Kolli Hills, in Figure 2.

³ *Nadus* are a historic classification of villages since the medieval period. In these 14 *nadus*, there are 16 revenue villages and 263 hamlets. Normally a *nadu* is referred to a village community comprising 10-15 settlements, which were later re-designated as *panchayats* by the government of Tamil Nadu.

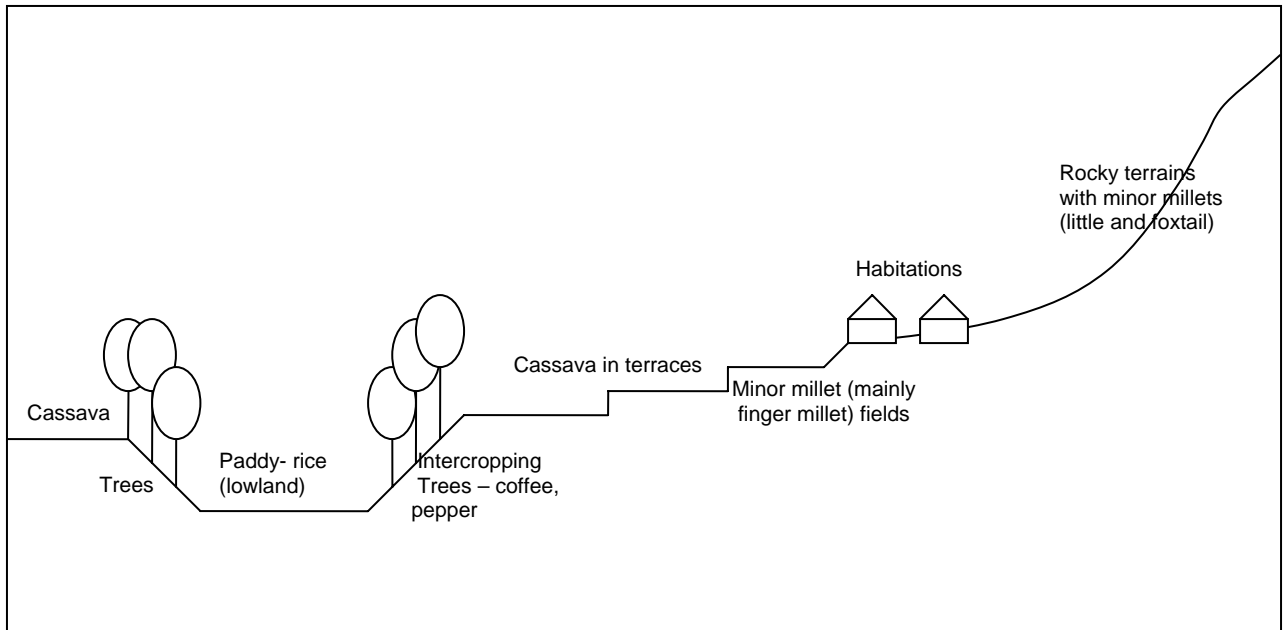


Figure 2. Schematic representation of the agricultural cultivation in Padasolai settlement, Kolli Hills (August 2006)

In this representative village, the landscape is terraced, with rice growing at the bottom of the valleys, above which are located several terraces of cassava in well-prepared terrain, followed by a small area devoted to minor millets (mainly finger millets). Above the inhabited areas, other minor millets are sown sparsely in rocky terrain on the upper part of the slopes. Multi-cropping patterns with coffee, banana, pepper (inter-cropped with silver oak trees especially for taming peppers), cardamom, guava, and jackfruit occupy the interspaces between levels.

The Kolli Hills are known for their agro biodiversity, and especially for the genetic diversity in minor millets. In the context of the Hills, the term ‘minor millet’ refers to little millets (*Panicum milliaceum*), finger millets (*Eleusine corocona*), and Italian (foxtail) millets (*Setaria italica*). Each of these crop species presents a diversity of land races. The intra-specific phenotypic variability of minor millets is enormous; the populations are highly heterogeneous in morphological and agronomical character. The heterogeneity within the races and the microclimatic variations in the fields at different altitudes help reduce the risk of crop loss due to various abiotic and biotic stresses. The region is also known for its knowledge with regard to traditional medicine (indigenous) and for its high-quality honey with reputed excellent flavor.

Just like most other crops currently cultivated in the Hills, cassava is an exotic crop for the area and was completely unknown to the local population before its introduction. Minor millets are probably among the last traditional crops in the Hills, along with certain medicinal plants that also remain largely underutilized. The shift to cassava was generated by an increasing demand from starch-based industries located in the plains of the Namakkal and Salem districts, particularly for the production of sago, the most popular starch product. Most local cassava processing companies located in the plains

offer attractive contract-farming arrangements to local producers, including the provision of the necessary agricultural inputs, and assure yearlong remuneration to farmers.

3. Market development for minor millets in Kolli Hills

In this section, we first present the situation before market development. We then explain how the intervention was conducted by the MS Swaminathan Research Foundation, and we analyze the newly-created market chain and the role of the different groups of actors along the chain.

3.1. Before market development: informal exchanges in autarky

In Kolli Hills as in other places in India, minor millets were grown extensively and widely consumed. The traditional agricultural system consisted mainly in growing minor millets (generally as a mixed crop) in the existing forest ecosystem, with literally no tillage and no external inputs. The system was highly subsistence-driven in nature and whatever surplus was left over had an immediate market from external sources. Minor millets were cultivated on a subsistence scale and there was no formal market for them.

But their cultivation progressively declined, due to changing consumption and production preferences, and the increasing presence of competing crops such as rice, cotton and other cash crops. Historically, minor millet production in Kolli Hills started declining from the mid 1980s, and was progressively replaced by cassava (tapioca), a cash crop, since the early 1990s (Rengalakshmi et al. 2006). As shown in Table 1, the area devoted to minor millets decreased from 1799 ha in 1970-71 down to about 600 ha in 2004-05 (G>Returns of Namakkal District 2005). Meanwhile cassava, which was not cultivated in the 1970s, quickly expanded after its introduction, to reach an estimated total 5,200 ha by 1997-98. Pineapple, which was also an introduced crop in the Hills in the early 80s, has also expanded rapidly, occupying nearly 1000 ha in 2004-05

Table 1. Changes in cultivation acreage over years under minor millets in Kolli Hills

Year	Minor Millets (ha)
1970-71	1799
1996-97	967
2000-01	687
2004-05	604

Source: G>Returns of Kolli Hills, Directorate of Agriculture, Tamil Nadu (2005)

3.2. Role of M.S. Swaminathan Research Foundation

The M.S. Swaminathan Research Foundation (MSSRF) is a very reputed non-governmental organization, founded and led by the eminent agricultural scientist, Professor M.S. Swaminathan, with headquarters in Chennai, the capital city of the State

of Tamil Nadu. The MSSRF conducts research and development projects on agriculture and conservation-based issues in certain regions of rural India. The strategy formulated by the foundation is fundamentally demand-driven; all interventions are preceded by a series of consultations with the concerned stakeholders. The foundation also strongly believes in the role of collective action among rural communities, as a driver for any sustainable action.

