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VERTICAL SHAFT BRICK KILNS (VSBK) AND SUSTAINABLE CONSTRUCTION PRACTICE IN NEPAL

Promoting innovative building materials to green Nepal's construction sector

The project reduced energy consumption by 30%, black carbon emissions by 99% and created 1 500 jobs by triggering private investment worth EUR 2.5 million

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The Challenge

Kathmandu valley is viewed as one of the most polluted areas in Asia resulting in numerous premature deaths. Emissions have increased four-fold over the past decade, including short-lived climate warming pollutants (SLCP), such as black carbon. The construction sector, including conventional brick production, is a key source of black carbon and CO_2 emissions and consumes 30-40% of the total energy. Whilst the sector contributes 10% to the national GDP, it accounts for the largest share in the use of natural resources. Applying Sustainable Construction Practices will show far-reaching positive consequences regarding environmental, social, and economic sustainability. By applying energy-efficient and earthquake resilient Vertical Shaft Brick Kiln (VSBK) production technology, Nepal could realise a reduction of CO_2 emissions of over 370 000 tonnes annually, if all were to use VSBK to make bricks.

Objective

The VSBK project aimed to contribute to the mitigation of global warming and environmental degradation by reducing CO_2 emissions and fostering sustainable production and consumption (SCP) in the construction sector; and to contribute to economic prosperity and poverty reduction in Nepal.

The specific objectives included:

- Reducing energy consumption and CO_2 emission from the brick and building material production sector in Nepal;
- Promoting SCP patterns in the construction sector;
- Mobilising and capacitating the private sector for green building materials and solutions in cooperation with financial and public sector authorities;
- Informing consumers about the benefits and choices of cleaner and low energy building materials;
- Creating an enabling policy and regulatory framework.

Activities / Strategy

The VSBK project was implemented by a consortium of two European and one Nepalese partner organisations. It promoted VSBK and sustainable construction (SC) technologies, and raised awareness in order to improve working conditions in the construction sector.

The project addressed both the demand and supply side of SC, and strengthened policy support through an ongoing exchange and lobbying of SC technologies at various line ministries, such as the Ministry of Industry and the Ministry of Environment, Science and Technology.

Addressing Local Demand for Sustainable Construction Materials and Practices

- Increasing the awareness of SC practices through media events, exhibitions, workshops/exposure visits to end consumers and producers
- Providing support to formulate enabling policy through promoting policy dialogue and awareness creation at the level of government institutions and business associations

Anchoring Sustainable Construction Practices and Strengthening the Supply Side

- Triggering substantial private investment in VSBK and SC technologies by linking with financial institutions and providing technical and commercial consultancy to entrepreneurs
- Skill enhancement of a large number of construction professionals at all levels
- Capacitating supply chain actors – enabling their commercial functions and capability to provide technical consultancy on market conditions to investors in SC
- Preparation of social groundwork for economic upward movement through skill enhancement and job creation
- Promote better working conditions / occupational health and safety (OHS) by focusing as well on entrepreneurial social responsibility

TARGET GROUPS

- Supply chain actors, e.g. technical and business support service providers, consultants, change agents, financial institutions;
- Producers of construction materials, e.g. VSBK entrepreneurs, green building material producers, small contractors;
- Final beneficiaries: workforce of SMEs, masons, consumers, house owners, real estate developers as well as public and private organisations, which finance housing schemes for marginalised communities.

Scaling-up Strategy

Capacitating Supply Chain Actors

Supply Chain Actors (SCAs) can be either companies, consultants, individual professionals or multipliers such as business organisations. The project provided extensive training, including on-the-job training, to potential SCAs to provide technical and consulting services to other businesses or individuals enabling them to implement and use sustainable construction (SC) practices. The training included not only the provision of relevant technical know-how, but also a wide range of business-related aspects, such as energy and cost savings, ecological impact, customer demands as well as how to market SC practices by addressing the right "business drivers" to promote the implementation of VSBK.

The previously existing VSBK Entrepreneurs Association is now capable of offering commercial services to potential entrepreneurs willing to invest in the VSBK technology. A newly established National Cement-Based Production Material Entrepreneurs' Association was established during the project's implementation, and will support the building material producers to apply SC practices. This support includes small-scale consulting services and training.

