

Low Carbon Pathways Sustainable Civil Society Initiatives

Tara Karigar Mandal



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Abbreviations

BKP	Bundelkhand Knowledge Platform
BMTPC	Building Materials and Technology Promotion Council
CDM	Clean Development Mechanism
CERs	Carbon Emission Reductions
CIGs	Common Interest Groups
CRIDA	Central Research Institute for Dryland Agriculture
CSOs	Civil Society Organisations
DRDA	District Rural Development Agency
DST	Department of Science and Technology
FAO	Food and Agriculture Organisation
IARI	Indian Agricultural Research Institute
IAY	Indira Awaas Yojana
ICRISAT	International Crops Research Institute for the Semi-Arid Tropics
IGFRI	Indian Grassland and Fodder Research Institute
IIVR	Indian Institute of Vegetable Research
KVKs	Krishi Vigyan Kendras
MEAL	Monitoring, Evaluation, Action and Learning
MoEF	Ministry of Environment and Forests
NABARD	National Bank for Agriculture and Rural Development
NAPCC	National Action Plan for Climate Change
NIRD	National Institute of Rural Development
NRCAF	National Research Centre for Agro-Forestry
PoADD	Programme of Activities Design Document
PoP	Package of Practices
PRA	Participatory Rural Appraisal
PRI	Panchayati Raj Institutions
RCC	Reinforced Cement Concrete
SCSI	Sustainable Civil Society Initiative to Address Global Environmental Challenges
SDC	Swiss Agency for Development and Cooperation
SORs	Schedule of Rates
SSMM	Sankalp Swashakti Mahila Mandal
TKM	TARA Karigar Mandal
TNA	Training Needs Assessment
UNFCCC	United Nations Framework Convention on Climate Change
USP	Unique Selling Proposition
VERs	Voluntary Emission Reductions
VLC	Village Level Community
WEC	Women Energy Cluster
WUA	Water Users Association

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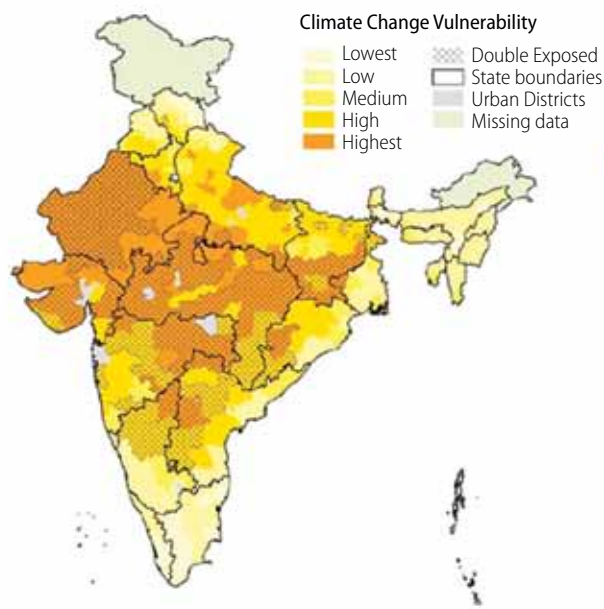
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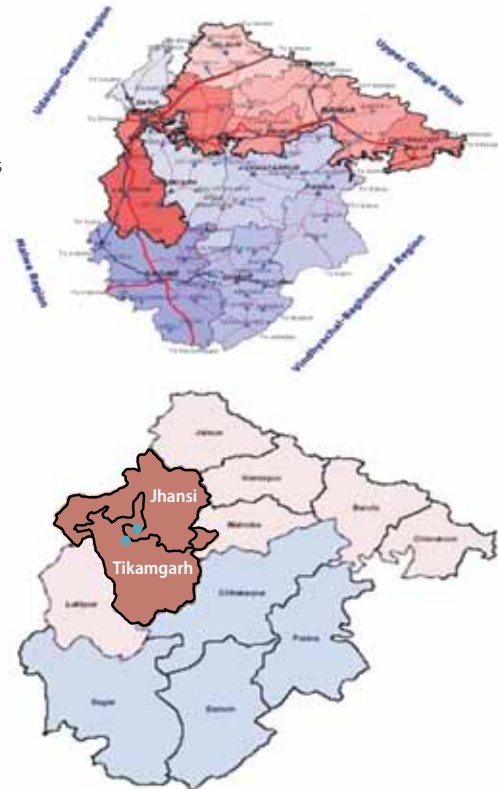
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Fig. 1: Bundelkhand and the Project Areas



Source: IPCC 2007
Map not to scale

Bundelkhand and Surrounding Regions



Artisans are profitably engaged in delivery and promotion of eco-building products and services



Introduction

Bundelkhand, a microcosm of rural India, located in the heart of the country spanning seven districts of Uttar Pradesh and six districts of Madhya Pradesh, is one of the most backward regions of India and rates very low on almost all development indicators (Fig. 1). Agriculture forms the backbone of the rural economy in the region with almost 75 per cent of the people dependent on agriculture and animal husbandry for their livelihoods. Most agriculture is at the subsistence levels. A large livestock population with low productivity and poor infrastructure of energy and connectivity leading to low industrial development and inadequate livelihoods in the tertiary sector characterise the region. Rapid degradation of soil with reduced forest cover and a break-down in the management systems of surface water have added to the loss in land productivity, increased environmental stress and mass migration particularly of the farming and trades communities.

The semi-arid nature of the terrain with poor natural resource base, erratic rainfall, and low economic and social capital has resulted in communities in Bundelkhand being highly exposed to impacts of climate change. It is hoped that understanding of various adaptation strategies will enable informed decision making, both at the policy and ground levels to enable solutions for rural communities to adapt to the changing climate and direct their growth towards sustainability. While regeneration of the natural resource base needs immediate attention, development imperatives, especially for habitat and infrastructure, will require

activities that may further compromise the natural resource base unless resource and energy efficiencies are mandated as core values in the growth process and alternatives to critical resources are found. Clearly, the ability of communities to address global environmental challenges and at the same time moving up the development ladder will depend on improvements in various aspects of social capital among rural communities; availability and ready access to technological and financial solutions for both adaptation and mitigation and a policy environment that responds to people's needs and supports sustainable initiatives/models.

