



## Building Materials and Green Economy

### CONTEXT

Construction is a crucial component and indicator of a country's development. India is poised to become the 3rd largest construction market by 2018 (PwC, 2011). In 2011-2012, the sector accounted for 8.2% of the GDP, while the contribution at factor cost was 3,850 billion in 2010–11. With increasing urbanisation and expanding cities and towns, the growth from the sector is expected to increase 5,833 billion in 2018 and 7,925 billion in 2022 (NSDC, 2009).

Globally, only 30% of the world population lived in urban areas in 1950, with an increase to 54% in 2014. This share is expected to increase to 66% by 2050 (UNDESA, 2014). India – a country in the midst of rapid transformation from a predominantly rural to an urban society, houses 377 million people in urban settlements. This is expected to increase to about 600 million by 2030 (UNDESA, 2014). Small cities and towns have been the primary locus of this growth, with the number of towns increasing from 2,774 to 7,935 between 2001 and 2011 (Census of India, 2011). The geographic reconfiguration of the demands for housing and infrastructure towards urban and peri-urban areas has resulted in a surge of construction activities in the country.

The sector is also the second largest employer after agriculture, with the employment figures steadily increasing from 14.5 million in 1995 to 31.5 million in 2005, and 41 million in 2011. The construction industry has a varied workforce employed throughout the value chain, ranging from labourers to contractors

and architects. Bulk of the workforce, 83.3% comprises of unskilled workers, predominantly migrant workers. The sector faces a serious shortage of skilled workforce, accounting for a meagrely 6% of the workforce that undergone formal training.

Along with the social and economic implications, the construction sector has a critical role to play in the environmental implications as well. Being an energy intensive sector, it contributes to around 24% of total national GHG emissions, 80% of which is borne by building materials alone (Parikh et al, 2009). The construction and building sector consume 30% of national electricity, with a growth rate of 8% a year. Besides energy, this sector is also very resource intensive. Worldwide, the construction sector accounts for over 30% of the material use with project costs of the same ranging from 40% to 60% (Darko et al, 2013). Cement, steel, lime and bricks are the largest bulk consumption items in the Indian construction industry and also the most energy-guzzling. The sector has an adverse impact on agricultural yield exerting pressure on food security due to conflicts of use of fertile top soil between agriculture and brick making, aggregate mining and sand dredging of rivers for concrete, mortars and plasters. Considering, in India 70% of the building stock required by 2030 is yet to be built (NRDC; ASCI, 2012), the impacts of the construction sector have the potential of being rather grave.

## THE OPPORTUNITIES

The global discourse on green economy has been progressively intensifying over the years. The basis of green economy is a fair, efficient and environmentally sustainable society, with the potential of uplifting millions out of poverty; inducing efficiency in the financial systems, and nurturing human and natural capital to establish large scale livelihood opportunities. Considering the scales of the impacts on environment, it is imperative that the construction sector embeds the concept of sustainability and green economy in its development trajectory.

The pathways to sustainability in construction do exist. Cleaner and alternate technologies have been developed that can substantially reduce the ecological footprint of the sector. In the brick sector, the use of Fly-Ash, Hybrid Hoffman Kilns and Vertical Shaft Brick Kilns (VSBK) considerably increase resource efficiency. A Fly-Ash brick unit has the ability to produce 5,000 bricks per day saving 2500 m<sup>3</sup> of fertile top soil and using about 2,250 MT of fly ash annually (Darko et al, 2013). Cement production can also be made less resource intensive; with the implementation of the vertical roller mill technology, fluidised bed cements fired kiln system, and the use of mineralisers. Substitution of fuel by waste materials also offers scope for substantial improvements in resource efficiency. Additionally, alternative building

materials like micro-concrete roofing tiles, stabilised concrete earth blocks and prefabricated roofing elements are also viable options to replace resource intensive materials. Use of alternate technologies like rat-trap bonds, ferro-cement channels, slabs and cavity walls can reduce the resource consumption by 25-30% (DA-CDKN, 2013). The embodied energy of construction materials should be taken into account in view of the associated environmental implications of resource depletion and GHG emissions.

Energy consumption in the construction sector offers large scope for improving and inducing efficiency. With proven commercially viable technologies, energy consumption in new and existing buildings can be cut by an estimated 30% to 80%, with potential net profit during the building's lifespan (UNEP SBCI, 2007). There is a need to combine cutting-edge energy-efficient technologies with the adaptation of practices used in vernacular architecture; which use more locally available materials and resources.

There are viable opportunities for greening the sector, however, in order to translate the opportunities to tangible benefits, several interventions in form of public policies, awareness generation, capacity building and skill development, and appropriate financial tools are imperative.