The first substantial successes can already be reported. The VSBK Association started to offer commercial service to new VSBK entrepreneurs from Kailali and Kapilbastu, thus actively contributing to the creation of green investment and jobs in the brick-making sector. The local project partner, Federation of Nepal Cottage and Small Industries (FNCSI), organised training for construction specialists in other districts of Nepal, which were not covered by the project.

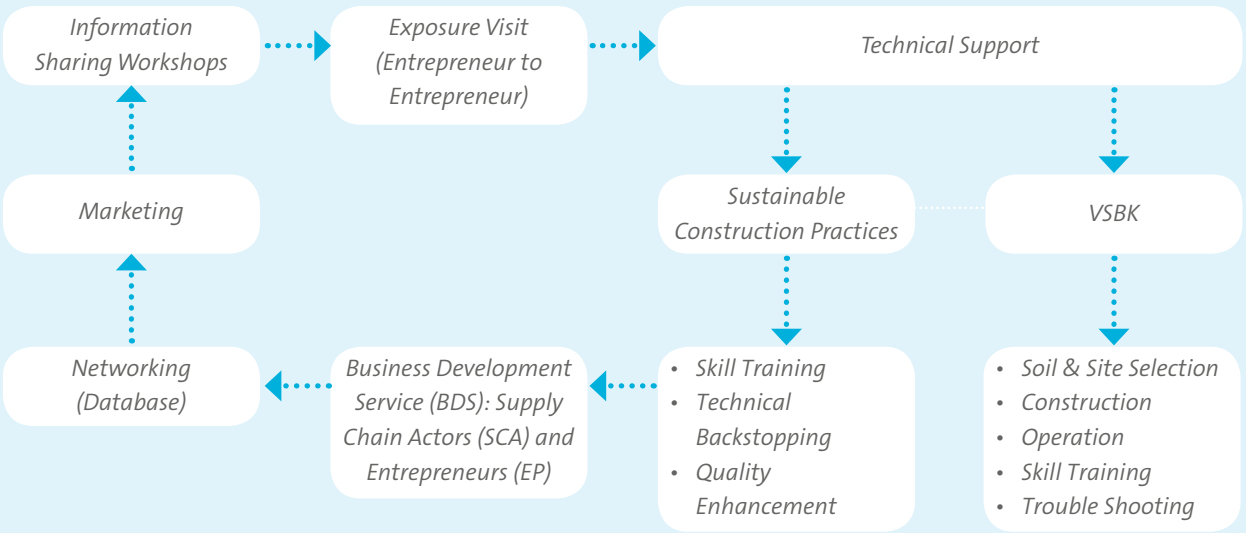
Inclusion of Sustainable Construction Topic in the Curricula

The project trained more than 6 000 construction specialists, masons, engineers, architects, SCAs, as well as small contractors, in a series of over 300 workshops. At the same time, civil engineering students were exposed to SC in various presentations. The ACME Engineering College and Thapathali Institute of Engineering plan to integrate SC training materials developed by the project into their curricula to raise awareness and provide knowledge and skills on SC materials and practice.

Enhancing Policy Dialogue

The project supported the VSBK Association developing and disseminating a "White Paper" on VSBK technology to all relevant line ministries. It also addressed the need for enforcing regulations against the widespread misuse of awarding VSBK licences to traditional brick makers. In this way, the project strengthened the position of the Association as a key player in the brick market and advocated the benefits of sustainable construction practice to policymakers in various high-level meetings.

VSBK project's approach: Policy and Financial Linkages



Results

Enhanced Skills and Shared Knowledge among Construction Actors

In Nepal, construction services are mainly provided by small and medium-sized contractors. Through the project, roughly 6 000 construction specialists, masons, engineers, architects, small contractors and entrepreneurs have enhanced their skills in the application of well-tested sustainable construction technologies, such as concrete hollow block (CHB), micro-concrete roofing, reinforced cement concrete (RCC) door and window frames, and the use of natural round aggregate (NRA).