There is a growing urgency to understand the vulnerability of the region and to find solutions for the communities to adapt to climate uncertainties as well as demonstrate low impact/low carbon economic growth models. Development Alternatives, with its focus on the development and growth of the Bundelkhand region has set itself a mandate to work with local stakeholders and design strategies for 'low carbon climate resilient growth' in the region.

Construction sector is the second highest contributor to green house gas emissions after the energy sector in India.¹ Besides, the sector is a primary consumer of virgin materials such as soil for bricks and potable water which causes ecological impacts during extraction of materials whether stone for aggregates, ores for steel or soil for bricks. The sector as such competes for resources and resource footprints with agriculture. In such a scenario, an intervention in this sector through energy and resource efficient

Buildings consume energy and resources while promoting job creation and local economic growth. There is a need to optimise the former and maximise the latter. The construction of habitat and infrastructure in rural areas has therefore tremendous potential to demonstrate climate sensible growth.



building materials and construction methods would contribute to mitigation of adverse effects on the environment. This sector provides an opportunity to demonstrate green growth/low carbon growth in action with additional benefits of local wealth generation and job creation.

Given the observation that the construction sector in rural areas is also the major promoter of jobs and livelihoods of building materials producers and artisans delivering construction services, Development Alternatives has identified the building artisans group as a significant stakeholder and influence in promoting low-carbon habitat and infrastructure development in rural areas.



Artisans as primary delivery agents of habitat in rural areas play an important role in influencing building practices. They stand to gain if eco-construction is also cost effective and high quality as this enhances their market value thus improving livelihoods.



The Initiative

This project is a part of Development Alternatives Shubh Kal Campaign that promotes carbon climate resilient growth for vulnerable groups in the region. The Initiative is a 15 year long 'Sustainable Civil Society Initiatives to Address Global Environmental Challenges' (henceforth SCSI) conducted in association with and support from the Swiss Agency for Development and Cooperation / Climate Change and Development Division, Embassy of Switzerland in India. The Project has been in place from 2008 and this Report covers the period from inception to 2011. The Project has worked with 3 identified vulnerable groups of farmers, women and building artisans in Bundelkhand. The specific objectives during this period of 3 years directed towards the artisans and the habitat sector were:

- Realisation of better job quality by the artisan groups and their profitable engagement in delivery of eco-building services; and
- Facilitation of agencies at local, state and national levels to take cognisance of knowledge outputs and initiate action to amend policy instruments.

Building artisans in rural Bundelkhand suffer low and irregular remuneration not only on account of stagnant growth affected by

recurrent droughts, but also due to limited skills that they possess, inability to offer value based solutions and lack of information on available work in and around their places of residence. They also face exploitation in terms of wages and timely payments from clients. This has usually meant seasonal migration to nearby urban centres along with their families. It was observed that building artisans had traditional knowledge, but they lacked technical and professional skills including value adding ecofriendly technologies. Building artisans operating as individual petty artisans can enhance value and status of their work if they move up the value chain to provide services of contractors, supervisors, trainers, etc.

Although the Project had identified skilled eco-artisans as a key for promoting eco-construction in the region, it was realised that individual artisans cannot impact the market. The Project, therefore, helped organise building artisan into Common Interest Groups (CIGs) covering 10 villages - 5 each from Niwari and Orchha blocks of Tikamgarh districts - federated into TARA Karigar Mandal (TKM). At present, 130 building artisans form the present active membership of the Mandal, with a core group of 80 building artisans.

The TARA Karigar Mandal is a growing association of artisans skilled in various eco-friendly construction technologies. During the course of the project, institutional strengthening has helped get traditionally individual entrepreneurs to collaborate and work towards collective market development for resource and energy efficient construction practices.