The MSSRF started its intervention in Kolli Hills in 1994 by conducting a three-year appraisal of the issues faced by farmers of minor millets and other crops in the area. At the end of the process, several issues were identified: the decline in the food basket, land transformation towards irrigated cassava cultivation, and the lack of a marketing system for minor millets. Before the MSSRF intervention, there was no marketing system for food derived from minor millets in Kolli Hills, except in the case of finger millets, which are widely known and used as a food substitute for diabetics.

These audits led to several subsequent programs over the nine years that followed. First, the MSSRF devised field-based value addition activities in food fortification among minor millet growers in Kolli Hills. Second, a program was initiated to promote millet biodiversity by means of conservation and commercialization. In this latter program, the MSSRF identified three main objectives: supply productivity improvement, improvement of millet quality, and facilitate processing of minor millets.

To address these issues, the MSSRF initiative first proposed to work on marketing chain development. The foundation set up a field-based station in the Hills with the objective of demonstrating the potential of improved agronomic practices on minor millet crop productivity and also to initiate training on post-harvest handling methods. More specifically, the MSSRF established seed banks and initiated a participatory plant breeding effort on minor millets. The selection of lines from a pool including the traditional varieties and improved varieties obtained from ICRISAT was made by minor millet users and producers, with the objective of conservation and productivity improvement to obtain a large portfolio of adapted varieties. On the supply chain, the objective of the Foundation was first to link the primary producers to a marketing chain, second to develop different uses of the minor millets, and third to promote it as a competitive alternative to other cereal crops. Finally, the MSSRF has also been involved in a program providing enterprise management skills and knowledge of supply system along the chain. The capacity building strategy followed a trainers' training methodology for rapid replication of skills and knowledge dissemination among the communities. Most of these programs were carried out with the major funding coming from the SDC (Swiss Development Agency) and IFAD (International Fund for Agricultural Development).

a. Market development through collective action

In order to develop a market for minor millets, the MSSRF established market linkages at both local and regional levels. Self-help groups and enterprises were formed to institutionalize market operations. The various groups have also been brought under a single system of federation that was linked to the Tribal Cooperative Marketing

Development Federation of India Ltd. (TRIFED). Marketing mechanisms and particular economic linkages were negotiated and resulted in a Memorandum of Understanding stating the rules and procedures to be followed by marketing federation members. This was signed by representatives of each group (MSSRF 2002).

Self-Help Groups

Self-help Groups (SHGs) are the common grass root institutions through which development activities are implemented in many regions of India. Participation is voluntary and the basic schemes are based on internal lending incentives. These groups meet every other week to discuss current issues and pool their funds to support individual or common needs. Originally, the groups were promoted as a means for families to help each other financially. In 1996-1997, thirteen self-help groups (SHGs) were created as part of the participatory rural appraisal of the MSSRF in Kolli Hills.

There are currently about forty SHGs in Kolli Hills, divided into four groups, spread all over the central area. The MSSRF has acted as an initial catalyst of these groups, by helping them to organize themselves, training them in financial and book-keeping skills; imparting skills to take up enterprise-based activities; helping them to get financial help from the financial institutions, and then following up periodically to evaluate their functioning, especially during the incubation period. However, the work division and the group meetings are organized and sustained according to the choice of the village participants. Most of these SHGs are comprised exclusively of either male or female members of the community, while a few groups are mixed, with participation on the part of both male and female members.

Enterprises

As part of the development of a market for minor millets, as well as other initiatives taken in the valley on pineapple marketing and seed conservation efforts, a number of specific task-driven groups were formed, based on the choice of people in the concerned communities, along with the feasibility of the proposed enterprises. These enterprises, such as the ones contributing to the marketing of minor millets, undertake various activities from input and seed conservation (seed packaging) to packaging of processed millet products. Each enterprise comprises people belonging to one or more SHGs. Several enterprises include a combination of members from different SHGs, thus enabling the enterprise itself to rely on a larger credit base and enhancing the coordination of activities along the chain. The basic infrastructure for each of these enterprises was either funded voluntarily by village participants, or provided with the help of MSSRF grants or loans, and in one specific case funding was obtained from the State of Tamil Nadu.

Twelve types of enterprises were set up with specific activities ranging from agronomic input groups (seed banks) to credit institutions (mainly micro credit), marketing and processing groups. All such groups initiated by the MSSRF share the same objectives of promoting conservation efforts, and the creation of markets and basic infrastructure,

along with commercialization. These enterprises are spread out all over the Hills. More generally, a map of SHGs shows that the MSSRF intervention covered most of the crucial points for the successful marketing of minor millets. We will describe more specifically the role of each enterprise involved in the market chain of minor millets in the following section.

3.3. Situation after market development

a. Market chain of minor millets

In this section we provide a description of the market chain for minor millets in Kolli Hills, as it currently stands, and then focus on three specific groups of market actors to understand the role of these groups in the market chain.

b. Description of the overall market chain

The supply market chain for minor millet involves three major group types: 1) a first group in charge of procuring millet from farmers, 2) a second SHG in charge of dehusking and processing, 3) a third set of SHGs to take care of value addition packaging and before sending the products to retailers. In addition, a number of other groups contribute to activities related to input and production of minor millet. The complete marketing channel is represented in Figure 4. At the end of the chain, minor millets are now sold as packaged rice, flour or malt to local consumers and, since recently, to a few supermarkets in Chennai (Spencer's Foodworld stores).