## DRIVERS AND BARRIERS

### Technology and Capacities

Currently the Indian construction sector suffers from lack of appropriate technologies and the support by efficient technology transfer. Innovation of cleaner and environment friendly technologies is essential to transform the construction sector. The absorptive capacity due to lack of information and skill deficit is a major barrier to the growth of technological innovation in the country. Several aspects need to be addressed for the development and transfer of these technologies. Some of them include collaborative research, technology demonstrations, access of information, and capacity building of the workforce.

Successful adoption of these technologies can be seen in small pockets across the country. While these

technologies are available, limited information about the benefit of these technologies, its viability in the local context, and the operation processes hinders its growth. Large-scale awareness programmes targeting both entrepreneurs and users is the need of the hour to develop and nurture service providers.

Lack of technical capacities is one of the biggest barriers faced by this sector. In India, about 12 million people join the workforce each year, and only 4 million are skilled workers (FICCI & Ernest and Young, 2012). While several schemes that work towards upgrading the skills of the workers have been launched by the Central and State Governments, they remain woefully inadequate. The technical training of masons and engineers is not organised on a regular basis and it is hard to obtain industry-sponsored apprenticeships.

Another major concern is the lack of a definition of green construction. While several green building rating systems like the Leadership in Energy and Environment Design (LEED) and Green Rating Integrated Habitat Assessment (GRIHA) are present, ambiguity in the definition still exists and the multiplicity of these systems adds to the confusion. As a result, many buildings are being marketed as green, which undermine the quality of green construction. The current rating systems focus majorly on energy efficiency. Pilot projects should be undertaken to demonstrate its benefits. Some of the popular rating systems have been adapted from other countries and are not suitable for India. Their suitability in the Indian context in terms of quality and environmental sustainability needs to be assessed, before being implemented. Thus, a common framework defining the parameters of green construction should be developed and implemented across the country.

### Policy and Regulation

The intent to introduce and promote 'green' in the construction sector in India is gathering focus with the National Housing Policy advocating the use of alternate technologies and a holistic approach to sustainability. Both the 12th Five Year Plan (2013-2017) and the National Action Plan on Climate Change have identified green buildings and construction as a focus area. However, despite several policy mandates; the translation to plans and schemes has been minimal. Policies and schemes such as Jawaharlal Nehru National Urban Renewal Mission (JNNURM) and Rajiv Awas Yojana (RAY) that aimed to provide affordable houses lacked the inclusion of green features in their objective Schedules of Rates (SoR) do not always include a wide range of green options. To remedy this, guidelines should be developed to include the aspects of green construction in policies and schemes. The scope of SoRs should be expanded to accommodate green building materials. This would enable the government departments to use environment friendly construction techniques and technologies in their construction. Awareness generation should also be an integral aspect of these policies. Capacity building of officials for the proper implementation of these policies should also be within the scope of this framework. Such a stimulating policy framework would help in creating confidence among the stakeholders in environment friendly technologies and green construction.

While the concept of green construction is missing as the basic fabric, the set of codes and standards that regulate

### Bihar's Successful Efforts in the Promotion of Green Construction

Government of Bihar, in association with Development Alternatives has been actively promoting the adoption of low carbon and resource efficient technologies; especially fly ash brick technology in the state. An Inter Departmental Task Force (TF) on Accelerating Cleaner Production Systems in the Building Materials Sector in Bihar was set up in June 2012. Its members include various government departments like the Bihar State Pollution Control Board, Department of Environment and Forests, Department of Building Construction, Department of Industries and organisations like National Thermal Power Corporation (NTPC) etc. Over the last two years, the TF has emerged as a decision making venue, where policy ideas are discussed and vetted. They are then forwarded to the concerned departments for further action. Policy interventions along with awareness generation activities have garnered immense interest among the entrepreneurs in the state.

Due to the interventions of the TF, Bihar brick sector has seen an upsurge of fly ash brick production units in the last two years. A total of 25 units have been commissioned in various districts. Currently, fly ash brick units have the capacity to produce approximately 60 million bricks per year. This has increased by 55 million since 2007. The Task Force is increasingly being viewed as an innovative policy influencing platform. This can be replicated in other states to promote various aspects of green construction.

the efficiency and quality of the building materials used is rather weak. Where Bureau of Indian Standards (BIS) has set standards for some alternate building materials, however it doesn't have any mandates for enforcing it. A quality control system should be set in place that is in the form of eco-labelling/rating systems for materials and products. While ensuring quality is essential, it is also crucial to allow flexibility in the design and applicability of these materials. Materials and design should be selected on the basis of local geographical conditions, climate and availability of local materials.