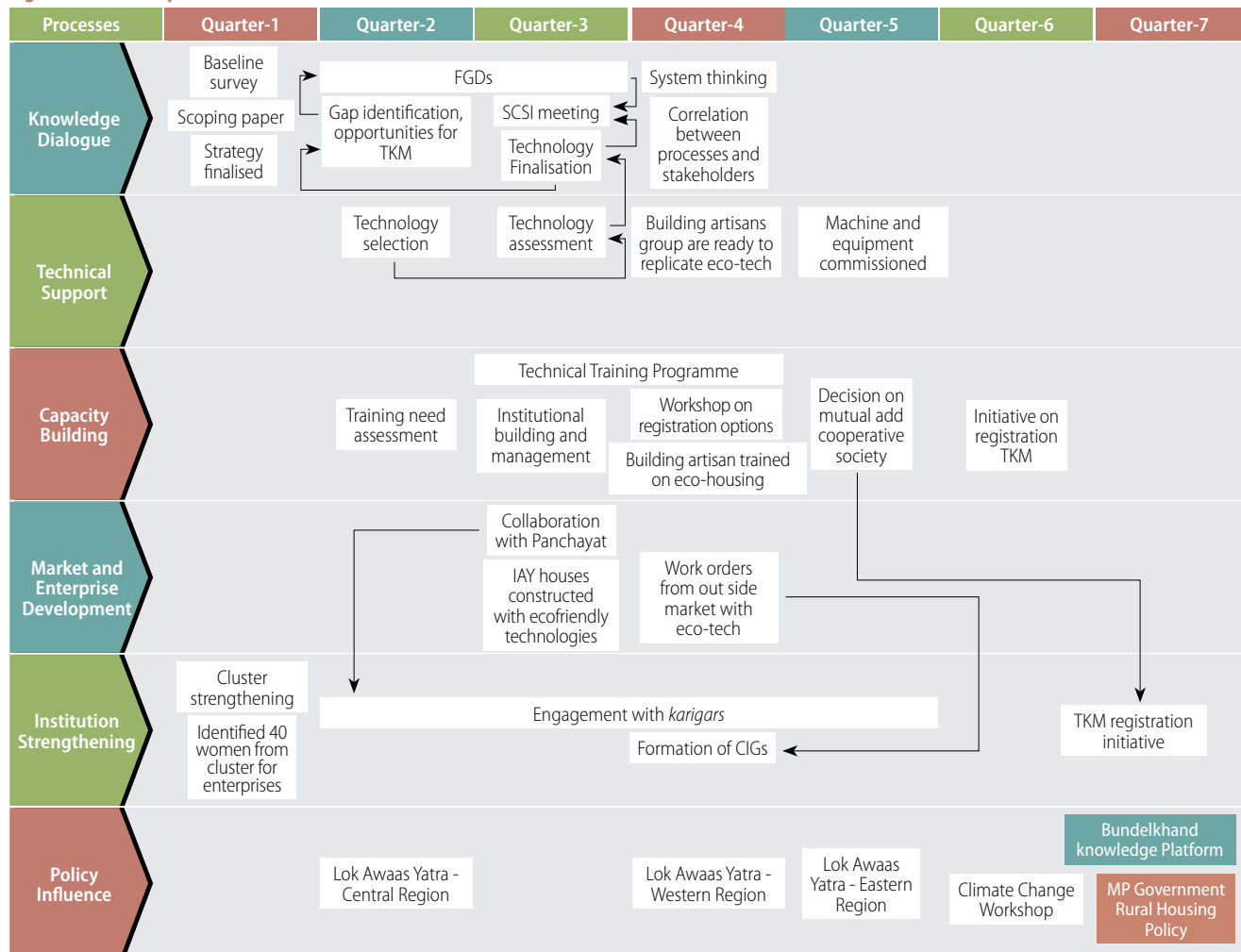


The Process and Pathways

In order to facilitate a change in practice, the activities were designed around a three-pronged strategy based on:

- Knowledge dialogue amongst targeted artisans to select 'low-carbon' habitat technologies suitable for the context;
- Capacity building of the building artisans and of local institutions through technical training and institutional development;
- Packaging the green social enterprises model which included market testing and promotion and networking and leveraging supports; and

Fig. 2: Process Components





- Influencing policy frameworks at the state and national levels that favour the large scale replication of 'low-carbon habitat'.

Knowledge Dialogue

Dialogue processes with artisans were led through Focus Group Discussions (FGDs) in the selected target villages. Discussions progressively focussed on issues of climate change and need for eco-friendly construction; livelihoods of artisans and the connect of their livelihoods with 'green buildings'; the need and potential of artisan group working together and using the 'green construction techniques' as their unique selling proposition (USP) and the market potential for artisans' skills.

Building a knowledge map was the first step in building up an understanding of the artisan universe. This exercise provided an idea of the relationship that the artisans share with the stakeholders and the markets that influence their livelihood. The knowledge map is a dynamic document reviewed at regular intervals and used for designing the intervention strategy.

A key development of the dialogue process was the identification of market oriented technical solutions and building products that the artisans decided to promote in the market based on a criteria defined in a participatory manner. Further, they also identified techniques that they required capacity building in. The application of these solutions by the government and the various other market stakeholders was seen as a crucial intervention.

Subsequent discussions with the artisan

groups have revolved around strategies to influence the market of public buildings in rural areas and neighbouring towns. The need for tools such as a comparative catalogue that brings out the benefits of eco-technologies versus convention techniques of construction for social housing as well as public building designs was identified, along with meetings and sensitisation of district and block level engineering staff of the government.

During FGDs to discuss challenges of getting adequate work, better wages, improved skills and other similar issues being faced by the building artisan it was agreed that an association model such as the TKM should be strengthened and institutionalised. Such a model should have CIGs that are both savings groups as well as share economic activity as a base.

Communication and Outreach

During the implementation of the Project, awareness and promotional programmes were carried out to;

- Highlight the importance of eco-construction technology and its benefits amongst the building artisans and the rural people;
- Associate with the village community, Panchayats and local administration to disseminate the benefits of eco-construction technologies, its availability and potential skill upgradation through the TKM's services; and
- Work with the building community and the materials providers about the existing skills of the TKM members as service delivery agents in the construction sector.

Many rounds of discussions with artisans led to the identification of technologies to be promoted, institutional form and structure of their association, marketing strategies and skill requirements. These discussions themselves have been an exercise of team building and capacity development.





Visits to different parts of India through the Lok Awaas Yatra have exposed the artisans as well as panchayat and district level officers to many alternative ways of construction. The Yatra also provided an opportunity for the project to strategically associate with district level officials responsible for the public social housing initiatives under the various central and state sponsored programmes.

In addition, a concerted effort was made to promote the concept of eco-construction at the state level with the Madhya Pradesh Government to influence the adoption of eco-construction techniques and technologies in public buildings and social housing programmes of the Government.

Various modes of communication used for spreading awareness about eco-construction technologies and to promote TKM, are as follows: **Radio Programmes:** Radio Bundelkhand, the local community radio, was engaged to broadcast messages and jingles. The messages were designed on green building materials and technologies and also on related government schemes. Some radio spots were designed to publicise the TKM's construction services.

Wall paintings and messages: The promotion of TKM was done through various wall paintings and messages in the local villages and nearby areas. The information given through the wall paintings and messages prompted many rural families to start asking for details about eco-construction technologies to build independent houses.

Networking and Policy Advocacy: The TKM Project components actively worked with district and state level policy makers in the department of Rural Development of Madhya Pradesh to influence the adoption of energy and resource efficient construction technologies in housing and public buildings in the rural areas. This process, involved discussions with the State Government and district officials, workshops to initiate dialogue exposure visits of the government functionaries, the Lok Awaas Yatra² and a regional

seminar on sustainable rural habitats to promote eco-construction. Links were established with the Chief Minister's Awaas Yojna³ and a host of communication material was prepared.

The Project led the pilot central zone Lok Awaas Yatra. The workshop organised by the Rural Development Department of the Government of Madhya Pradesh in October 2010 in a two step process brought 50 CEOs from 50 districts of Madhya Pradesh to the Development Alternatives to be oriented to various eco-construction technologies. An interaction with the artisans was organised and a film on the process of developing sustainable rural habitat was made. Another step involved working group sessions with the district officials Bhopal to design the Chief Minister's Awaas Yojna. It brought to fore the significance of sustainability in construction, mechanisms for large scale training of artisans and demonstration of eco-technologies using public community buildings.

Another workshop on Green Building Technology took place in April 2011 at Orchha. The artisan groups were made aware of the various governmental schemes of the state, district and gram Panchayats for a greater employment opportunities. The event concluded with an exhibition of various building products like rat trap bond, MCR tiles, etc. and their applications.

Capacity Building

Technical Training and Support: Besides technical skills in identified construction technologies, soft skills of construction management, quality assurance, negotiation and contracting were also identified by the



building artisans (and also the project team) as essential to raise the profile of TKM.