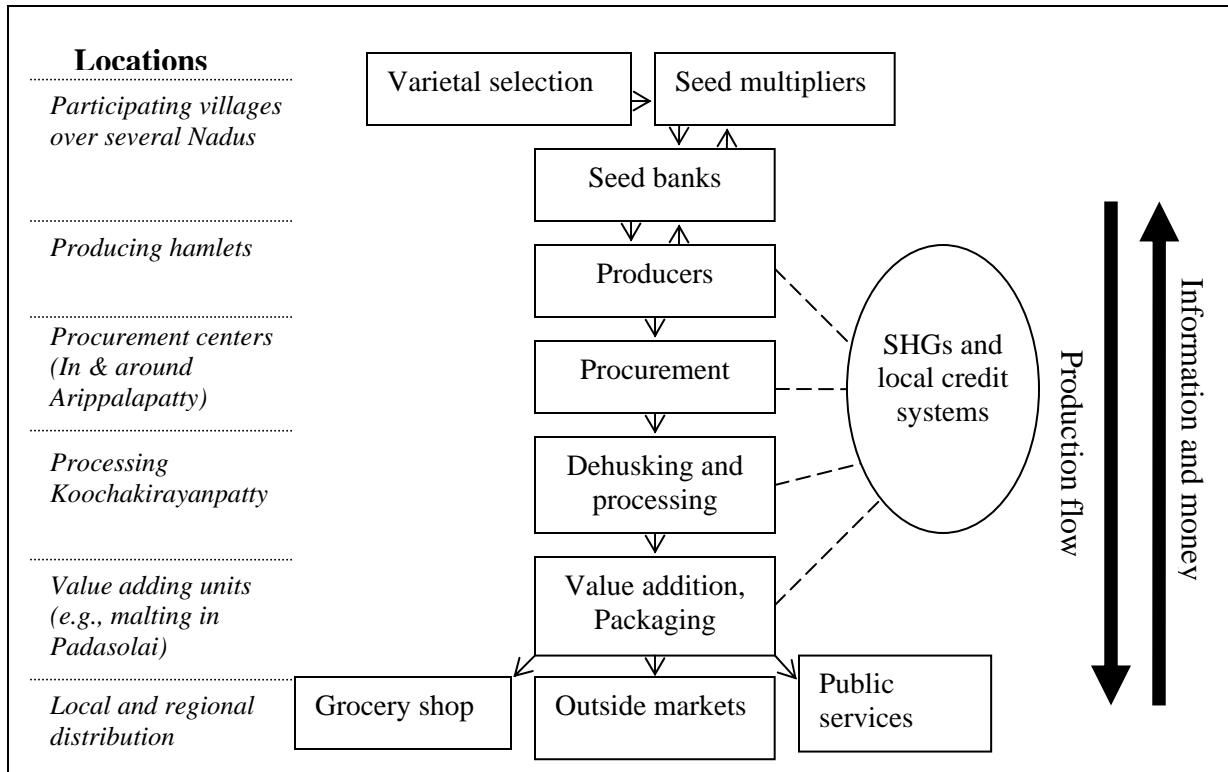


Figure 3. Schematic representation of the market chain for minor millets

c. Participatory varietal selection site in Padasolai

On the productivity side, the MSSRF has employed two distinct strategies for productivity improvement: first, improved cultivar selection, and second, extension, to achieve an improvement in agronomic practices, with line sowing and proper spacing.

One of the major activities undertaken by the Foundation was to conduct a selection of minor millet cultivars and varieties. This process started with the provision of up to 2000 isogenic lines that were then progressively reduced to 36 lines. The original 2000 lines included both the land races of the Kolli Hills and improved cultivars from various research institutions obtained from the International Crops Research Institute for the Semi-Arid Tropics (ICRISAT). The selection was made using a participatory approach, with the help of voluntary farmers. Farmer SHGs were able to compare the output of different varieties and make their choice according to their own criteria. They chose improved varieties as well as certain local land races. This mixed outcome is seen as very positive from the point of view of the MSSRF, whose goal is to increase productivity for marketing while maintaining traditional lines to conserve local diversity. New improved varieties have shown a potential yield improvement of 10-20% compared to currently traditional ones. The yield could improve from 2400kg/ha to 2700kg/ha.

Tribal women played an essential role in this participatory plant breeding experiment (MSSRF, 2002). Thanks to their practical knowledge in seed selection, they ensured that the selection approach was balanced. For instance, small millet land races were selected

by a set of men and women, but their selection criteria varied greatly. The men selected an early maturing variety while the women preferred varieties with high yield performance or nutritious quality. The women, being responsible for cooking, preferred varieties with adequate taste and consistency and they also considered the vigor of the whole plant in the marginal agro-ecosystem along with well-filled grains in the panicle, while men used good panicle as their main choice variable (MSSRF, 2002).

We visited the hamlet of Padasolai, which was one of the locations where seed multiplication was going to be conducted for several selected improved lines of minor millets. Figure 2 represents the cropping pattern during our visit at the beginning of August 2006, during sowing time. We met with the local landowners, farmers preparing the soil and sowing seeds, as well as local helpers managing the seed multiplication stage of the process. Although the farmers and landowners taking part in this multiplication are voluntary participants, the seeds produced will be partly sold to the MSSRF for distribution to farmers, and partly kept by the landowners for their own use.⁴ Helpers come to provide support and extension advice, particularly during the critical multiplication stage, but after that the farmers will be on their own.

To summarize: the seed selection and multiplication activity included two types of groups: first the SHGs that selected the lines, and second, the group of helpers, who are also farmers, and who provide the seeds voluntarily and organize the seed multiplication process. These groups helped in convincing and supporting the local producers and landowners who devote some of their land to multiplication, on a semi-voluntary basis.

d. Woman group on procurement of minor millets in Arippalapatty

Lower along the marketing chain of minor millets, we held further discussions with a women's group from Arippalapatty, whose members are primarily responsible for procuring minor millets in and around growing regions and then transporting them to the dehusking center for further processing and marketing. Group members say that they produce about 300kg/household, keep 50% for home consumption and sell 50% for processing. Most farmers keep their own seeds for the next season; they sow 50% of the old seeds and 50% of the new. Group members walk up to 5-7km to procure the grains, and transport millets on head loads or sometimes by bus. Then they gather all the grains in an assembly room and hire a vehicle to transport the harvest to the Koochakirayanpatty processing mill. The transportation costs Rs. 500 per ton of minor millets.

Their marketing margin is fixed at Rs. 1.5/kg, i.e., they procure unprocessed minor millets from farmers at the rate of Rs. 6/kg, and processing pays Rs. 7.50/kg. Regarding information dissemination, group members think that the current system is working efficiently among the various groups. Information regarding demand is provided before the harvest, from end-of-chain, and then they procure adequately to respond to the demand. Last year, 1,000kg of packaged product was obtained in this particular location.

⁴ MSSRF requests the farmers who got 'the initial seeds or varieties' from MSSRF for further multiplication or for production purposes to return a part of their produce to other farmers in the community.

The procurement system starts locally and then expands to other villages, when each participant in the procurement group goes from door-to-door to ask inhabitants if they have millet to sell. They go on until they obtain the total required demand. The total production capacity is uncertain, but they believe that the supply could easily be doubled in their area.

In fact, the main constraint is not related to production quantity but to the limited production area. The Hills agricultural system is dynamic and it progressively pushes minor millets towards the top of the hills as time passes by. The cycle goes as follows: 1) fields are covered by weeds; 2) producers burn the weeds; 3) they cultivate millets for two years; 4) they flatten the land; 5) they plant cassava; 6) after a number of seasons of cultivating cassava on the same land, the soil becomes unfertile; 7) tree plantations and fallow replace cassava, and then the field could go back to the first step. The risk seen by the MSSRF is that minor millets will continue to be marginalized and will finally be dropped off the system to the profit of cash crops which have no subsistence value and which, in intensive culture, tend to deplete the fertility of the soils.

e. Dehusking and processing mill – men’s group in Koochakirayanpatty

Further along the marketing chain, we also interviewed members of the SHG who manage the dehusking and milling facility in Koochakirayanpatty. We met with three members of the men’s self help group at the processing facility. The group has twelve members, but with a rotation on duty call for carrying out and managing mill operations: only two members work there every day, with the help of assistants. They process rice and millets, and charge Rs.1/kg of raw minor millet processed.

The major challenge for this group was to obtain the necessary infrastructure, which included machinery and a building, and to meet the energy requirements. They first obtained a loan from the MSSRF to purchase machinery; then they purchased the land to set up the facility. They complied with governmental standards and fulfilled all regulatory requirements. In return, they obtained a special grant from the District Rural Development Authority (DRDA), which amounted to Rs.37, 000 to construct the building. This type of grant is rather exceptional, and can be considered an enormous achievement. Now they have the personnel, the machines and the building, and they are just waiting to be connected to electricity shortly, in order to replace the current diesel engines.

