Scoping Study and Policy Imperatives on Green Jobs and Eco-Entrepreneurship Opportunities for Women in Select States in India.

GREEN CONSTRUCTION

Green jobs and Eco-Entrepreneurship has been integral to the discourse on green growth/economy for over a decade and has assumed greater significance of late. This study - Scoping Study and Policy Imperatives on Green Jobs and Eco-entrepreneurship Opportunities for Women in Select States in India was initiated in early 2020 and draws upon the learnings from the United Nations Development Programme (UNDP)'s project "Creating Employment and Entrepreneurship Opportunities for Women in India" (Disha) project. The intent of the study is to identify areas for and promote greater women's workforce participation in renewable energy, green construction, green transport, water management and carbon sinks (forests and marine fisheries). Given the vastness of its scope and geographies, the study was confined to the UNDP's Inclusive Growth project states of Delhi, Haryana, Maharashtra, Karnataka, Telangana, Uttarakhand and Odisha.

The report, prepared by KPMG, is based on secondary sources and stakeholder interactions, as the study was initiated just prior to the COVID-19 pandemic and lockdown, that greatly limited access to primary research, physical consultations and data collections. Even though virtual stakeholder interactions, online consultations and peer review provided information across thematic areas, it is likely that there may be some gaps due to unavailability of gender disaggregated data or restricted information.

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GREEN CONSTRUCTION

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List of Abbreviations

ADB	Asian Development Bank
BEE	Bureau of Energy Efficiency
CGTMSE	Credit Guarantee Fund Trust for Micro and Small Enterprises
CSDC	Construction Skill Development Council
CIDC	Construction Industry Development Council
CII	Confederation of Indian Industry
CPCB	Central Pollution Control Board
CREDAI	Confederation of Real Estate Developers' Association of India
CSEB	Compressed Stabilized Earth Blocks
DBOCWWB	Delhi Building and Other Construction Workers' Welfare Board
ECBC	Energy Conservation Building Code
FABQRS	Fly Ash Brick Quality Rating System
FAR	Floor Area Ratio
FIWE	Federation of Indian Women Entrepreneurs
GHG	Greenhouse Gas
GRIHA	Green Ratings for Integrated Habitat Assessment
GSDP	Gross State Domestic Product
HVAC	Heating, Ventilation and Air Conditioning
IBEF	India Brand Equity Foundation
IGBC	Indian Green Building Council
JJMS	Jan Jagaran Mahila Sangh
LED	Light Emitting Diode
LEED	Leadership in Energy and Environmental Design
MHT	Mahila Housing SEWA Trust
MLD	Million litres per day
MoEFCC	Ministry of Environment, Forestry and Climate Change
MSME	Micro, Small, Medium Enterprise
MSSDS	Maharashtra State Skill Development Society
NIESBUD	National Institute for Entrepreneurship and Small Business Development
NSDC	National Skill Development Corporation
PMAY-G	Pradhan Mantri Awaas Yojana-Gramin
PMAY-U	Pradhan Mantri Awaas Yojana-Urban
PMEGP	Prime Minister's Employment Generation Programme
PPP	Public Private Partnership
QP	Qualification Packs
RICS	Royal Institution of Chartered Surveyors
RPL	Recognition of Prior Learning
SCGJ	Skill Council for Green Jobs
SDEL	Skill Development, Entrepreneurship and Livelihood Department
SEWA	Self Employed Women's Association
SIDBI	Small Industries Bank of India
TSECBC	Telangana State ECBC
USGBC	US Green Building Council
VOC	Volatile Organic Compound

Foreword

Climate change is perhaps the biggest challenge of our times and it is forcing all of us to define the kind of economy that works for everyone. The effects of climate change will undoubtedly alter the structure of employment; new jobs and new job families will emerge, others will evolve or become unsustainable. Economies must find ways to reorganize work and production differently.

According to ILO, at least half of the global workforce, around 1.5 billion people will be affected by the transition to a greener economy. The challenge lying ahead of us is the urgent need to equip the people with the right skills that will help them adapt to this transition. Skills gaps have already started emerging across a number of sectors, such as renewable energy, energy and resource efficiency, renovation of buildings, construction, environmental services and manufacturing.

Moreover, the exclusion of women and their needs in decision-making process for mitigation or adaptation measures can pose challenge to achieving gender equality at work. This will have a deep impact on the larger economies. Given that women make up a little over half of the world's population (WEF 2013), their untapped talent could significantly alter our economic development (UNDP 2013).

Nearly 60 percent of India's population is directly dependent on climate-sensitive sectors such as agriculture, fisheries and forestry for its livelihoods, and 80 percent of economically active women are in the agriculture sector. Hence the climate crisis severely affects the women who are dependent on these climate-sensitive livelihoods and who do not have any alternative livelihoods.

Keeping in mind these multiple challenges and based on our learnings from Disha Project that UNDP implemented in partnership with IKEA Foundation, to create employment and entrepreneurship opportunities for women, a study was commissioned to assess the green jobs and eco-entrepreneurship opportunities for women in India. The study focused on five major sectors identified by the Skill Council for Green Jobs: renewable energy, green transport, green construction, forestry, fisheries and water management. It covered Delhi NCR (National Capital Region), Haryana, Maharashtra, Karnataka and Telangana as well the potential states such as Uttarakhand and Odisha.