Training courses were designed as a combination of practical and theoretical exercises and ranged from 7 to 15 days (Table 1). Construction training is a capital intensive activity and essentially requires a building/or a dummy to build while building artisans are being trained. The training strategy identified the houses constructed under the Indira Awaas Yojna⁴ (IAY) and the schools in the villages as training grounds. This meant networking with village Panchayats, beneficiaries of the IAY houses and block officers in the target area. Subsequently, some IAY beneficiaries agreed to get their houses constructed while building artisans were being trained. Techniques of rat-trap bond masonry, brick arch and plank and joists roofs were demonstrated.

A training building was constructed with support from the Building Materials and Technology Promotion Council, (BMTPC) Government of India at TARAGram, Pahunj⁵ where four different types of roofs were demonstrated and master building artisans trained. The building artisans also built an office space using their training on application of interlocking compressed earth block masonry systems and MCR tile roofing at the TARAGram, Orchha⁵ campus.

Training programmes were converted into modules and manuals for subsequent replication of these techniques. These were all prepared in the vernacular and were used by master building artisans to conduct trainings across 17 districts of Madhya Pradesh.

The Project identified a need to provide regular technical support to the newly trained artisans so that they can establish their acquired skills and position in the market and

Table 1: Artisans Trained Under the Various Eco-technologies

Training type	Number of artisans covered
Technical training	
Rat trap masonry system	40
Compressed stabilised earth block masonry	20
Plank and joist roofing	30
Brick arch panel roofing	20
MCR tile production and roofing	15
Production of RCC door and window frames	20
Production of pre-fabricated boundary wall panels	15
Production and installation of pre-fabricated toilets panels	20
Roof rainwater harvesting	10
Biogas plant construction	
Indira Awaas houses – designing and costing	10
Soft skills	30
Quality management and supervision	20
Master trainer	20
How to be a successful contractor	-
Communication skills	-
Basic math	30
Group management and book keeping	48

Technologies promoted through the project and adopted by the Karigar Mandal are not new. These eco-construction techniques and materials have been developed through rigorous scientific research by institutes such as the Central Building Research Institute, the Indian Institute of Science, Auroville Earth Institute, Development Alternatives and many more. Over the years these technologies have been demonstrated across the country but have not been actively promoted and systems for mainstreaming these technologies have not been set in place. The need now is to take these up for large scale replication through market and institutional measures.





Some of artisans in the Mandal had previous knowledge of the eco-construction techniques as they had been associated earlier with the TARA Nirman Kendra projects across the country. These have moved fast into roles of master building artisans and master trainers. Interestingly however, the TARA Karigar Mandal now has many new “first generation building artisans” who see this as a viable livelihood opportunity in the region and new skills as the basis of getting a good wage rate.

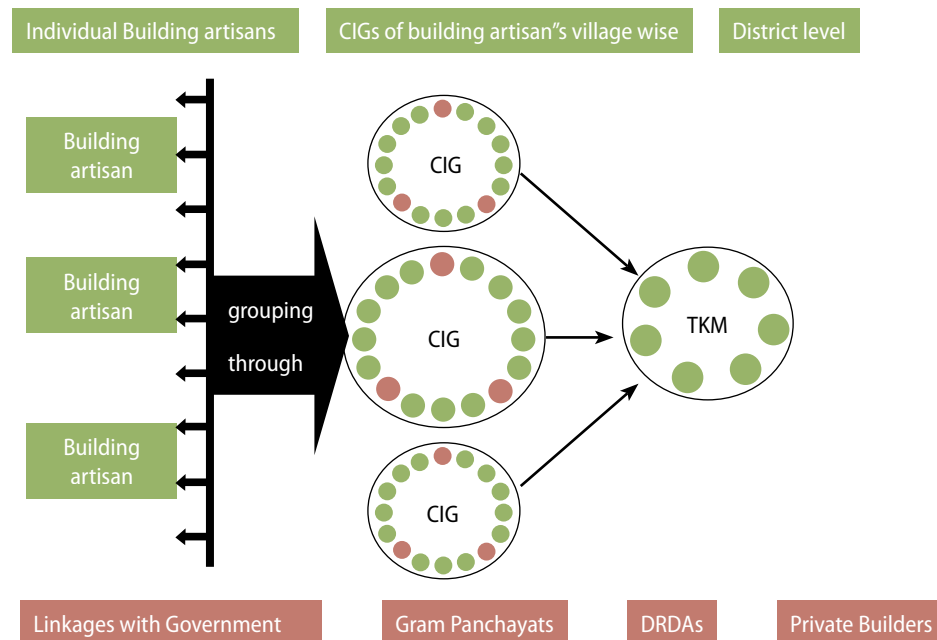
demand higher wages than their counterparts. TARA Nirman Kendra⁶ at Orchha linked to Development Alternatives, provided additional technical and supervisory supports in quality management and in reading drawings. Additional capacity building supports has been provided by a parallel initiative in affordable housing for the rural poor, supported by FEMI Italia and Fondation Carpilo from Italy and linked with the Madhya Bharat Grameen Bank of Madhya Pradesh. Training in basic math was imparted through the TARA Ganit Programme⁷ of Development Alternatives and small tools and implements for ensuring quality of works were made available. The TARA Livelihoods Academy⁸, has integrated the building artisans’ courses as

part of their regular training curriculum.

The TKM artisans had the opportunity to visit other regions in India by participating in the Lok Awaas Yatra. Overall, 20 artisans had the opportunity to visit other eco-construction and integrated habitat development projects. They were accompanied by members from the local Panchayats and district line departments responsible for the IAY housing. This interaction has enabled a variety of new ideas.

Institutional Strengthening: Regular meetings and discussions are arranged among building artisans for information sharing. The CIGs structure at village level helps in organising building artisans for skill upgradation and for service delivery (Fig. 3). This has also imparted them a

Fig 3. The Institutional Structure of Building Artisans’ Common Interest Group





unique identity. The process of strengthening the building artisans association is still ongoing. It is hoped that the CIGs will eventually act as full-fledged self sustained business groups which will provide eco-building services to the Bundelkhand region.

The underlying objectives of the TKM are:

- To develop a collective of artisans to whom a platform is provided where they can share their problems, demands and ensure better livelihood options and not only enhance their skills on new or alternative green building technologies, but also promote them;
- To gain supervisory skills and be able to negotiate/bargain for better jobs and work towards improving the socio-economic status

of building artisans and protect their rights;

- To facilitate job availability in the region; and,
- To have quality control and training and certification.