Like other enterprises, this group is working in agreement with other groups and in constant contact with other actors in the chain. In particular they take part in discussions with groups lower and higher along the marketing chain, to set up the production numbers, collaborate on the financial side to pay the procurement group, at the rate of Rs.7.5 /kg of raw product and receive payment from the marketing and packaging group in exchange for the dehusked and or milled flour from minor millets.

f. Market infrastructure

In the current system, the infrastructure required to accomplish various activities in the marketing chain is minimal. For instance, most of the packaging activities (such as malt or polished grains) are done at the dehusking mill premises in Koochakirayanpatty or at the MSSRF field office located in Semmedu. The products are also stored in these premises before being taken out for commercialization. Producers of millets are located in various village communities or settlements. Most of the village communities are either connected by road (mud or tar roads) or located closer to road networks. However, a number of millet producers and their settlements remain isolated from roads. The quality of the road is relatively good, but not in all places. In addition, in certain weather conditions, such as under heavy rain, only the hillside roads are usable, which means that users have to go around the Hills before reaching the main market place. Currently, the women's groups responsible for procurement use their own houses for storing the millet bags collected from various producers before transportation to the processing facility. For instance, the procurement group located in Arippalapatty is nearly 10 miles from the processing facility and it takes nearly Rs.500-750 to transport 500 -750 kgs of millet grains there

The fact that there is a unique windy road connecting the Hills to the plains can be seen as both a positive and negative constraint for the minor millet market chain. Obviously, if there were additional roads to link the Hills to the plains, it could reduce transaction costs, increase traffic in the valley, promote tourist activities, investments and interest in local produce. But at the same time, this situation contributes to the remoteness of the Hill system as a kind of natural supply control. The region is well defined by its remoteness, which contributes to the local brand identity, and several minor millet production and marketing activities are centralized near the main hamlet of Semmedu. With additional roads, the forest would likely be even more difficult to preserve, more cash crops would get in, and serve as competitors to the minor millet. So, despite the fact that in the long-run more roads will be beneficial and encourage more activities, in the short-term the market chain has probably benefited from this semi-isolation from the rest of the region. Furthermore, the volume of marketable surplus exported out of the Hills is still low, so transportation is not seen as a binding constraint.

As explained earlier, the processing facility at Koochakirayanpatty has been built and the machinery for the same was purchased through a bank loan obtained by the farmers' association. Currently the processing facility is powered by an oil engine and still awaiting for an electricity connection. As this is the only facility that exists for dehusking or milling of minor millets for the whole of Kolli Hills, located near Semmedu, still the communities far away and isolated from road networks could not utilize the current facility. This is mainly due to poor transportation networks as well as the cost of transaction.

g. Marketing strategy and the role of market-related policies

Currently the focus is to try to establish a robust local market – within 100km radius, by using promotion campaigns, awareness-raising strategies, and new recipes in order to add value locally. To expand demand, a branding strategy was adopted to try to better promote the product as a locally-grown, uncertified organic product, thanks to the chemical free production practices used in the Hills. Two types of packages are sold with recipes and pieces of advice on how to use the products, both in Tamil and in English. The recipes provided come from both traditional uses and new uses developed by cooking specialists. For example, women from the SHG in Arippalapatty reported that they have traditional recipes for porridge using finger millets or Italian millet .

The groups have also compiled a recipe booklet on minor millets (MSSRF 2004), which is sold as part of the marketing effort. The major task of the market developers - and the remaining challenge for the MSSRF - is to raise awareness in order to increase the share of households likely to consume minor millets. In order to do so, MSSRF staff have used local events and the annual temple festival in Semmedu and Arapalleswarar temple to sell the products deriving from minor millets, and inform the visitors about the various recipes and the nutritional quality of the millets.⁵

At the same time, the MSSRF wants to go further through policy advocacy. When we visited the hamlet of Padasolai, a settlement where finger millet is grown primarily for malt-making purposes, we were able to visit a kindergarten facility run by the government that provides free meals twice a week to young children. As part of the statewide program entitled the 'Integrated Child Development Services' (ICDS), prepared meals are provided with proper nutritional content, which include wheat, maize, sorghum, finger millet and other minor ingredients. The Foundation is trying to promote the use of all types of minor millets into noon meal schemes, to further increase demand. In parallel, the Foundation is also lobbying the federal government to include minor millets in other child programs. Swaminathan (2006) recently urged the government to permanently require the purchase and inclusion of *ragi* (finger millet), *bajra* (pearl millet), *jowar* (sorghum) and other millets in the public distribution system (PDS) in order to ensure nutrition security and production sustainability. He further emphasized that these underutilized crops should be referred as 'nutritious cereals' instead of 'coarse cereals' as is the current practice.

The major challenge on the consumption side comes from the fact that most other crops, and particularly close substitutes, are heavily subsidized both on the production and consumption side, while millets are obviously not targeted by any government program.

⁵ For instance MSSRF field staff in Namakkal/Kolli Hills organized an exhibition (Aug 1-3rd, 2006) at the annual temple festival in Kolli Hills, held by the Tamil Nadu State Tourism Development Corporation. The purpose was to demonstrate the various culinary preparations made from minor millets in order to promote the concept that minor millets are health foods. The farmers groups sold different minor millet products during the exhibition and netted a profit of around Rs.4500 (100 USD). Out of 40 exhibits, this theme was selected as one of the best displayed and the Ministry of Tourism and Development, Govt.of Tamil Nadu, India, awarded it first prize.

For instance, there is a consumption quota of rice provided to each family every month for a very low and insignificant price.

h. The role of the private sector

Market intervention on minor millets was led by the MSSRF and did not involve any major private actor directly. However, as the market chain grew and became functional, private services have become more and more relevant. In particular, two types of critical activities are provided by private actors or companies. One is transportation services from one point to the other - this requires hired trucks, and will grow in importance as the volumes progressively grow. Second, the outside distribution of the millet product - which is the result of a consultation with private distributors and retailers in the region. Local staff from the MSSRF, in association with actors from the market chains, have been proactive in contacting local and regional food retailers to present their products and negotiate contracts.

As the supply volume grows, the role of MSSRF will be reduced, and the many groups they helped create (SHGs and enterprises) will become more coordinated as private entities within a functional market chain. MSSRF has provided some training to various actors within the chain, to develop entrepreneurial skills. It has also initiated some activities on the use of market information.

4. Socio-economic and environmental effects of market development

In this section we assess the effect of market development, based on a value chain analysis in the village of Kolli Hills.

4.1. Social and economic benefits of the value chain creation

a. Supply/demand trends

The decline in acreage and production of minor millets in Kolli Hills is attributed to change in production and consumption trends over the years. Hence, when MSSRF planned its intervention strategies to promote the cultivation of minor millets in Kolli Hills, it initiated those strategies by creating strong market backed production linkages to achieve the twin objectives of conservation and commercialization of minor millets. In order to improve the supply of minor millet grains, the MSSRF introduced participatory plant breeding (PPB) techniques. By PPB, they could introduce suitable varieties to the hills by selection from local land races with promising productivity levels. Farmers were also involved in the choice of improved cultivars from a pool of genetic resources. Simultaneously, market linkages were also strengthened to promote the utilization of millets, thus enhancing the profitable nature of these minor grains. Such interventions contributed to the creation of value-added opportunities for minor millet products (e.g. dehusked/milled/powdered/malted products). The aim of this was to promote the

consumption of minor millet grains both locally and also in non-traditional markets such as among urban consumers. Among the millet-growing farming communities these efforts of value-addition not only enhanced their participation in markets along with increased consumption, but reduced the drudgery of women - especially in the processing of millet grains, thus improving the consumption levels.