Although we faced the challenge of lack of gender-disaggregated data, and the study being conducted during the COVID- 19 pandemic, the sector-specific reports present some promising prospects for a greener skilling and livelihoods ecosystem. The Government of India and some of the state governments are already moving in the right direction. For instance, the International Solar Alliance in the Renewable Energy space has already gained momentum and the cost of the solar panels in India has reduced in the recent years.

While substantial work has been done to build capacities of people and communities on water management, forest or fisheries, to promote climate-resilient practices, women are often left out and mostly under-represented in such initiatives. As we recover from the pandemic, we must ensure that women are given equal opportunities to be part of our green recovery. Only when we tap into their talents and the huge demographic dividend that is often left out, can we achieve our Sustainable Development Goals at the end of this decade.

UNDP has been working closely with the Government of India and other key partners for an inclusive and climate-sensitive response to COVID-19 that paves the path to greener pathways for recovery. India, as an emerging economy, holds immense potential, given its demographic dividend. But it can never recover fully, or reach its full potential, if half of the population – the women- are not part of its green recovery.

Shoko Noda
Resident Representative

Acknowledgement from Lead Facilitator

UNDP India has undertaken a study on the "Scoping Study and Policy Imperatives on Green Jobs and Eco-Entrepreneurship Opportunities for Women in Select States in India". The report takes into cognizance the climate crises and its implications on lives and livelihoods of the people, and provide some pathways in terms of nature-based livelihoods, that can often be turned into opportunities for more decent work. Be it renewable energy, green transport, green construction water management, forest or fisheries, strides are being made by the Governments at national and state levels to build the capacity of the people and promote climate-resilient practices. And it is but appropriate to bring in the women to partake in the development and be part of the dynamic workforce in the country. And this forms the basis of the study.

This report has been made possible with contributions from many individuals and experts, who took out time and helped put this study together. This report was initiated just prior to the onset of pandemic and was drafted virtually through the lockdown period. A number of virtual consultations with thematic and regional experts were held between April and November 2020, and inputs received on each of the chapters drafted.

In this endeavour, we owe our deepest gratitude to Dr. Sunita Sanghi (Additional Secretary and Senior Advisor, Ministry of Skill Development and Entrepreneurship, Government of India), Dr. Praveen Dhamija (Advisor, Sector Skill Council on Green Jobs), Vandana Bhatnagar (Chief Programme Officer, NSDC), Sudipta Bhadra (Senior Programme Officer, ILO), and Anubha Prasad (National Coordinator, PAGE) for their guidance while discussing our findings, assessing the quality of analysis, the reliability of data, and the soundness of the recommendations emerging from the study.

The support provided by our collaborators in the formulation of background papers needs a special mention. We express our utmost appreciation for the hard work put in by the KPMG team lead by Manpreet Singh and Vivek Panda.

We would like to thank and acknowledge the inputs received during the peer review of the draft chapters by Dr. Srinivas Shroff Nagesha Rao (CEO, REC Foundation), Hitesh Vaidya (Director, NIUA), Suneel Padale (Director Programs, CARE India), Vishaish Uppal (Livelihoods Specialist, WWF India), Moho Chaturvedi (Independent Consultant) and Ramya Rajagopalan (Independent Researcher).

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We are eternally grateful to Ms. Shoko Noda, Resident Representative, UNDP India and Ms. Nadia Rasheed, Deputy Resident Representative, UNDP India for their inspiration, encouragement and guidance throughout the process. None would have materialised without the faith that they reposed in our endeavours.

We thank all the experts and colleagues for their support and contribution.

Swayamprabha Das
Inclusive Growth

Executive Summary

Construction is a resource intensive industry, globally accounting for 25 to 40 percent of global energy use and 30 to 40 percent of global greenhouse emissions. Buildings account for approximately 30 percent of global energy consumption and generate around 20 percent of all energy-related greenhouse gas (GHG) emissions[1]. Considering the resource demands this industry exerts on the environment, green construction is seen as an emerging domain that can potentially address the concerns that are currently inherent to the sector.

India has seen a significant increase of green buildings over the last several years and will continue to observe a similar trend in the foreseeable future. This study presents a sectoral analysis of green buildings in the country and attempts to assess employment growth in the segment, while suggesting recommendations to increase women's participation, especially of marginalized women, in semi-skilled and unskilled job roles. Green building area is projected to increase to 9.5 billion square foot (sq. ft) from 7.09 billion sq. ft observed in 2019. This increase will entail demand for a skilled workforce which is already in short supply in the construction sector. According to the International Labour Organization (ILO), green jobs in the Indian construction sector are likely to increase by 466,200 between 2018 and 2030.