The rules for membership are simple,

- Anyone, irrespective of caste, gender, class, religion or political orientation who does masonry work for a livelihood and has been associated with any of the CIGs for at least 6 months can become a permanent member;
- The member has to give priority to works generated by the TKM as and when it is available;
- A membership fee of Rs. 500 initially and Rs. 300 for annual renewal is mandatory. This money will be regarded as owner's equity.

Fig. 4. Structure of the TARA Karigar Mandal





The core group of 80 building artisans from 10 villages has now grown to 130 in 12 villages in Orchha and Niwari blocks of Tikamgarh district. These are all official fee paying members of the TKM. In addition, through the training programme for the Madhya Pradesh Chief Minister's Awaas Yojana, the project has directly enhanced skills of another 170 artisans. More than 330 building artisans have been trained in eco-technologies through the efforts of technical agencies influenced in this period.

Nominal members may be included for the limited period of 6 months based on the consent of managerial body. This is a way to be associated with the CIG.

Fig. 4 provides an overview of the structure of the TKM.

The TKM structure and form and its governance systems has enabled the Mandal to receive grants as well as collect fees and a share of profit from the works of its members. Thus, the Mandal has been able to develop a small kitty of funds that is now available to its members to initiate new activities and procure equipment which is available for rent amongst the members.

The Green Social Enterprise Model

The TKM is being floated as a Mutually Aided Cooperative Society which allows the Mandal to not only become a service provider, but also a business enterprise owner. A draft business plan has been developed and artisans are being oriented towards group economics along with the growth in individual incomes. As an eco-construction service provider, TKM has been supported through training and orientation to provide trained manpower for the construction to government, semi-government and private builders. Building artisans from the Mandal are also trained in techniques for disaster resistant construction and have in the past provided services for post disaster reconstruction.

The various construction material and methods which are being promoted by the TKM include: arch roof panel, funicular roof, plank and joist roof (roofing options) and rat trap bond and compressed earth block (walling option). The

TKM also promotes and supports independent ventures by its members where they can manufacture eco-friendly construction material like MCR tiles, stabilised compressed earth blocks and precast walls. In the period of the Project from 2008 to 2011, members of the TKM have been engaged in various construction projects using eco-technologies promoted through the Project. These projects, all in the local area, (Table 2) demonstrate savings in materials, economy in cost and reduction of emissions in construction. They have contributed to building a portfolio for the TKM.

Standard internal and external contract templates have been developed for taking up private works in the villages (Table 3). In addition, typical design templates, estimation templates and drawing catalogues for houses and public buildings are available that building artisans may use for market development and negotiations with clients from private and public sectors. As far as small production units of eco-products by the TKM members (in addition to their services in construction) are concerned, there are collectively defined rules for supporting members' production enterprises. These include signing of memoranda of understanding and terms of references with the parent body, i.e., TKM, insurance of the equipment, initial payments and total loan support, repayment terms, quality management and enterprise support fee (0.5 per cent of profits) to TKM, transparency in accounting and reporting procedures.

The Project has conducted a study in the 12 villages of the target group and two block



towns - Orchha and Baruasagar - to identify the market challenges, potential clients and niche areas for the TKM. The study also identified the lacuna of eco-materials for the promotion of eco-construction and the income potential in this space. Data was collected via individual questionnaires, interviews and FGDs with informed villagers, contractors and dealers of building material and government officials and agencies.

The study helped tremendously in identifying locations where TKM could promote its skills and eco-materials. It also found niche areas where the Mandal could establish links for work opportunities.

Networking and leveraging supports:

Networking with existing opportunities in the construction sector had meant lobbying with Panchayat offices at the block and the district levels and other line departments. The

launch of the Chief Minister's Awaas Yojna³ in Madhya Pradesh has been accompanied by their indication to use/promote locally available eco-construction technologies in the State. To this effect, the Project has initiated a process to assist the state government in redeveloping the 'standard schedule of rates' (SORs) for construction technologies by incorporating new eco-technologies in the State schedule. In this way 20 building artisans who have been associated with 17 district training programme of building artisans have graduated into master trainers. An ongoing intervention in a parallel social housing programme supported by Italian companies (which has also helped in the training, as discussed earlier) has provided the building artisans with an opening to test out their new skills and operationalise the enterprise structure.

The Project has developed an information system whereby a database covering various

Artisans meet as a group every month and also whenever there is an opportunity. Governance rules of the association have been defined and formalised.

Table 2: Major Outcomes from the Market Assessment Study

Awareness	Responses (N = 163) in %	Association with other value attributes
About Eco-materials		
About materials available at TARAGram	94	TARAcrete brand
MCR	94	Quality, linked to TARAGram
FC Channels	56	Durability
Plank and joist roof	12	Promoted by TKM
RCC Door and Window frames	16	Available at TARAGram and durable
Fencing poles and paving systems	83 and 94 respectively	Easy and fast and good quality
About Services of Eco-artisans available from TKM		
Preferred mode of employing building artisans	Builders (10) Individual building artisan – contractors (90)	Quality of trained workmanship



aspects such as building artisans' strength, levels of skills and workdays generated etc., has been created. The TKM is now setting up books of accounts so that quarterly profit-loss statements and balance sheets may be generated.

Additionally, the Project designed a carbon

and resource footprint assessment tool. This tool is being seen as a potential support to track and design finance from carbon funds available and also to support the State Government in tracking and reporting carbon savings and resource made through eco-construction techniques.

Table 3: Eco-Construction by the TKM Members in the Period June 2008 to July 2011

Construction Method	Sq. m constructed	Associated Projects
Stabilised compressed earth block wall MCR roof	18 186	TKM office at TARAGram, Orchha Maya School, Orchha
Rat trap masonry wall, MCR roof	83	Training building at TARAGram Pahuj, Jhansi
MCR roofing	67	Gaushala Office, Orchha
Rat trap masonry wall, stone roof	235	Rudrani Arts Village, Orchha
Rat trap masonry wall	56	Home stay for Friends of Orchha
Rat-trap masonry wall, stone roofs	610	Credit based rural housing under FEM, Orchha and Niwari
Rat trap masonry walls, planks and joists roofs and MCR roofs	540	Community buildings for the Madhya Pradesh Chief Minister's Awaas Yojna



The TKM brand has been popularised in the target villages and at the district level. Their USP is 'prakrit nirman' construction in sync with nature. They educate the customer in the ecological value of the new construction technologies while also indicating cost saving potential.