Demonstrated SC Practices to Consumers

The project demonstrated the use and application of SC practices to consumers. The first behavioural changes have been notified with regard to the increased use of locally available construction materials, such as NRA. More and more people apply SC practice such as Rat Trap Bond (RTB) walling technology for the construction of load-bearing houses.

The VSBK project was successful in achieving its goals, and unique in its history. Based on some 10 years of technological preparation and promotion of sustainable construction technologies in Nepal, financed by the Swiss SDC, it demonstrated that the full introduction and market penetration of a new technology takes time. The local context was receptive, which was demonstrated by the high level of private investment achieved in SCP during this project. Our hands-on oriented training sessions, the support to SMEs, policy lobbying as well as well-targeted marketing activities proved their value and helped to contribute to a healthier and cleaner environment for the Nepalese citizens through the transfer of green technology and know-how.

Christian Wagner,
Team Leader,
Deutsche Management
Akademie Niedersachsen

With technical support from the VSBK Project, we started out business in February 2015 in Sankhuwasabh, a mountain district with high demand for bricks as construction materials. Until we completed our own two-shaft Arun VSBK, the only technology allowed here due to the close proximity to forests, bricks were supplied from some 400 km away with the associated high transportation cost. Now we can supply our district with 2 million bricks per year (with an estimated demand of 3 million per year) at half the former price, saving transportation and energy costs. We are optimistic that we can optimise the production process further and produce even more high quality bricks.

Mr. Ded Raj Khadka,
Owner of Arun VSBK,
Tumlingtar,
Sankhuwasabha District

Attracted Private Investment and Created New Jobs

The project attracted private investment of roughly EUR 2.5 million for 22 new brick-producing VSBK shafts, creating more than 1 500 green jobs. Compared with conventional brick making, VSBK brick production took into consideration social aspects by providing better jobs (e.g. using green brick moulders) for marginalised communities with higher salaries and improved working conditions. Using VSBK brick technology, an estimated 12 500 tonnes of CO_2 will be reduced annually, slashing black carbon emissions by 99%. Approximately 130 new SMEs in cement-based materials production were founded or upgraded during the project implementation.

Knowledge on VSBK Technology Disseminated Internationally

The project organised an International Brick Symposium, involving nine countries, ranging from Peru to Thailand, from Germany to South Africa. The event not only enhanced the project's visibility, but also facilitated knowledge exchange on VSBK technologies within and beyond the countries covered by the SWITCH-Asia programme, demonstrating major potentials of VSBK-related energy and emission savings.

Impact in Numbers

Economic Impact

- Increased the market share of green brick/VSBK technology from 3% to 5%.
- Private investment of EUR 2.5 million generated by roughly EUR 0.5 million project cost for training and consulting services to VSBK entrepreneurs.
- Created new business opportunities through the production and marketing of green construction products resulting in consumer market extension.
- Strengthened the supply chain through increased awareness of the benefits of green construction materials among consumers and producers, and improved technical and marketing skills among supply chain actors (SCAs) and SMEs.
- Introduced new green products in the market such as green bricks, concrete door and window frame, concrete hollow block, micro concrete roofing tiles, rat trap bond know-how, natural round aggregate, etc.

Environmental Impact

- Compared to traditional Fixed Chimney Natural Draught Straight Line Firing, VSBK technology in brick making resulted in considerable energy and emission reductions per 100 000 bricks:
  - Reduction of energy consumption (coal) by 28%, from 255 000 MJ / 100 000 bricks to 183 000 MJ / 100 000 bricks
  - Reduction of mass emission load by 87%, from 251 kg of suspended particulate matter (SPM) to 33 kg SPM
  - Reduction of SO_2 by 95%, from 82 600 g to 3 800 g
  - Reduction of CO_2 by 78%, from 40.8 tonnes to 9 tonnes
  - Reduction of black carbon by 99%, from 32.6 kg to 0.3 kg
- The project promoted and implemented a wide range of SCP technologies, adapted to local conditions and targeted to consumer markets.
- VSBK technology contributes to forest conservation since wood cannot be used as conventional fuel in making bricks.