An increase in the number of green buildings provides employment opportunities; however, the construction sector already faces a shortage of skilled labour. Nearly 80 percent of employment in real estate is attributable to minimal skills. Availability and accessibility of skill development training are major challenges in skilling workforce. Additionally, lack of training that meets industry standards also poses a significant challenge. Training of women for the male-dominated industry is not prioritized, leading to disproportionate gender representation and unmet demand for skilled labour in the sector. Skilling women is crucial to address industry needs as well as for inclusive development.

Several success stories in the sector are analysed to input into key recommendations for enhancing women's participation in the sector. While bridging the skill gaps is a key focus area, recommendations also include measures to increase participation of women in the workforce and promote eco-entrepreneurship in the sector.

With the outbreak of COVID-19, challenges for the workforce have increased significantly. The impacts are particularly severe for migrant workers engaged in unskilled and semi-skilled roles. The halt on construction activities across India has affected employment of millions. As migrant workers move back to their village/hometown, the cost of labour is expected to increase.

The government's attempts to counter the impacts of COVID on the construction industry including enhanced fiscal stimulus through affordable housing subsidies, incentives to green building developers, collateral-free loans and improved job security for women in construction could lead to faster recovery and green growth of the sector.

1 Green Growth Knowledge Platform, 2016. Energy efficient buildings for low-carbon cities.

1

Overview

1.1 SETTING THE CONTEXT

As the construction industry tackles the challenge of providing adequate infrastructure to all segments of the society, it does so in the face of constantly diminishing resources. In such a scenario, while India is transitioning to a low-carbon economy, the construction industry has been paying increasing attention to green construction. Green construction in the country has seen significant increase over the last several years. However, this shift has also resulted in a growing shortage of labour that is trained in skills required by the industry.

As the number of green buildings increase over the years, this study is timely since it aims to assess growth of the green building segment, corresponding requirement of skilled workforce, current skill gaps and ways to enhance women's participation and training to bridge the gap between supply and demand of a skilled workforce.

This report presents a sectoral analysis of green buildings in India and outlines policies in place pertinent to green jobs and eco-entrepreneurship opportunities for women in selected states.

BACKGROUND

This scoping study on Green Jobs and Eco-entrepreneurship opportunities for women in select states, draws its strength and learning from the UNDP-IKEA Foundation project 'Creating Employment and Entrepreneurship Opportunities for Women in India (Disha)'. This project focused on enhancing opportunities for marginalized women in jobs and entrepreneurship and enabled development of models and curriculum like the Biz Sakhi and Women Sourcing Managers. Though some of the pilots under Disha did include components of green initiatives, but a full-fledged pilot/programme could not be developed majorly because of lack of disaggregated data/ information. But as the conversations around jobs/ entrepreneurship - climate change nexus gathered momentum, a need was felt to design a study to fill this gap and develop sector specific pathways with a focus on marginalised women. .

While the discourse on Green Economy/Green Growth is huge and covers a range of sectors, the study focuses on addressing the following two-fold objectives:

- Gap assessment of existing and potential green jobs and mapping the availability of skilled workforce for the identified job roles in the RE sector; and
- Development of an implementation roadmap and provision of recommendations to enable women to leverage the existing and potential opportunities.

Given the limitation and the acceptance that many areas in the Green Jobs sector is still evolving and maybe in nascent stage, the geographic scope of the study was limited to the states of Delhi NCR, Haryana, Maharashtra, Karnataka, Telangana, Uttarakhand and Odisha.

APPROACH AND METHODOLOGY

The scope of the study included the following five phases: finalization of methodology and assessment framework, secondary research and assessment, primary stakeholder consultation, analysis and report writing.