Outcome

Economic Risk Reduction and Growth in Income

Income tracking survey is conducted on a monthly basis to track the work and type of technology being used and wages paid against the services to the building artisan. To track the income of each building artisan, an income tracking sheet has been developed which records the average monthly income of each building artisan, type of technology promoted and number of days engaged.

It has been observed that the employability of the TKM building artisans has increased and as a result their tendency to migrate has reduced. Factors which have led to this are the capacity building programmes, training in negotiating for business with potential clients, preparation and distribution of promotional material about the TKM's services and skills. Building artisans of the Mandal, based on levels of skills are now earning in the range of Rs. 300 to 450 per day through eco-construction as compared to Rs. 150 – 200 prior to their association with the Mandal. TKM building artisans now get about 20 days of regular work in a month and their monthly average income has increased to Rs 5000 to 6000.

The target beneficiaries of the project termed as experimental group has been compared with a socio-demographically similar group termed as control group (Table 4).

Skill Enhancement

Training not only in the construction skills, but also concerning the eco-friendly ventures has been a strong point in this Project. A total of 130 (80 core) building artisans belonging to 12 CIGs have been trained on a variety of eco-construction technologies. Most of the building artisans associated with the Project had previous masonry knowledge or were associated with the construction trade and 20 are first generation building artisans. In fact 40 building artisans had previous knowledge of at least one of the techniques – the rat trap bond. The post intervention survey revealed that all building artisans of the core group have recall value of the new skills and are regularly utilising their skills in pursuing their livelihoods.

In the 3 years of project, 11 building artisans have graduated as supervisors and 20 as master trainers. This is indicated by individual contracts and training responsibilities that they have

Trainings have led to the construction of many buildings that now demonstrate eco-technologies across the project area. These are houses, community centres, schools, resorts and commercial buildings. The demonstration value is being capitalised upon by the building artisans as 'portfolio' of works for engaging with new clients, and by the project to promote eco-construction in public buildings.

Table 4: Work Days and Monthly Earnings

	Experimental Group	Control Group	All
Average working days (in no.)	17.10	15.70	16.40
Rate a year ago (Rs.)	204.90	216.40	210.65
Current rate (Rs.)	300.00	275.00	287.50
Average earning in a month (Rs.)	4694.50	4453.00	4573.75
Base	50	50	100





Skill building and the name of TARAGram associated with that skill has definitely enhanced the value of the trained building artisans in the market. These building artisans have become synonymous with better quality and with techniques that save money for the client – as these use less materials. Housing clients are increasingly engaging the TKM building artisans with a resultant increase in their incomes.

assumed. As a result of above training and technical interventions, TKM building artisans created their own identity and demand of eco-construction technology has increased.

Behaviour Change

A study involving 100 respondents, 50 each from the target and the control group at the end of the Project period, has thrown up interesting results. The overall analysis reveals that there were more first generation artisans in the experimental group than in the control group. Most of the artisans in the villages were members of TKM. About one-fourth of the artisans from the experimental group were engaged in producing building materials such as concrete body wall panels, concrete door/window frames and bricks etc.

In terms of awareness about techniques and materials used for walls, knowledge about and usage of rat trap bond masonry was the most prominent difference between the artisans in the experimental group vis-à-vis the control group. Almost everyone is aware of English bond and rubble stone masonry techniques as these are the conventional masonry systems here.

Rat trap masonry is more popular among the experimental group compared to the control group. The awareness about compressed stabilised earth block masonry and concrete blocks is higher in the experimental group compared to their counterparts. The participants were aware of the merits of a rat trap bond masonry, such as it is 'cost effective' and that 'it is cool from the inside'.

With respect to roof construction technologies, awareness about reinforced cement

concrete (RCC) for roofs is universal across both the groups. However, awareness about other contemporary techniques is higher among the experimental group than in the control group. 86 per cent among the experimental group are aware of micro concrete roofing technology compared to 66 per cent among the control group. The awareness on ferro cement, brick arch, funicular roof and plank and joist roof is much higher among the experimental group than their counterparts.

The FGDs showed that the participants were aware of the terminology of eco-housing technique (*praktik nirman taknik*) which they spontaneously related to the TARAGram training.

Artisans from the experimental group were also able to articulate the benefits of eco-housing techniques - 86 per cent building artisans revealed that there was a reduction in the amount of material used; about 70 per cent considered the technique to be cheaper whereas 48 per cent thought it was faster. Aesthetic (32 per cent) and comfortable from within (22 per cent) were the other benefits reported by the artisans.

Ninety per cent of the artisans from the experimental group were aware of rainwater harvesting compared to 48 per cent in the control group. However, there were many in the group who wanted more detailed training in rainwater harvesting so that they can also take up the work in future. Respondents were aware of monetary help from the government in case of water harvesting and saw this as an opportunity for increased work for them. The building artisans from the experimental group had gained substantially from the training.



Artisans are aware of the economic and resource efficiency benefits of the new technologies. The artisans were asked to recall the topics on which they were trained. Table 5 and 6 provide the details about recall of topics and use of training.

Emission Benefits

Benefits of reduced carbon and resource footprints: The Project has documented the eco-technologies applied on ground. A tool has been developed to calculate CO₂ emissions due to embodied energy intensity of construction and the resource footprints for soils and water resources. In order to collect data from the site, data login sheets were prepared and provided

to field staff. Data was recorded at the site on a monthly basis. At regular intervals data was collated. After this, data login sheets were verified by professional and managerial staff before being sent to for further analysis. The emission reductions per unit construction have been calculated based on information from the data login sheets and the carbon calculator.

On being asked about the impact of training, all of them said that their skills have improved post- training and as a result their man-day rates have increased and more people are approaching them for work. For 68 per cent of the artisans, the income has increased substantially after the training (Table 7 and 8).

The rat-trap bond masonry system has found popularity amongst both users and building artisans. With 20% reduction in materials, and improved aesthetics, home owners get a cheaper building and building artisans get more work at higher wages. New roofing techniques carry a substantially higher risk perception and the savings are weighed against this perception. These will need market confidence building exercises through many more demonstrations in public and private construction.