Policies and standards are essential to mainstream green construction. However, greater integration and coherence among the government departments and policies is necessary. For example: the responsibility of management and utilisation of fly ash lies with the Ministry of Environment, Forests and Climate Change. However, other departments also play a key role in ensuring the efficient usage of the same, like the Department of Science and Technology encourages research and development, and demonstration of ash disposal and utilisation technologies. BIS has developed

standards for building materials produced out of fly ash, and further at the state level, the Department of Industries promotes industries based on fly ash through incentives and subsidies. Thus a concerted effort by all the government departments has resulted in an increase in the utilisation of fly ash in the country.

### Market and Finance

Construction is a highly unorganised and informal sector. The disaggregated nature of this sector throws up challenges with respect to strengthening the supply chain of materials and services. Aggregation of construction services is imperative. Continuous supply of construction materials can be ensured by setting up micro enterprises; such use of local materials and local employment provision while servicing local demand is an ideal situation. They also promote the use of locally available waste materials in the product manufacture to promote resource efficiency. Quality is another key component in the aggregation of green construction services. Standardised curriculum and a system for certified skills for masons and artisans will go a long way in monitoring and assuring quality. Common interest groups and guilds can be leveraged to strengthen this cadre of skilled personnel. Despite the availability of the market, the demand for such technologies and practices is low due to the low level of awareness of various stakeholders. As a result, the level acceptance of the end-users is low.

#### TARA Karigar Mandal

TARA *Karigar Mandal* (TKM) is a social enterprise that builds capacities of masons through dissemination of sustainable eco-friendly construction techniques. Registered as a Mutually Aided Cooperative Society (MACS) with the Madhya Pradesh State Government in India, TKM facilitates creation of eco-houses by acting as a service provider to provide construction services and training masons to fulfill the needs of the people while contributing to low carbon development. The masons under the *Karigar Mandal*, help meet the growing demand for rural housing without harming the Earth.

The availability of skilled masons enables new homeowners to make informed and empowered choices. A frontrunner of green job creation - TKM has supported training of artisans across the state of Madhya Pradesh to service their social housing initiative, The *Karigar Mandal* model has a large potential for replication by skill enhancement and currently six other *Karigar Mandals* are being incubated in the Bundelkhand Region. TKM has been initiated and supported by Development Alternatives.

The main challenge in the promotion of green construction is the access of finance to entrepreneurs. Access to finance for entrepreneurs (SMEs) is tricky due to the small size of loan demanded by them. Innovative tools catered SMEs should be developed and incentives should be provided to entrepreneurs investing in environment friendly technologies. This can be extended to those end-users, who adopt environment friendly techniques and technologies in construction.

Exploring tools such as taxing and disincentivising entrepreneurs and SMEs who utilise conventional technologies and techniques, i.e., technologies that have a negative impact on the environment should be initiated.

### Institutions and Partnerships

Given the current state of technology in the construction industry; research and development is essential for improving and promoting environment friendly and resource efficient technologies. While R&D has been going on, these technologies remain confined to the research laboratories and institutions, out of bounds for common entrepreneurs and developers in terms of affordability and accessibility. It is essential to strengthen commercialisation of appropriate technologies as and when invented or developed. One of the methods to do this is through propagating incubation services that act as intermediary between the laboratories and research institutions, and entrepreneurs. Such pilot demonstrations will generate awareness among the stakeholders. However, the incubation service should not be limited only to technologies. The incubation service can also include other softer aspects of construction like design and processes, capacity building, etc.

With the increasing involvement of private sector in the construction industry, it is vital to promote public-private partnerships (PPP). In such partnerships, the services are delivered by the private sector, while the responsibility of providing service rests with the government. PPP includes all non-government agencies such as the corporate sector, voluntary organisations, self-help groups, partnership firms, individuals and community based organisations. PPPs will not only help in commercialisation of the technologies, they would also play a key role in creating a critical mass of skilled workforce necessary to implement the policies and incorporate green aspects in construction.

### Green Building Centres

TARA Machines and Tech Services Pvt. Ltd, a social enterprise of the Development Alternatives Group, has partnered with ACC and is setting-up TARA-ACC branded "Green Building Centres". These franchises are a one-stop shop for all green building requirements, from design to facilitation of construction. The Green Building Centre is a very attractive social entrepreneurship model with high investment returns.