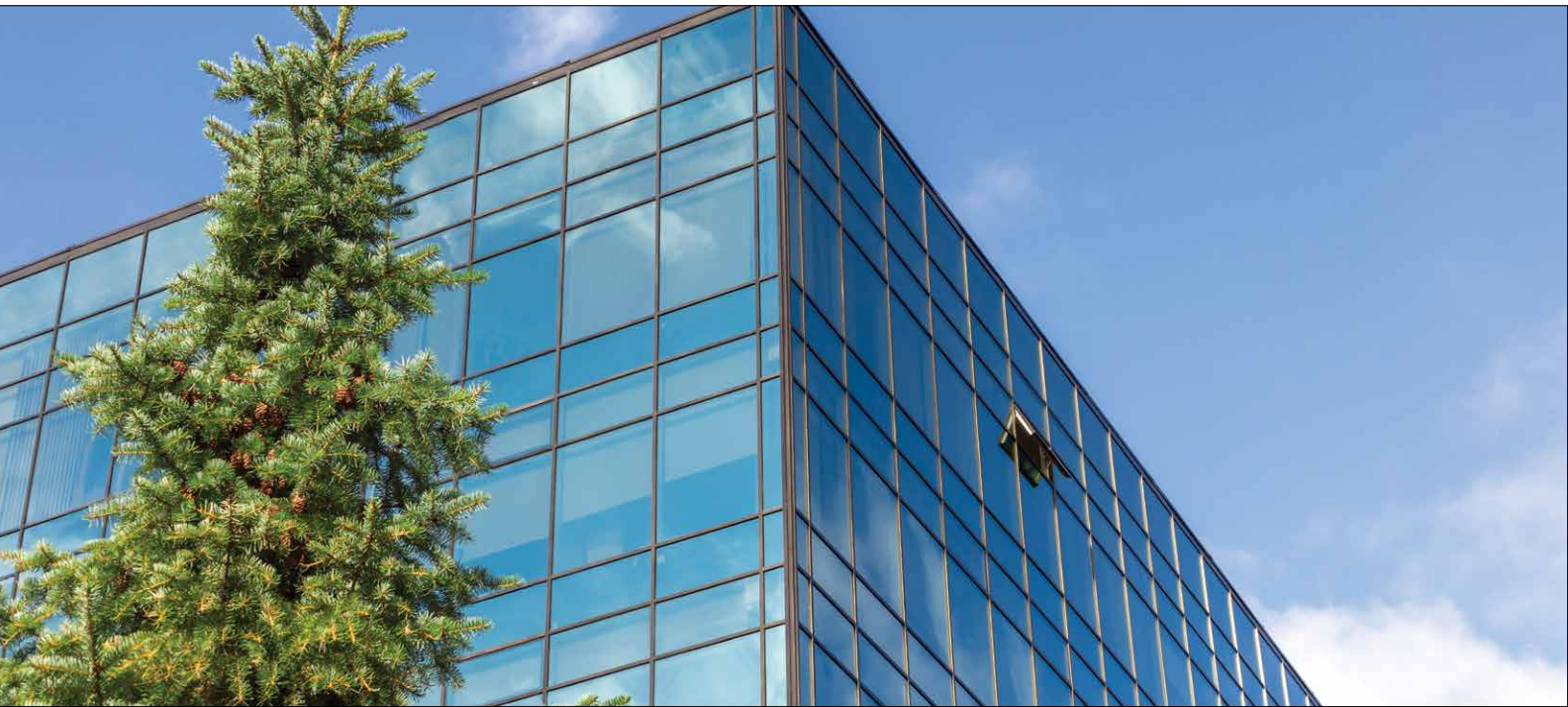


Figure 1: Approach and methodology

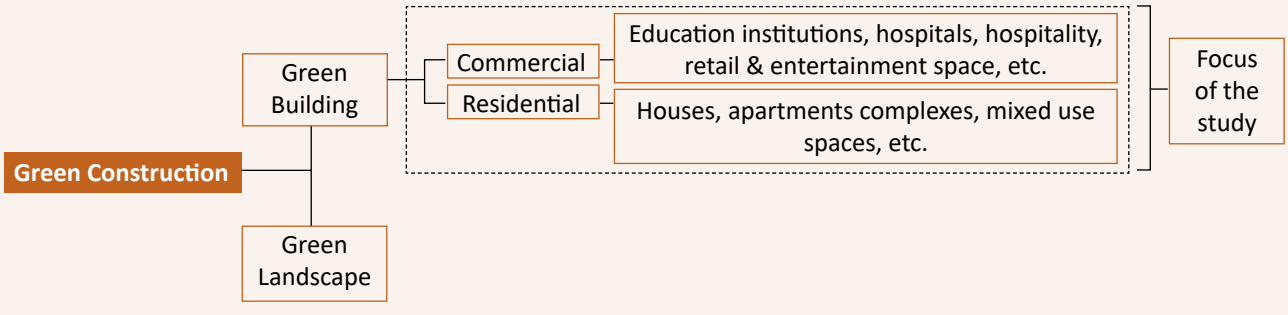
Scope of the Study :
Green construction includes green building and green landscape. This report **primarily focuses on commercial and residential green buildings.**

LIMITATIONS OF THE STUDY

The uniqueness of this assignment is an opportunity to explore and find a way forward but it also presents its own set of challenges, particularly in terms of paucity of data. The analysis conducted in the study is bounded by the following limitations:

- Lack of sector-specific data for women currently engaged in unskilled and semi-skilled job roles in the selected states;
- Consequently, estimation of the growth forecast for semi-skilled and unskilled job roles in the sector is a challenge;
- Data on manpower requirement in the construction sector in Delhi and Telangana are not available. Similarly, limited information is available for Uttarakhand and Odisha;
- Data related to green building trends for the selected states are not available;
- Information on skill gaps in the green building sector, particularly for semi-skilled and unskilled job roles, is not available; and
- There is limited information about institutes that provide training to women on technical skills required in the green building segment. For the institutes that do provide training to women, the data related to enrolment, placement and type of construction course pursued are not available

Figure 2: Scope of the study



1.2 INTRODUCTION

The construction sector provided employment to 7 percent of the world's formal workforce as of 2013[2]. The employment numbers for the informal segments of construction should be much higher. Studies suggest that construction accounts for 25 to 40 percent of global energy use and 30 to 40 percent of global greenhouse gas (GHG) emissions. The industry is expected to record a compound annual growth rate (CAGR) of 6.5 percent to reach US$10,835.6 billion by 2023[3]. The buildings account for approximately 30 percent of global energy consumption and generate around 20 percent of all energy related GHG emissions[4]. Demand for indirect and direct use of energy and water is very high throughout various stages across the value chain of buildings.