Social Impact

- Increased income for workers (e.g. masons) nearly doubled, from NPR 3 000 – 4 000 (EUR 23 – 33) per day to NPR 7 000 – 8 000 (EUR 55 – 65) per day.
- In the VSBK sector, around 1 500 new jobs have been created solely by triggering private investment. Another 250-300 jobs have been created by establishing new SMEs in 10 project districts.
- Increased awareness of occupational health and safety (OHS) in brick sector (e.g. wearing helmets) through training, e.g. on socio-technical topics.
- VSBK and Rat Trap Bond walling technology demonstrated a high level of earthquake resilience. The newly constructed VSBK in the Gorkha epicentre continued its production immediately after the earthquake in 2015.
- Improved people's life quality by reducing air pollution, generating job opportunities, better quality housing.
- Prohibited child labour through the VSBK Association's statute, which is binding for all members. Additionally, an initiative has been started to promote schooling among workers' children.

Climate Benefits

- Achieved energy saving by reducing the use of coal of 1 620 tonnes per year.
- Reduced 13 000 tonnes of GHG emissions and 12.79 tonnes of black carbon per year.
- Introduced green technology among SMEs and promoted green construction materials among consumers, contributing to GHG mitigation.
- Enhanced awareness on climate change via training, radio interviews and TV advertisements, and public campaigns at the local community level.

Green Finance

- Engaged with 12 new entrepreneurs investing in VSBK.
- Two SMEs benefitted from better access to green finance, e.g. Clean Energy Development Bank (CEDB) loan with total amount of EUR 250 000.
- Initiated the signing of MoU between VSBK Entrepreneur Association and CEDB. The favourable green loan scheme has been promoted by the bank representatives during National Annual VSBK EP Workshops and other events.
- Developed new financial instruments such as VSBK loan, project loan and overdraft loan.

Target Group Engagement

- Engaged more than 400 SMEs in training activities and promotion events.
- Involved five relevant ministries, four business associations, and two associations of construction professionals.
- The project organised or participated in more than 50 promotional events and reached about 130 000 potential consumers and producers.
- Engaged with FNCSI, VSBK Entrepreneurs' Association, National Cement-Based Production Material Entrepreneurs' Association, Contractor Associations (Kumarwarti Nirman Sewa, Chitwan Nirman Sewa), Nepali Engineering Association; Society of Nepali Architects; Nepal Federation of Environmental Journalists, Community Forest Users Group, and Institute of Advanced Sustainability Studies (IASS) in Potsdam, Germany.
- Stakeholder groups were reached through technical workshops, training, exposure visits, exhibitions, trade fairs, marketing and promotion of SCP products, radio and TV interviews and broadcasts.

Policy Development

- The project reached out to policymakers through 22 dialogues, meetings and technology exposure visits.
- Together with SWITCH-Asia project Green Homes, the VSBK project advocated and promoted the introduction of a new green construction building code, including the promotion of Rat Trap Bond walling technology.
- The project advocated the enforcement of existing policy such as banning of illegal licenses, and cleaner production certification and incentives to promote SCP. It developed and submitted a white paper on VSBK technology.
- Brought about changes in Nepal's construction sector as the project successfully contributed to policy enforcement and reducing the number of misused VSBK construction licences in various districts of Nepal.

Europe-Asia Cooperation

- Conducted three events involving European and Asian partners, where the International Brick Symposium attracted representatives from Asia, Africa, the Americas and Europe. The symposium was held on February 23-24, 2015.
- Promoted knowledge transfer on issues of global warming; brick sector facts, standard and national policies; cement-based construction materials and technologies; earthquake resistant and national directives and standards. These have contributed to VSBK technology development, such as new bricks, operation, mechanisation, green brick and internal fuel, etc.

OBJECTIVES

The project aimed to promote sustainable consumption and production patterns in the construction industry, by raising awareness among private sector stakeholders of green building materials and solutions, providing consumer information on the benefits of clean energy and energy-saving building materials, and providing extensive training to large numbers of SMEs, small contractors, construction workers, engineers and other construction practitioners.

DURATION

PROJECT TOTAL BUDGET

EUR 2 146 750
(EU contribution: 90%)

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