Table 2 presents the quantity of marketed minor millets in the last 4-5 years. This gradual evolution shows that efforts to market or promote the utilization of minor millets among urban consumers, as health foods, are starting to pay off. The self-help groups, which are involved in various value-addition activities, are supplying minor millet grains to various urban center markets. It is evident that there is an increasing demand for Kolli Hills products from the local, nearby urban markets (e.g. Namakkal and Salem).

Our discussions with the individual and farmer members of the self-help groups producing minor millets, clearly pointed out that the returns are much higher for the new millet products (more than 50%) - even with only simple value addition techniques such as provision of de-husked grains- than with whole grains. The farmers were also of the view that that being a part of the group for value-addition reduces the overall transaction costs, thus increasing their share in the retail margin. The value-addition also improved the local consumption levels. For instance, nearly 150 households from 10-12 village settlements used the de-husking mill capacity at the Koochakirayanpatty in the year 2005-06, of about 2000 kilograms of minor millets for their own household consumption purposes. It should be noted that when the processing facility was opened in the year 2000-01, only some 35 households utilized the facility, processing about 350 kilograms of minor millets.

Table 2. Quantity of grains (processed) marketed in urban centers

Year	Urban –Metro centers(kg)	Urban-Local(kg)	No. of households supplied grain	Gross returns(Rs) to SHGs
2002	11600	0	53	265,000
2003	2600	250	29	65,525
2004	10800	250	73	220,988
2005	6500	1485	64	167,125
Total	30500	14400	219	600,000

Source: Table adapted from Rengalakshmi et al (2006).

b. Value chain analysis:

Table 3. Margins received by the enterprise groups for processed millets in Kolli Hills

Stage in marketing chain	Marketing margin	Add up costs	Remarks
Procurement price at the farm gate	Rs. 6/kg	Rs. 6/kg	Little and fox-tail millets are procured at this rate. Finger millet is procured at Rs. 9 per kg because of higher demand from the buyers.
Procurement and transportation to the processing center	Rs. 1.50 per kg	Rs. 7.50/kg	Currently, the procurement group hires a van for transportation to the dehusking center situated 8-9 kms away.
Processing and/or dehusking at the mill	Rs. 1.25 per kg	Rs. 8.75/kg	
Transportation to value-addition center	Rs. 1.25 per kg *	Rs. 10/kg*	Value addition centers are located in different village communities
Value addition			Value addition centers managed by groups involved in i) breaking the dehusked grains as rice, which is cleaned, and packed for sale as whole or broken grains in the market, including recipe pamphlets; or ii) malt making by further grinding and including other ingredients, such as wheat, maize, cardamom and green gram
i) Value addition as polished and cleaned ” rice”	i) Rs. 1.50/kg* for cleaning + Rs. 5/kg* for packing	Rs. 16.50/kg*	
ii) Value addition through malt making	ii) Rs. 5/kg* of malt + packing cost of Rs. 2/kg*	Rs. 17/kg*	
Transportation to retailers			Normally sent in bulk to reduce the cost.
a) To local markets in plains	a) Rs. 3-5 per kg*	Rs. 22/kg*	a) Sent to Namakkal and around
b) To Chennai	b) Rs. 10-12 per kg*	Rs. 27-30/kg*	b) Mostly Spencer’s food markets
Retail			
	1. Namakkal and the plains– Rs. 8/kg.*	Rs. 30/kg*	
	2. Chennai: Rs.10/kg.*	Rs. 42/kg *	

*Kg of processed products – assuming grain: husk ratio at 1:1.5, i.e., about 50% of unprocessed millet is lost.
Source: Compiled by authors

In Table 3, on previous page, we show a detailed distribution of marketing margins and cost additions. Prices and marketing margins were set up in agreement with all groups when setting up the Memorandum of Understanding, and remain constant per unit. They reflect the cost of the transactions. The retail price of products derived from minor millets is currently around Rs. 18-20/500g packet of clean millet rice. Of this amount, farmers get approximately Rs. 6, the procurement group gets Rs.1.50, the processing group gets Rs. 1.25, transport gets Rs. 0.60,value addition units use Rs. 3.25, with transport Rs. 1.50-2.50 to sell it to the retailer who keeps a margin of 4-5Rs. Thus, primary producers keep about 30% of total retail price which is more than reasonable as compared to other food processed products. Currently, there is a more than sufficient demand, most of which comes from metropolitan regions with health-conscious consumers and diabetics. Generally, MSSRF local staff believes that the market potential is relatively small but could grow in the near future.

4.2. Effects of market development on crop biodiversity

a. Intra-specific diversity: in-situ conservation via participatory selection

As discussed in the earlier sections, the area under cultivation of minor millets has declined considerably over the last 3 to 4 decades with the rise in cultivation of other commercial crops such as cassava, pineapple and other plantation crops. This has direct implications on the reduction of intra-specific diversity of millets cultivated in the hills over the years. Thus, in proportion to the decline in the area; the varietal diversity has become reduced, as farmers excluded certain land-races due to changes in the socio-economic and cultural environment. During the early 1980s each household used to cultivate two or three short-duration and one or two long-duration varieties of minor millet species to optimize resource management and to spread out the risk in production. But, at present, many households cultivate only one of the land-races based on their preferences,⁶ which further reduces the species diversity both at the farm-household and at the community levels (MSSRF 2002; Rengalakshmi et al.2006).

b. Inter-specific diversity: slowing the “cassava invasion”

As mentioned before, cassava has rapidly spread all over the Hills, to the point that local agricultural observers have jokingly nicknamed the area *Koochi Hills*, which can be translated as ‘the cassava hills’. Cassava is only a recently-introduced crop, and local inhabitants told us that they had never heard of cassava before it was introduced, in the mid 1990s.

Before meeting with the woman procurement group of Arippalapatty, we met all the participants in the field preparing the ground and planting cassava in a rather orderly manner. They used line-sowing techniques with adequate spacing to plant the cassava seedlings on a red soil terrain that had been well prepared, and leveled off. During our focus group meeting with them, we discussed the production of cassava and its development compared to minor millets.

When asked why they chose to cover all their fertile land with cassava cultivation, the women of the group first mentioned land management issues. Minor millets are ready in 3 to 4 months, and after planting millets, there are no clear or advantageous alternatives, in part because of the bad timing of the season. Thus, the land is not used for any type of cultivation. In contrast, cassava takes ten months to grow and thus is not wasting land space. In addition, minor millets provide a one-time harvest with partial cash payments, whereas, thanks to the contractual arrangement with the purchasing company, farmers obtain revenue from cassava all the year round. The company provides support from the beginning of the season until the end, and provides revenue that can amount to about Rs.10,000 /year. Overall, the net return of cassava per unit of land is estimated to be about Rs.5,000 for a season of 9 months, whereas returns from millet cultivation average at Rs.2,500 for a season of 3-4 months if sold in the market. Among the minor millets,

⁶ Most farmers tend to cultivate one land race but some do cultivate up to two land races per millet species.

finger millets get better farm gate price (Rs. 9 per kg) compared to other minor millet crops but it also consumes more water, and becomes a competing crop for rice paddy in the valleys.