Construction is one of the most energy-intensive industries in India, accounting for 2.12 percent of the total industrial energy use, after the iron and steel and chemicals and petrochemicals industries (Energy Statistics, 2019)[5]. **In 2016, residential and commercial structures consumed nearly a third of the country's total electricity[6] of which residential and commercial buildings consumed 26 percent and 9 percent energy, respectively[7].**

Figure 3: Sector-wise energy demand in 2019

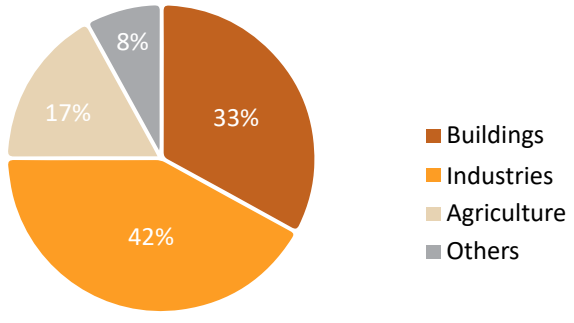
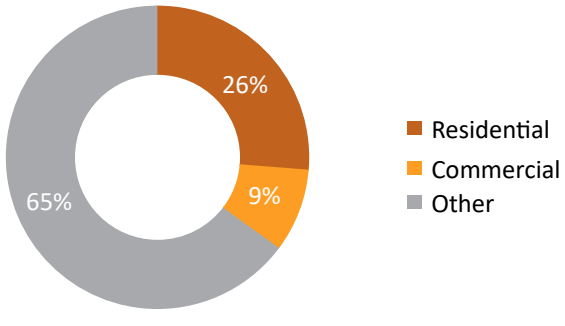


Figure 4: Energy demand in 2016 based on building type



Furthermore, the requirement for water during and after construction is also enormous. **Nearly 80 percent of the water supplied for domestic use turns into wastewater, which is ultimately disposed in rivers/ streams and contributes 70 percent of the pollution** load to the streams of India.

Consumption of other resources in construction that have negative environmental impacts[8] includes:

- Bricks used in construction which exert extreme **pressure on the fertile topsoil;**
- Stone aggregates are used to make concrete, processing of **which** has a **significant impact on air pollution;**
- India utilizes about 226 million tonnes of limestone, of which the cement industry has the highest utilization share. Limestone mining also has negative environmental impacts such as **water contamination** and **fugitive dust emissions;** and
- Steel has a high recyclability potential; however, steel production and iron ore extraction are **extremely polluting activities.**

As population expands and incomes grow in India, this shift will likely be realized alongside demographic changes that will exponentially increase demand for urban amenities such as housing, energy, water and waste disposal. It is estimated that more than half of India of 2030 is yet to be built[9].

Considering the demand for enormous energy by buildings, construction of energy efficient buildings can be adopted as a strategy that can contribute significantly towards the achievement of India's climate target to reduce emissions intensity by 33 to 35 percent from its 2005 levels by the year 2030 as part of the Paris Agreement[10]. Over the last several years, green building has seen a significant increase in India and will continue to observe a similar trend in the foreseeable future. For instance, floor area in India is expected to double by 2035 from the floor area in 2017. However, only a limited part of the sector is covered by mandatory building energy codes[11]. Certified green buildings can deliver energy savings between 20-30 percent and water savings of up to 30-50 percent.

2 UNDP, 2013. Green jobs for women and youth- what can local governments do?
3 https://www.globenewswire.com/news-release/2020/01/02/1965613/0/en/World-Construction-Industry-Size-Forecast-to-2023-Continuous-Major-Economic-Growth-in-Various-Developed-Emerging-Markets-Drives-the-Industry.html
4 Green Growth Knowledge Platform, 2016. Energy efficient buildings for low-carbon cities.
5 Ministry of Statistics and Programme Implementation, 2019. Energy statistics.
6 https://www.wri.org/blog/2017/11/indias-move-make-buildings-efficient
7 https://shaktifoundation.in/wp-content/uploads/2019/11/ECBC_compliance_in_Indian_Cities.pdf
8 Deutsche Gesellschaft für Internationale Zusammenarbeit GmbH, 2016.Material consumption patterns in India. A baseline study of the auto motive and construction sectors.
9 https://www4.unfccc.int/sites/ndcstaging/PublishedDocuments/India%20First/INDIA%20INDC%20TO%20UNFCCC.pdf
10 ECBC resource guide, 2017. Telengana state and Greater Hyderabad Municipal Corporation – building a better future.
11 UNEP, 2017. Global status report.

DEFINING GREEN JOBS

International Labour Organization (ILO) defines green jobs as those that, "are decent jobs that contribute to preserve or restore the environment, be they in traditional sectors such as manufacturing and construction, or in new, emerging green sectors such as renewable energy and energy efficiency."

According to ILO, decent work involves "opportunities for work that is productive and delivers a fair income, security in the workplace and social protection for families, better prospects for personal development and social integration, freedom for people to express their concerns, organize and participate in the decisions that affect their lives and equality of opportunity and treatment for all women and men"[12].