Table 5: Recall Topics Covered during the Training

	Top of Mind	Unaided	Aided	Total
Learning and sharing of knowledge and skills	2.0	12.0	80.0	94.0
Different techniques of construction	8.0	20.0	60.0	88.0
Rural housing	12.0	28.0	54.0	94.0
Disaster proof construction	0.0	14.0	54.0	68.0
Watershed structures	0.0	4.0	74.0	78.0
Water management practices	4.0	34.0	54.0	92.0
Earthquake resistance houses	0.0	10.0	40.0	50.0
On the job training on wall (RAT trap) technique	46.0	20.0	28.0	94.0
On the job training on roof techniques-Arch panel	8.0	24.0	66.0	98.0
Planning and orientation of TKM towards legalisation	0.0	6.0	58.0	64.0
Cost and time effective toilet construction	0.0	4.0	60.0	64.0
Supervisory skills	0.0	4.0	44.0	48.0
Basic Mathematics	10.0	8.0	64.0	82.0
Reading drawings	0.0	2.0	48.0	50.0
Biogas plants	0.0	2.0	38.0	40.0
Base (N)				50





Both class room and practical training have been imparted and these are regularly refreshed. The project is also associated with private sector players like the Ambuja Cements Foundation and ACC and public agencies such as the Building Materials and Technology Promotion Council, Government of India to develop training modules. Association with IGNOU and with Construction Industry Development Council to develop standardisation of training certification could however not be taken to its logical conclusion due to many associated reasons and still remains a missing link for large scale replication of this model.

Table 6: Recall Topics Covered during Training for Details of Usage

	Use a lot	Use Sometimes	Never use	Base
Learning and sharing of knowledge and skills	27.7	44.7	27.7	47
Different techniques of construction	31.8	52.3	15.9	44
Rural housing	55.3	42.6	2.1	47
Disaster proof construction	17.6	58.8	23.5	34
Watershed structures	15.4	46.2	38.5	39
Water management practices	28.3	65.2	6.5	46
Earthquake resistance houses	8.0	52.0	40.0	25
On the job training on wall (rat-trap) technique	40.4	51.1	8.5	47
On the job training on roof techniques-Arch panel	28.6	49.0	22.4	49
Planning and orientation of TKM towards legalisation	12.5	37.5	50.0	32
Cost and time effective toilet construction	28.1	59.4	12.5	32
Supervisory skills	12.5	45.8	41.7	24
Basic mathematics	14.6	65.9	19.5	41
Reading drawings	24.0	52.0	24.0	25
Biogas plants	10.0	50.0	40.0	20

Emission reductions due to the various interventions made in 2 years by the artisans of the TKM through the creation of housing

and institutional buildings with 8500 building artisan days of work are described in Table 9 and 10.

Table 7: Impact of Training on Business and Income

	Experimental Group (%)
Impact on business	
Man-day rates have increased	58.0
Demand for work has increased.	
More people are approaching them for work	42.0
Impact on income	
Increased substantially	68.0
Somewhat substantially	28.0
Remained the same	4.0
Base	50

**Table 8: Total Construction done by TKM over a Period of Two Years**

Construction Item	Quantity	Unit
RCC roof	87	cu.m
Roof Stone Patti	106	sq.m
Roof Arch Panel	25	cu.m
Pre-Fabricated Plank and Joist Roof	108	sq.m
MCR roofing	200	sq.m
Wall Rat Trap	1300+250	cu.m
Wall English Bond	3580	cu.m

Table 9: Emission Reductions for Eco- Techniques in Comparison with Conventional Techniques

Construction method	Default compared to	T of CO ₂ emission reduction per unit area
Stone Patti	RCC Slab	0.010/sq.m
Roof Arch Panel	RCC Slab	0.014/cu.m
Rat Trap Bond Walling	English Bond Walling	0.087/cu.m

Table 10: Calculation for Reduction in CO₂ by using Eco Technologies Using the Carbon Calculator

Construction method	Default compared To	T of CO ₂ emission reduction per unit area
Stone Patti	RCC Slab	0.010/sq.m
Roof Arch Panel	RCC Slab	0.014/cu.m
Rat Trap Bond Walling	English Bond Walling	0.087/cu.m

Emission reductions have been calculated by using the embodied energy tool kit developed by the Development Alternatives Group. Emissions related to primary transport from mining to production of cement and steel are not accounted for. Transportation has been taken from the point of origin, i. e., cement factory/ brick kiln to the destination. While calculating emissions from walling options it was assumed that the bricks were from fixed chimney kilns.

For the purpose of calculating the emissions reductions comparison was carried out with

default options as given below:

The TKM members also performed a few energy intensive constructions during the period due to the market demand. If these constructions had followed the eco-techniques the savings would have been enhanced considerably. The potential carbon savings which would have been achieved in case these constructions were carried out by alternate means are denoted in Table 11 and 12.

According to latest market trends, the rate of a certified emission reductions (CERs)

The carbon and resource tracking tool is able to document emission and resource savings for small rural housing units that are being constructed with eco-technologies as opposed to conventional 'pucca' of English bond masonry and RCC roofs. While each house offers a tiny saving, the aggregation of the potentially large number of houses and public buildings to be constructed in rural Bundelkhand would amount to substantial savings. The challenge is how this switch can be incentivised through institutional means.





Discussions with district level CEOs and their interaction with trained artisans from the TARA Karigar Mandal has provided confidence to otherwise sceptical public sector officials and old guard civil engineers regarding the structural, economic and ecological feasibility of the technologies being promoted. The emerging lessons from the project were linked with new opportunities available in the form of the Chief Minister's Awaas Yojna. The Project could engage with district and state level officials and provide information on energy and resource efficient technologies. The engagement resulted in a massive state wide training process of artisans in eco-construction techniques.

Table 11 : Emission Reductions Due to Various Interventions

Construction method	Default compared to	Emission reduction (t CO ₂)
Stone Patti	RCC Slab	2.11
Roof Arch Panel	RCC Slab	0.33
Rat Trap Bond Walling	English Bond Walling	135.00
Total		115.44

Table 12: The Potential Carbon Savings from Use of Alternative Eco-Techniques

Construction method	Alternate method	Potential reduction (t CO ₂)
RCC Slab	Stone Patti	6.92
English Bond Walling	Rat Trap Bond Walling	332.00

is approximately EUR 13 or Rs. 842 per ton CO₂ (April 2011 Issue of 'IDBI – Carbon Developments' Report). At the rate of EUR 13 each building artisan in the TKM on average stands to gain around Rs. 3,000 at current quantum of work.