Cassava is the major ingredient supporting the sago industry located in the plains which is used to extract i) glucose for pharmaceutical purposes and starch for textile industries particularly well developed in the region of Coimbatore, located 100 kms from Namakkal and Salem districts (the so-called Manchester of South India with a heavy concentration of cotton and textile mills); and ii) sago pellets that can be used as the equivalent of noodles for various food preparations such as porridge, crackers and gruel. The incentive of the industry to develop a cassava production unit in the Kolli Hills is based on agronomic advantages and low-cost family labourers who seemingly compensate for the additional transport cost on the only road that leads to the plains. The industry also found that cassava is subject to fewer pests in high altitude, and grows well on the local fertile land without any intensive external input. Cassava requires good water resources, which tend to become scarce in certain parts of the plains with the more frequent occurrences of drought and depletion of the water resource, but is not a problem with the heavier precipitation in the Kolli Hills environment. The main inputs used are organic fertilizers. Chemical fertilizers are not encouraged by the MSSRF, and do not seem to be considered necessary by the company in the Hill agro-ecosystem.

We also asked women of the group why they use the proper sowing techniques to plant the cassava and neglect to do the same for minor millets. They replied that they do not use line sowing and proper spacing technique for minor millets, because the millets are planted on the slopes of the hills in rocky terrain which makes it difficult to follow the same practices.

So to sum up, the market development initiative for minor millets has certainly helped in creating a new interest for this item, thus contributing to the conservation of crop biodiversity. At the same time, the increasing presence of cassava in the Hills shows that the competition is hard and that the conservation of minor millet production will remain a challenge in the future.

5. Conclusions: the role of collective action

In this paper we have shown that the market development initiative for minor millets in Kolli Hills was quite successful. The market chain creation has helped create a renewed interest in minor millets, and provided a new source of income for all chain actors, in a rather equitable way, while contributing to the preservation of crop biodiversity in the Hills.

Many factors have certainly contributed to this success, from the method and length of intervention of the NGO to the people involved and the financial help. But our analysis also shows that one of the most significant factors may be the use of collective actions in

market development. The production was improved and organized by groups, the development of the chain was done in consultation with groups, the market chain is organized by groups, the decisions are taken in groups and all communication are done within and across groups.

In the following section, we focus on this issue by comparing three market channels in Kolli Hills and evaluating the role of collective action for the market development of underutilized species.

5.1. The role of collective action in three marketing channels of Kolli Hills

a. Minor millets, cassava, pineapples: three different marketing chains in the Hills

In cases where there is an enabling political and institutional environment that allows actors to make their own decisions, there are three necessary conditions for the successful conduction of any particular development action: i) the will, motivation or incentive to conduct this action; ii) the capacity to do so; and iii) the strategy or plan of action. This conceptual framework can apply to individual or group actions. In this section, we compare this structure and the role of collective action in minor millets to the case of other crops in the Kolli Hills area, to demonstrate the specific role of collective action in markets for underutilized species.

In the case of minor millets, the successful development of the market chain has been implemented by support from collective actions that covered the three necessary conditions. First, the decision and motivation was based on group decisions after discussion with MSSRF staff. Second, the capacity to set up a market was built from a collective action: each enterprise decided to make it possible even if it meant providing some land, buildings or other inputs to make sure it would work. Finally, the strategy decided was the result of a grassroots discussion within self-help groups, enterprises and communities. By mixing members from different SHGs, enterprises benefited from the combination of their financial resources when needed, particularly during the initial phase of market developments. This system also encouraged interaction across SHGs. Furthermore, the shared capacity and common strategies reinforced the will of the collectivity to conduct this effort. Collective will is based on the fact that every enterprise knows their necessary step in the process for the common good. And there are multiplier effects along the chain, once the group is set up; the development of the market with the necessary capacity may encourage others to enter in the action; the common decisions make sure everyone is motivated, and the common motivation enhances the capacity.

The case of cassava is quite different. Based on information we gathered and group practice observation, cassava producers within each community tend to help each other during sowing and harvesting periods. The sowing is done by all female members of the community in each individual field. This shared effort helps to gain precious time before the onset of the rainy season. Furthermore, we witnessed a village-wide collection of cassava tubers, where the shared effort of all the men and women helped to collect and transport the tubers by head loads to the shared truck hired for the occasion. So it is clear

that collective action is involved in labour-intensive tasks. At the same time, unlike in the case of minor millets, each household can be individually contracted by the company; there is no need for common strategy and common will, because if the neighbour stops growing cassava, the others will still be able to grow it and sell it. In other words, contract farming tends to eliminate the need for collective action related to each of the three necessary conditions. The chain for cassava is all driven from the cassava industry, but the chain of orders is top-down. In contrast, the minor millet chain, at its inception, is obviously supply-driven, in the sense that local producers and chain actors are trying to develop a market and link their products to potential demand. The chain of order for minor millet is based on collective 'grassroots' decisions and, as such, can be considered bottom-up.

Pineapples produced in the Kolli Hills have a reputation for their freshness and savor. During the consultation by the MSSRF, five villages with a large area under pineapple cultivation were selected and mobilized into five self-help groups (three women groups, one men group, and one mixed group). One of the issues that came to the forefront was the difficulty of communities to transport pineapples to the market. Many pineapple producers had to walk all night before market day with a heavy load to access the regional market in Kolli Hills. The walk lasted for hours due to the long distance between production sites (which tend to be high in the fringe of the valley) and market sites which are located near Solakaddu, to facilitate access by traders coming from the plains. As a response, the MSSRF, as part of a project funded by IDRC with the producing communities, helped to organize procurement self-help groups for pineapples, in order to simplify transportation. It was decided to set up procurement centers very close to production areas and use them as a starting point for truck or vehicle loads of pineapples to the central market.

The second intervention by the MSSRF was designed to help set up an association of producers of pineapples and to link the producers' association to an exporter of organic pineapple production, the Ionic Exchanges India Ltd (IEEFL). Since Kolli Hills producers benefit from very good conditions and low pest infestation, they do not need to use any type of chemical control, provided good agronomic practices are adopted and could therefore obtain organic certification without much effort. ECOCERT International, a German organic certification company, was approached for certification. A group of multi-disciplinary experts inspected the site and certified an area of 232 acres as an organic production zone for pineapple cultivation.

The main issue faced by producers relates to the payment of the organic certification costs. As in other cases, the intervention was progressive: first the MSSRF paid the entire certification costs in the initial year, then the local association of producers paid 50% based on their revenue of the first year, and during the third season they paid all the certification costs. These costs are quite high; they include an annual inspection of field, market, transport, and wholesale by the German based ECOCERT. But the association of producers rapidly saw that it was worth the cost as the pineapples that were usually sold for Rs.1-3/kg are now sold to exporters for Rs.5-6/kg, for an average increase in profit estimated at about 40%. About 40 tons have been marketed out of an estimated potential

of 400 tons (MSSRF, 2002). So even if not all pineapples are certified as organic, this initiative has generated some significant benefits. Overall, the two-step intervention by the MSSRF produced obvious effects in three years, increased producers' net returns, lower transportation costs, and helped sustain environmentally-friendly practices. Unlike cassava, pineapple is not a competitor for minor millet, it is not competing for land and both contribute to diet diversity in the region. This is one of the reasons why the MSSRF accepted to intervene in both cases simultaneously.