United Nations Environment Programme (UNEP) defines green jobs as "work in agricultural, manufacturing, research and development (R&D), administrative, and service activities that contribute substantially to preserving or restoring environmental quality. Specifically, but not exclusively, this includes jobs that help to protect ecosystems and biodiversity; reduce energy, materials, and water consumption through high efficiency strategies; de-carbonize the economy; and minimize or altogether avoid generation of all forms of waste and pollution"[13].

For the purpose of this study:
'Green' implies:

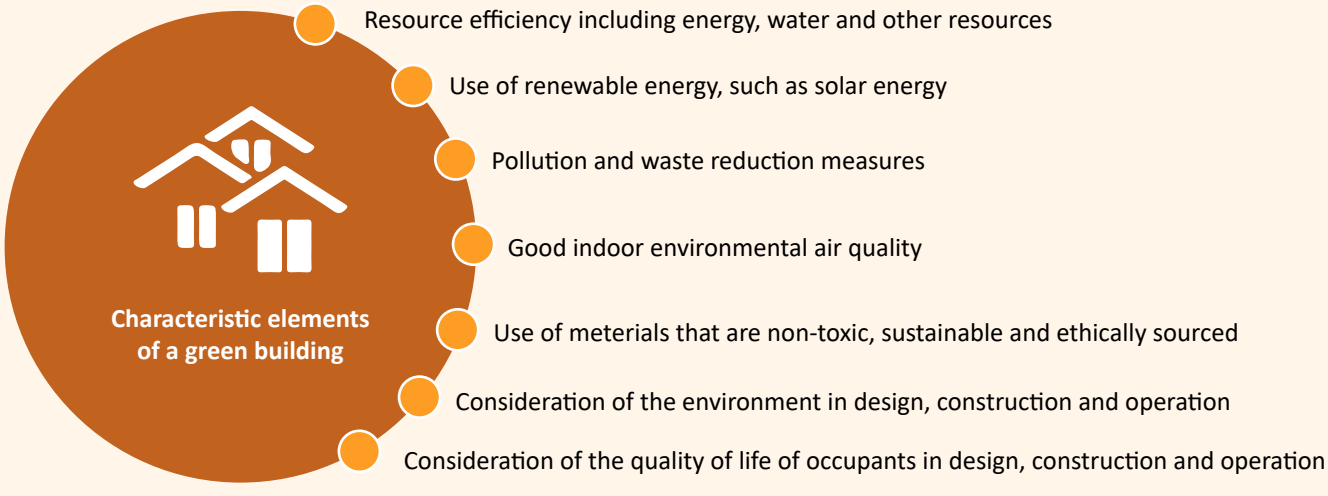
- Limiting or preventing negative environmental impacts, such as pollution, of ecosystem components such as air, water and soil;
- Being climate friendly via minimization of resource wastage;
- Maximizing resource efficiency; and
- Focusing on resource conservation.

'Green jobs' include social considerations such as improvement of working conditions, promotion of health and well-being, better livelihood generation, community development, etc. Green jobs can be existing or may require, reskilling, upskilling or developing new skills.

DEFINING A GREEN BUILDING

According to World Green Building Council, "a 'green' building is a building that, in its design, construction or operation, reduces or eliminates negative impacts, and can create positive impacts, on our climate and natural environment. Green buildings preserve precious natural resources and improve our quality of life." Features such as, efficient use of resources, use of renewable energy, pollution control measures, good indoor air quality, use of materials that are non-toxic, ethical and sustainable, consideration of the environment as well as quality of the occupant's life in design, construction, operation and renovation are characteristic of green construction[14].

Figure 5: Characteristic elements of a green building



12 https://www.ilo.org/global/topics/decent-work/lang--en/index.htm
13 http://www.fao.org/rural-employment/work-areas/green-jobs/en/
14 https://www.worldgbc.org/what-green-building

Defining green jobs in the green building segment

Considering the characteristics of green buildings and defining aspects of green jobs, the definition of green jobs in the green building sector, for this study, are defined as those that **maximize resource efficiency,** limit or prevent **negative environmental impacts** and utilize **environment-friendly material** that is locally and ethically sourced; and consider **improvement of working conditions,** promotion of **health and well-being of workers** and inhabitants, better livelihood generation, and **community development.**

GREEN BUILDING LANDSCAPE

There is increasing awareness of green buildings leading to a rise in the adoption of green building rating systems to certify building performance. Predominant green building rating systems in India include those by the India Green Building Council (IGBC), Green Ratings for Integrated Habitat Assessment (GRIHA) Council, and Green Business Certification Inc. that administers the Leadership in Energy and Environmental Design (LEED) certificate programme. Moreover, the Bureau of Energy Efficiency (BEE) has also developed the Energy Conservation Building Code (ECBC) to provide minimum requirements for energy-efficient design and construction of buildings[15].

According to U.S. Green Building Council data, outside the United States, India ranks third in the world in the annual ranking of the top 10 countries for LEED[16]. As of December 2019, more than 1,400 LEED-certified buildings were registered in India[17]. As of 2019-end, IGBC had also registered more than 5,723 green building projects accounting for 7.09 billion sq. ft area. The target is to have 10 billion sq. ft covered under green building projects by 2022[18].