The setup of the Green Building Centres, co-branded with ACC cements, provides best technology solutions as well as a quality brand name to develop a strong and growing business model for the entrepreneur. Green Building Centres have multiple economic, environmental and social impacts. Other than creating employment and giving a boost to the local economy, they have a huge potential in mitigating climate change impacts through promoting energy and resource efficiency and waste utilisation.

| Means of Implementation       | Barrier  | Driver  |
|-------------------------------|--|---|
| Technology                    | <ul style="list-style-type: none"> <li>Absorptive capacity due to lack of information and skill deficit</li> <li>Lack of technical capacities</li> </ul> | <ul style="list-style-type: none"> <li>Large-scale awareness programmes for entrepreneurs and users</li> <li>Technical training of masons and engineers</li> <li>Eco-labelling system for pilot projects</li> <li>Common framework defining parameters of green construction</li> </ul> |
| Policy and Regulation         | <ul style="list-style-type: none"> <li>Translation to plans and schemes</li> <li>Quality control system</li> </ul>                                       | <ul style="list-style-type: none"> <li>Inclusion of green feature in policy mandates and guidelines</li> <li>Capacity building of officials</li> <li>Greater integration and coherence</li> </ul>   |
| Market and Finance            | <ul style="list-style-type: none"> <li>Supply chain of materials and services</li> <li>Acceptance by the end-users</li> <li>Access to finance</li> </ul> | <ul style="list-style-type: none"> <li>Aggregation to construction services and micro-enterprise</li> <li>Innovative tools, taxing and disincentivising entrepreneurs who use conventional technologies</li> </ul>  |
| Institutions and Partnerships | <ul style="list-style-type: none"> <li>Confined to research laboratories</li> </ul>  | <ul style="list-style-type: none"> <li>Propagating incubation services and pilot demonstration</li> <li>Promoting public-private partnership</li> </ul>   |

### WAY FORWARD

Construction can be glimpsed as a disaggregated sector with complex interlinks among both public and private stakeholders. Introducing paradigm shifts to transition

towards a green and inclusive economy involves the coming together of all the stakeholders. In conclusion this can be summarised as below:

| Agents of Change            | Role  |
|-----------------------------|---|
| Government                  | <ul style="list-style-type: none"> <li>Streamlining policies to include the 'green' mandate</li> <li>Strengthening implementation processes and mechanism</li> <li>Increased coherence and integration among departments</li> </ul> |
| Private Sector              | <ul style="list-style-type: none"> <li>Partnerships strengthening supply chain through aggregation</li> <li>Enhanced access to finance to provide an impetus to micro-entrepreneurs</li> </ul>                                      |
| Civil Society Organisations | <ul style="list-style-type: none"> <li>Awareness</li> <li>Training and Capacity Building</li> </ul>   |

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## About Development Alternatives Group [www.devalt.org](http://www.devalt.org)

Development Alternatives (DA) is a premier social enterprise with a global presence in the fields of green economic development, social equity and environmental management. It is credited with numerous technology and delivery system innovations that help create sustainable livelihoods in the developing world. DA focuses on empowering communities through strengthening people's institutions and facilitating their access to basic needs; enabling economic opportunities through skill development for green jobs and enterprise creation; and promoting low carbon pathways for development through natural resource management models and clean technology solutions.



## About TARA [www.tara.in](http://www.tara.in)

Technology and Action for Rural Advancement (TARA) is a 27 year old non-profit organisation and a social enterprise of the Development Alternatives Group. TARA was set up to disseminate "*means for creating sustainable livelihoods*" at scale and mobilize widespread action to eradicate poverty and regenerate the environment. TARA's mission is to build capacities, incubate business models and manage processes to create economic, social and environmental value at scale. Its work over many years in central and northern region India represent the development objectives and goals the organisation has strived to achieve for the advancement of the underprivileged communities of the region. The hubs of TARA's activities are the TARAGram sustainability resource centres at Orchha, Datia and Pahuj (Jhansi) that support environmental economic and social value creation in over 150 villages across the region.



## About South Hubs Network Programme

As part of Development Alternatives work on green economy, the organisation entered into a partnership with the New Economics Foundation (nef), London to contribute to a global transition movement - a movement towards a sustainable and socially conscious economy. This programme is referred to as the South Hubs Network Programme. This initiative develops from, and forms part of nef's work on Global Transition Initiative (GTI) ([www.gtni.org](http://www.gtni.org)). A similar movement in an emerging economy like India is initiated with the aim to build a civil society and stakeholder movement of actors and organisations that are committed to the principles and objectives of transitioning to a new economy. The objective of this programme is to promote innovative ways of achieving a more environmentally sustainable and socially just model of economic development.

### DISCLAIMER

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