The involvement of collective action in the marketing channel of organic pineapple could be considered intermediate between minor millets and cassava. Men and women self-help groups pooled the produce from various areas to ensure quality while marketing at collection centers. Collection was carried out under the supervision of IEEFL. This process contributed to instill a feeling of collective ownership and provided self-help group members with business skills (MSSRF, 2002). Thus, as in the case of cassava, pineapple producers share labour-intensive tasks, but they go beyond that with the procurement self-help group and association, to pool funds in order to get organic certification annually. As in the case of minor millets, the chain involves groups that are absolutely essential for the production, information and money flows. But unlike in the case of minor millets, there is no effort to market the crop beyond the market link initiated by the MSSRF, there is no product development, no packaging and no consistent effort by all producers to maintain a production. Collective action exists to strengthen the capacity, as a common motivation, and with the help of a common strategy during the intervention. In other words, the intervention to improve the market chain has linked supply-driven and demand-driven factors. Action taken by each producer individually may be motivated by individual factors, but will be driven by a common strategy and semi-pooled capacity. Furthermore, unlike the two other marketing channels, this chain involves both top-down and bottom-up chains of order.

b. Comparison of the three marketing channels

The comparison between marketing channels for cassava, minor millets and pineapples in the Kolli Hills region reveals the very important role of collective action in the market development and successful commercialization of underutilized species. Table 4 summarizes the differences between these three markets in the Hills, according to the three necessary conditions defined in the conceptual framework for development action, the supply- or demand-driven nature of the market development initiative, and the direction of the chain of order or decision making process. Collective actions occur in all three markets at the level of production capacity, by sharing labour and capital. But the nature of incentives and the strategy adopted within each market differ considerably, from purely individual in the case of cassava to purely collective in the case of minor millets. Finally, both the chain of order and nature of the market development initiative vary largely among the three crops.

Underutilized species have the specific particularity of facing a weak demand, mostly due to lack of awareness of the product's attributes, and poor public and scientific knowledge, which tends to be associated with a lack of agricultural research. Unlike pineapple,

minor millets are not locally, regionally or internationally known by consumers. Unlike cassava, minor millets are not driven by a robust industrial demand. As a result, developing a market for an underutilized crop is very specifically a question of demand expansion.

Table 4. A Comparison of the role of collective action across three principal agricultural crops in Kolli Hills.

	Minor millets	Conventional and organic Pineapples	Cassava
Type of crop	Underutilized plant species	High value product and niche market	High value industrial crop
Capacity	<i>Collective action:</i> internal lending	<i>Collective action:</i> association of producers, organic certification fee and procurement groups	<i>Mostly individual, collective action</i> at harvest and sowing time
Will	<i>Collective action:</i> multiple enterprises and coordinated SHGs, lower economic incentive in the short run.	<i>Individual and collective action</i> for organic producers: association to obtain organic certification (medium run economic incentive)	External funding motivation, <i>individual payments</i> (short run economic incentive)
Strategy	<i>Collective action:</i> with MSSRF audit and participative selection, agronomic improvement, marketing enterprises	Association with the MSSRF on initial strategy but long term production <i>individual strategies</i>	<i>Individual contracts</i>
Market development	Supply-driven	Supply- and demand-driven	Demand-driven
Chain of order	Bottom-up and top-down	Top-down for conventional and mixed for organic	Top-down

Expanding demand is difficult and has to be done concurrently with the development of the market chain. Because these underutilized crops are only used locally in rural communities of developing countries, and mostly by smallholder farmers, any successful market development and demand expansion has to start from this basis of production. Because lack of demand for these crops make them uncompetitive compared to existing cash crops with well-established demand, the individual economic incentives to market them are rather weak - if not totally absent. For all these reasons, collective action initiatives are absolutely necessary to the development of a robust marketing channel. Local users help understand current and past uses, and help build proper ways of developing new uses for the products and promoting them. Local producers are also the basis of any successful development of a supply chain. Pooling resources, realizing scale economies, sharing information, and developing a community incentive are essential benefits of collective action. Market development without a driving demand will require capacity, strategy and a will that can only be obtained by collective action.

The comparison of the three markets can also help us to understand the possible evolution of markets. Without strong demand, the challenge of marketing development is first to

create a small but robust production and marketing chain while developing uses and linking products to potential demand, using promotion and awareness campaigns. All underutilized crops are facing these challenges. If the approach is successful, a demand becomes sufficient to sustain a market over time. At that point, the crop will potentially attract competitors, thus bringing both costs and prices down. If this happens too quickly, the incentive to continue marketing the crop could falter to the point that the crop becomes unprofitable for market chain actors. This is the reason why Gruere et al. (2006) argue that marketing should involve some type of branding in the original region, and from the beginning marketers should consider product differentiation strategies. The minor millet initiative in Kolli Hills set up a local brand, with organic certification, while proposing recipes and packaging designs under a specific format that makes their products well differentiated.

The goal of marketing development for these minor millets is to create a robust product niche in the region. If it goes beyond that to the generalized use of the crop over the years, it could potentially become a commonly-used, high value agricultural product with a strong and established sustainable demand. This would result in increasing capacity and industrialization towards the cassava model. But it is more likely that the objective of such a market is closer to the organic pineapple example, where the market chain is well organized and driven by a specific high quality niche market demand.

To sum up, the successful example of marketing development of minor millets in the Kolli Hills of Tamil Nadu shows that collective action initiatives play an essential role in the marketing of underutilized crops. Such initiatives are necessary for the successful marketing development phase and will most likely be needed for a sustained, effective marketing strategy.

In addition, it is obvious that the role of the Foundation has been preponderant in this action. Without its participation, the market for minor millets would not have developed. But at the same time its role can be considered as a facilitator for market development rather than a leader- financial supporting institution. In the case of Kolli Hills, in order to market any non commercial product successfully, an external facilitator was required for the following reasons; i) Kolli Hills is a hill-based eco-system, a very niche based agro-ecological system ii) the people living in the Kolli Hills belonging to tribes, culturally more closed and autarkic, and iii) the accessibility to Kolli Hills is a significant market constraint as many communities in the hills are still not connected by roads. Crops such as pineapple and cassava were introduced to the Kolli Hills system from external agents and when they were introduced the trading system came along with them. But the concept of 'value-addition' such as 'organic' was not introduced before the MSSRF started its interventions. Moreover, crops like cassava and pineapple were attracted to traditional trading methods through commission agents and thus loans and advances/credit availability to farmers was not a problem. In the case of minor millets, traditional subsistence crops that were not formally traded, the monetary help was not available by any means. Hence, there was the need for an external facilitator or help in order to create incentives through value-addition for some products (minor millets or pineapples) or even to create markets for others (minor millets).

Even if the intervention of the concerned NGO as a facilitator played a very important role in market development for minor millets, the role of intervention by an outside institution cannot be generalized for all cases of underutilized plant species. The case of minor millets represents a case without an established market; there was no significant incentive for market creation in the presence of competing economic opportunities. In other words, individual local inhabitants did not have a motivation to go ahead and create a market for these traditional crops. So our case study supports the argument that facilitation through a NGO is necessary to develop hitherto inexistent markets in cases where the underutilized crops are under economic pressure. But other cases of underutilized plant species will likely differ - some had a past market use, others suffer from an existing but underdeveloped market, and in these cases a simple improvement (such as market coordination) coming from the community itself and with very limited outside intervention can result in significant market and value improvements.