Policy Development

The Project contributed to favourable changes in the policy framework with respect to rural habitat development in Madhya Pradesh and it would be fair to say that the Project was positioned well to respond to policy changes. The Lok Awaas Yatra in the Central Region held its regional seminar in Bhopal. The participants of the Yatra and the seminar had included district level officers as well as state functionaries. This was the starting point of influencing the Chief Minister's Awaas Yojna – an ambitious State

programme to facilitate adequate habitat to all in the rural areas of the State. Discussions and meetings with State functionaries, exposure of the CEOs of all district governments of the State and networking have resulted in including many of the eco-technologies in list of those being promoted by the State Government. The project provided inputs to the formulation of a revised schedule of rates (SOR) that includes these technologies. As mentioned earlier, building artisans had become master trainers who have gone out to train building artisans in 17 districts of the state and created 17 community buildings using eco-technologies with 585 sq.m of green community buildings in the State directly and are now influencing the creation of housing in these districts using similar technologies.



Challenges

Rural housing is a major activity as part of overall infrastructure building initiatives in the country. Involvement of the TKM in construction of rural housing projects through (eco) green building practices and methods is one large window of opportunity. The Madhya Pradesh Government has announced its rural housing policy which favours the green (eco) building concept. The TKM which at present consists of 130 building artisans will not be able to undertake state wide construction. In such a situation the TKM may act as an expert agency for training of master building artisans.

Business Development

There is a need for a major push in the direction of market oriented development efforts. Although public infrastructure in villages is the niche area, unless the new schedule of rates is declared at the earliest and the district and block level engineers are oriented in eco-technologies – they will be hesitant to promote the application of eco-technologies in village buildings. Orientation and capacity building of the government engineers is required. Local Panchayat members are important stakeholders in that they look after construction related management of local public buildings. They have to be oriented towards eco-construction in a big way, if the market for low carbon construction has to grow.

Institutional Strengthening

The Mandal is a new organisation. It is also not a traditional way of working for artisans who are individual entrepreneurs. It needs additional

support, especially in accounts management and book keeping, conflict resolution and internal system management. The robustness of this institution needs to be demonstrated for its replication.

There are many hurdles yet to mainstream eco-construction in rural habitat. Lack of formal fiscal incentives for eco-construction, material producers and services delivery agents continue to be problematic. Production of eco-materials through small and micro-enterprises at a large scale is the key to catalyse application of and mainstreaming eco-construction technologies. At the same time, parallel disincentives for energy and resource intensive construction need to be set in place. Large training programmes need to be supported by the State as well as resource centres that can provide technical and institutional support for promoting eco-construction.

Accessing Benefits from the Carbon Markets

'The Kyoto Protocol, the Clean Development Mechanism, and the Building and Construction Sector,' a Report released by United Nations Environment Programme (UNEP) shows that only 10 out of some 4,000 projects in the pipeline of clean development mechanism are designed to curb the use of energy in buildings. The Report cites the following 3 as the main reasons:

- Nearly half of all building projects were rejected during the registration phase;
- Such projects involve high administrative costs; and

Building artisans may be the most important stakeholders in the construction sector, however, they are severely limited in reaching to the public sector market. The construction of institutional and community buildings through public procurement processes that form a large part of the rural construction market needs to be sensitised and influenced to change.





Changes in policy instruments are critical to support the intent of the new habitat initiative in Madhya Pradesh. These will include changes in schedule of rates, incentives in credit for producers and suppliers of eco-materials, and to home owners / building owners who opt to construct with eco-technologies. Investments will be required for large scale skill building of artisans and setting up of resource centres across the region. In addition orientation of policy makers and technical staff of the public sector will be required for the vital replication of these technologies.

- There are weak financial incentives as the revenues need to be shared between a number of stakeholders.

However, the TKM has the potential to register and to procure for itself carbon revenues as it is a registered agency. It offers the client construction at reduced rates by savings on material use and therefore is logically the sole stakeholder of the carbon revenue. Intermediary institutions need to be brought into the

picture to facilitate this process. State level aggregation of rural eco-habitat and infrastructure can demonstrate a critical mass of emission savings. These emission savings can be attributed at final levels of consumption of building construction or at levels of material production or both, thus providing incentives for the building market to switch towards low carbon and resource efficient construction.

Endnotes:

1. Nilanjan Sengupta; Current Science, Vol. 94, No. 1, 10 January, 2008.
2. The Lok Awaas Yatra is an initiative of the basin-South Asia Regional Knowledge Platform. (www.basinsa.net) and was specifically designed for local governance institutions and grassroots implementing agencies to learn from innovative models of rural habitat development across the 5 geo-climatic regions in India. The Central Zone Yatra which comprised Bundelkhand, Vidharbha and Marathwada regions culminated at a regional seminar in Bhopal and brought to fore the need for eco-technologies and integrated sustainable rural habitat development. (www.lokawaasyatra.net)
3. Madhya Pradesh Chief Minister's Awaas Yojna is a new scheme for facilitating housing for all rural families in Madhya Pradesh. It provides financial assistance through grant and credit and has incorporated the aspects of eco-construction in its implementation.
4. Indira Awaas Yojna is the flagship social housing scheme of the Central Government administered by the Ministry of Rural Development, Government of India.
5. TARAGram is a sustainability resource centre promoted by the Development Alternatives Group in the rural areas. The centre now has three campuses at Orchha, Datia (MP) and Ambai, near Pahuj (Jhansi). TARAGram centres provide technical, institutional and management supports and services for community and governance institutions in Bundelkhand for sustainable livelihoods in the region.
6. TARA Nirman Kendra is a building centre promoted by the Development Alternatives Group. Its focus is on eco-construction materials, services and capacity building for eco-habitat in Bundelkhand and India.
7. TARA Ganit Programme is a computer based basic maths teaching service for adults promoted by the Development Alternatives Group
8. TARA Livelihood Academy is a training arm of the Development Alternatives Group, working in the area of community training for livelihood generation, to fulfil the exact need of the target group.



Development Alternatives
B-32 TARA Crescent
Qutub Institutional Area
New Delhi 110016
Phone +91 11 2613 4103, 2696 0380
Fax +91 11 2613 0817
www.devalt.org
www.bkpindia.net

Climate Change and Development Division,
Embassy of Switzerland in India
Chandragupta Maurya Marg
Chanakyapuri, New Delhi 110021, India
Phone +91 11 4995 9570
Fax +91 11 49 95 9589
www.deza.admin.ch/en/Home
www.eda.admin.ch/newdelhi