According to a research by Dodge Data and Analytics, conducted in collaboration with World Green Building Council, revealed that the two most important triggers for green building activity in India in the future are environmental regulations and need for healthier buildings. Currently, the activities are driven by the need to comply with environmental regulations rather than expectations of the market[19].

From a policy and regulation perspective, there are various national schemes and policies that promote and boost the adoption of green buildings in India. These include the Pradhan Mantri Awas Yojana - Gramin (PMAY-G) and Urban (PMAY-U), Smart Cities Mission, Energy Conservation Act, Energy Conservation Building Code, etc.

15 Bureau of Energy Efficiency, Ministry of Power, 2017. Energy Conservation Building Code.
16 Manna, D. and Banerjee, S., 2019. A review on green building movement in India.
17 https://gbci.org/annual-top-10-states-leed-india-announced-gbci-india
18 IGBC Annual Report, 2018.
19 http://images.marketing.construction.com/Web/DDA/%7B86880419-3e18-436a-af4f-83172d070b08%7D_SMR0918_India_25Nov18.pdf

There are various types of material that have proven to be substitutes for traditional construction material that is more resource intensive. Such green building material include fly ash bricks, bamboo, Compressed Stabilized Earth Blocks (CSEBs), recycled plastic, recycled construction waste, ferrocement[20], etc. There are policies on utilizing fly ash in India which facilitate its adoption by developers in the construction sector. However, similar significant policies are missing for other green construction material. Recycled plastic has been utilized by construction material industries to manufacture tiles and centring plates that are used during construction of buildings. The Council for Scientific and Industrial Research developed a unique technology to make floor and pavement tiles from plastic waste[21]. Traditional centring plates of steel and wood are being replaced by those made from recycled plastic, which are lighter in weight.

CONSTRUCTION AND MANPOWER REQUIREMENT

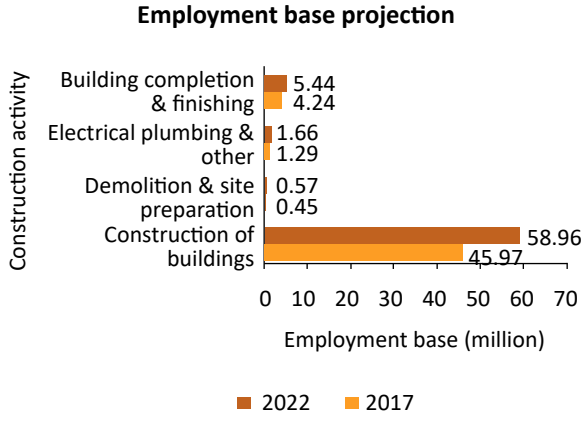
In the construction and real estate services sector, the gross domestic product (GDP) contribution is estimated to grow at a compound annual growth rate (CAGR) of 9.5-10 percent till 2022 in real terms[22]. Historical data demonstrate that the construction workforce comprises 80-90 percent unskilled and semi-skilled workers, and only 10 percent skilled[23].

In India, construction is the second largest industry after agriculture and provides employment to both skilled and unskilled workers. It engages over 35 million people, of which women make up nearly 30 percent. Almost 65 percent of these women work as construction labourers because their families are already in the workforce or male members of their family are employed there[24,25].

Table 1: Employment base projection for different segments of construction activity

Segment of construction activity	Employment base (million)	
Year	**2017**	**2022**
Construction of buildings	45.97	58.96
Demolition & site preparation	0.45	0.57
Electrical plumbing & other construction installation activities	1.29	1.66
Building completion & finishing	4.24	5.44

Figure 6: Employment base projection for different segments of construction activity



Construction industry snapshot

- The real estate sector in India is expected to reach US$ 1 trillion by 2030. The sector will contribute 13 percent of the country's GDP by 2025 (IBEF, 2019).
- Demand for affordable housing is likely to increase to more than 38 million households by 2030.
- Housing and building segment in the real estate sector is projected to have human resource requirement of 24,981 people by 2022.
- Green construction, in India, focuses significantly on passive building techniques that draw on traditional architectural solutions.
- The sector is projected to employ 63.66 million people by 2022, including an increase of nearly 15 million in employment base from that in 2017.

20 https://www.nbmcw.com/tech-articles/precast-construction/42138-low-cost-precast-zatpat-houses.html
21 https://www.csir.res.in/sites/default/files/daily_bul_211216_0.pdf
22 National Skill Development Corporation, Human resource and skill requirements in the building, construction and real estate services sector (2022).
23 RICS, 2011. Real estate and construction professionals in India by 2020.
24 Business World, 2019. Women workforce in the male dominated construction industry in India.
25 IBEF, 2019. Indian Real Estate Industry Analysis; NSDC. Human resource & skill requirements in the building, construction industry, and real estate sector; ILO. Greening of the building sector is held back by skill shortages.