Beyond that, the economic question for policy makers remain to evaluate whether marketing development is an effective sustainable solution for agro biodiversity conservation. The example of minor millet in the Kolli Hills shows that there may be significant issues regarding the use of this strategy, as discussed in the following section.

5.2. The limits of market development for agro biodiversity

a. Fragile and limited demand: what is the real market potential?

Measuring the potential market for a new or re-introduced good is very difficult. Underutilized products have an unexploited economic potential, which can be assessed based on past use, current trends in the local regional or international markets, and the properties of the products as compared to other substitute products. Gruère et al. (2006) argue that the gap in knowledge among local users and between local and regional users can be used as a partial measurement of the difference between the observed and potential value of an underutilized species.

Minor millets have been widely used in this region of India, but they have been progressively replaced by other cereal alternatives both in production and consumption. Outside of the Hills, particularly in the neighboring plain area, it is difficult to find farmers who still devote some of their land to minor millets. Without processing and value addition, it is arguably impossible to market millets profitably, so the production incentives are very limited in most areas. On the consumption side, minor millets also face a number of constraints. In August 2006, we conducted a parallel focus group discussion with thirty small and medium cotton farmers in a village in the plains of the Salem district, which belongs to the targeted scope for regional marketing development of minor millets from Kolli Hills. At the end of the meeting, we asked these men and women farmers about their current consumption of minor millets. Most of them said they do not consume minor millets anymore. They argued that rice is much easier to prepare. Minor millet processing is very difficult, physically. Moreover, women do not have the time to process millets and do not know how to prepare and cook them anymore. Besides, household members can buy rice for a very low price under public procurement systems.

Each family is entitled to 20kg/month for a very low price, which makes it almost free. Rice production in the area is not profitable because of the fertilizer needs and the cost - which exceeds the revenue but it constitutes the staple product of the local diet.

These simple remarks taken from a group of rural consumers reveals that there are a number of issues to be overcome. The regional availability of processed minor millet could help significantly in the rehabilitation of minor millets in the local population, but it will not be sufficient. First, rice is almost freely provided to these families, so it is clear that competition with a subsidized crop is a major constraint. Second, even without the price difference, the traditional cooking know-how for minor millets has been lost. This is where the recipe leaflets attached to the packaged products marketed by the Kolli Hills community could play a role. But including written recipes might not be sufficient for consumers to get interested in the product again, as the proportion of consumers who read food labels may not be high. Promotion and perhaps cooking demonstrations could be other ways of effectively delivering the message.

Another difficult issue not explicitly mentioned in this meeting is the change in taste; local inhabitants may be used to eating rice and other grains several times a day, and replacing rice by minor millet could be a challenge. In other words, fighting against a long-term trend would require very important promotion and awareness campaigns.

All these factors show that there may be a market potential for minor millet products regionally, outside the Hills, but it could be seriously limited. There is a wide difference between establishing a marketing niche and reaching significant market shares in local food consumption. And even for the establishment of a niche market for minor millets, efforts will need to be sustained and expanded to particular groups of the population that could constitute a stable segment of consumers. This segment could include health-conscious urban consumers, diabetic persons, and perhaps even tourist outlets, as an initial target.

As in the case of the initial phase of market development, collective action has a significant role to play in establishing a successful promotional strategy and implementing it. Pooled resources, pooled expertise, and pooled capacity will be critical to the expansion of a robust demand for minor millets or any other underutilized plant product. But it remains a *necessary but not sufficient condition* for successful commercialization. Group coordination and concerted efforts will not prevent the failure of a market to establish a sufficient niche if the market potential is not sufficient in the first place, or if the competition is distorted by production and consumption subsidies.

b. Sustaining the incentive: private versus public benefits

Economic incentives have arguably been the main driver for the expansion of cassava in the Kolli Hills. One has to recognize the competitive edge of cassava cultivation, compared to minor millets. MSSRF (2002) reports that although the market linkages encouraged by its initiatives encouraged local people to grow minor millets, practical constraints still discourage them from expanding their production activity. In particular,

various land races of minor millets in Kolli Hills are grown in more than 250 hamlets in 16 revenue villages - mostly on undulating terrains, which make it difficult for complete procurement and homogenous sales of all millets in all hamlets. Financial constraints constitute another obstacle to the success of the market initiative: there is no insurance mechanism to compensate the risk of loss.

The basic costs and returns of production also differ considerably in cassava production, which is the next competitive opportunity. As previously mentioned, returns from cassava production per unit of land largely surpass those obtained with minor millets. Even with a higher cost of production, cassava simply provides more returns to the individual households. This extra income expands the purchasing power of producing households. As a consequence, it increases their accessibility to utilities. Now they can send their children to faraway and good schools, have good health care and enjoy other luxuries from external markets with the surplus income earned from growing cash crops.

However, a comparison of the external costs and benefits associated with both systems clearly rules in favor of the traditional system using minor millets. From the environmental point of view, the production of cassava or any other cash crop has a number of adverse effects. The foremost is land degradation, which is caused mainly by the slash and burn followed by constant tillage, removal of inherent fertility, addition or dumping of fertilizers (artificial) into the soil system, exhaustion of soil fertility by intensive cropping. Second, local honey production is under threat because of lack of suitable pollen that was available in plenty with the traditional system for the wild bees. Third, uncertainty facing the existing cash cropping system is another threat to challenge the farming community, as was clearly proven a couple of years ago when there were heavy rains and the entire cassava acreage was washed out because of waterlogging, whereas traditional millets survive through the heavy rains and drought. Fourth, the introduction of cash crops also led to new pests and diseases in the ecosystem. And last but not least, the loss of biodiversity in terms of plant species - especially minor millets and medicinal plants - from the ecosystem. Corresponding to each of these negative effects of cassava production is a neutral or positive effect associated with the traditional system of cultivation of minor millets (Nagarajan, 1999).

Because of the difference in private and public values, this competition between crops calls for a public intervention to reduce the negative spillover effects of cassava production while sustaining a stable, minor millet production. Market development helped minor millet generate income over the subsistence level, but this income is not at a level sufficient to reduce the private comparative advantage of cassava cultivation. The most direct answer to this problem would be a direct subsidy to minor millet producers up to a level deemed sufficient to maximize the social benefit of growing both crops, but this policy would have to enter the political sphere, which is something that will not happen in the very near future.

The current MSSRF strategy is based primarily on market solution. If the demand-expansion phase is successful, and the groups are able to maintain a sufficiently strong and durable participation on the part of their members, the project will be a complete

success. The results will be the sustainable creation of a robust market for minor millets in the area, for the benefit of the poor and for the conservation of agro biodiversity. If, however, the long-term demand is not sufficient and the groups are not sustained over a generation, minor millets will likely be neglected and may become progressively marginalized years after the intervention.

At the same time, however, one could argue that political actions in support of minor millet led by the MSSRF at both state and federal level, shows that the overall strategy of the Foundation does not exclude the use of public support. Lobbying for the inclusion of minor millets in public meal programs, such as child or public procurement programs are ways to subsidize demand for these crops. International observers have also suggested lobbying for the use of grains from nutritionally-advantageous underutilized species in military rations, to further support the demand for these products. If successful, public political approaches of this type could effectively complement the expansion of local market demand and enable underutilized species such as minor millets to thrive in the regions in which they are produced, for many decades ahead.

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