Projection for the Green Building Sector

According to India Green Building Market Opportunity Outlook 2020[26], there were 4,500 green building projects in India in 2016 with about 4.17 billion sq. ft of built-up area. The trend continued and, in 2019, according to an IGBC report, the total green building area in India rose to 7.09 billion sq. ft. Globally, the green buildings market is projected to have a CAGR of 10.26 percent up to 2023. Based on this, the green building area in India is projected to be that of 9.5 billion sq. ft by 2022.

Table 2: Projected green built area in India for 2022

S. No.	Year	Green Building (billion sq. ft)
1	2016	4.17
2	2017	4.98
3	2018	6.33[27] (as of October 2018)
4	2019	7.09
5	2020	7.82
6	2021	8.62
7	2022	9.50

There are various national schemes that facilitate adoption of green buildings across India. These include PMAY, incentives for buildings certified as green by GRIHA, IBGC, LEED, etc.; mandate by the Ministry of Environment, Forestry and Climate Change (MoEF&CC) on fly ash utilization as well as priority consideration for buildings and construction proposals that have received green building rating. Such policies, in combination with skilling initiatives, create a system that is conducive to the growth of the green building segment and a skilled workforce through targeted skill development in the sector.

Thus, the trend of overall increase in human resource demand in the construction sector is also projected for green construction activities. Green construction is projected to observe a rise in employment opportunities in the future. According to ILO, **8,800,000 jobs** will be added in the green buildings/campuses segment between 2021 and 2030[28].

State-wise Projections

According to the U.S. Green Building Council, as of 2019, Maharashtra, Karnataka, Haryana, Telangana and Delhi were among the top 10 states for green built space.

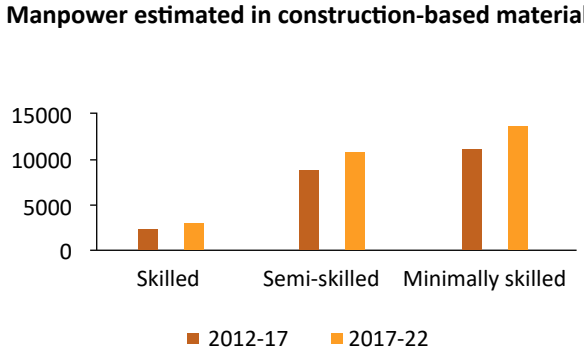
Haryana

The state demonstrates incremental human resource requirements although with significant geographical and sectoral variations. The demand for manpower in the construction-based material industry in the state is estimated to increase to 27,177 from 2017 to 2022[29] (data for traditional construction material). The manpower requirement in this sector can be addressed through training workforce in green construction material production and use, such as bamboo and fly ash bricks.

Table 3: Incremental manpower requirement projected for construction-based material industry, Haryana

Construction- based material	Incremental manpower requirement (2017-2022)
Skilled	2,717
Semi-skilled	10,871
Minimally skilled	13,589
Total	**27,177**

Figure 7: Incremental manpower requirement in construction-based material industry, Haryana



Demand of manpower in the construction industry in the state shows an increasing trend as well.

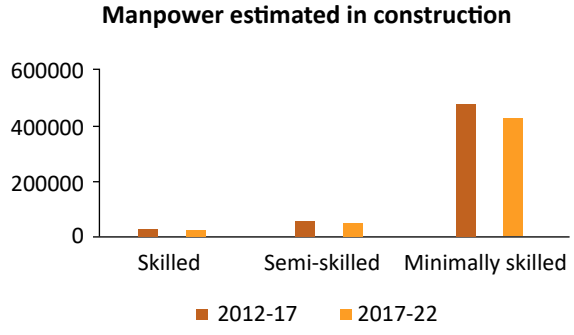
26 hhttps://www.researchandmarkets.com/reports/3920458/india-green-building-market-opportunity-outlook
27 IGBC Annual Report 2017-18.
28 ILO, 2018. Skills for green jobs in India.
29 National Skill Development Corporation, District-wise skill gap study for the state of Haryana (2012-17, 2017-22).

Manpower requirement in the green building segment: Haryana has the potential to adopt green building construction because of the additional floor area ratio (FAR) given to green buildings rated under various categories by IGBC and GRIHA. Additionally, the Haryana Skill Development Mission has a target of skilling youth in various trades. This presents an ecosystem that can lead to skilling of youth to meet the increasing demand of the growing green building segment in the state.

Table 4: Incremental manpower requirement projected for the construction sector, Haryana

Construction	Incremental manpower requirement (2017-2022)
Skilled	25,062
Semi-skilled	50,126
Minimally skilled	426,065
Total	501,253

Figure 8: Incremental manpower requirement projected for the construction sector, Haryana



Construction is a priority sector from a manpower development perspective in the state. One of the challenges in addressing the skill gap prevalent in the sector stems from the perception that this is an unattractive career choice for the youth. Another challenge is the view of industry personnel on the lack of technical and soft skills in prospective employees.

Karnataka

Building, construction and real estate are some of the largest sectors in Karnataka and are likely to generate significant employment opportunities. Most of the employment is likely to be for minimally skilled and skilled workers. The common perception of jobs in the sector is poor; they are considered inferior, the reason why people are not inclined to take up these jobs. The result is a manpower shortfall in this sector[30].

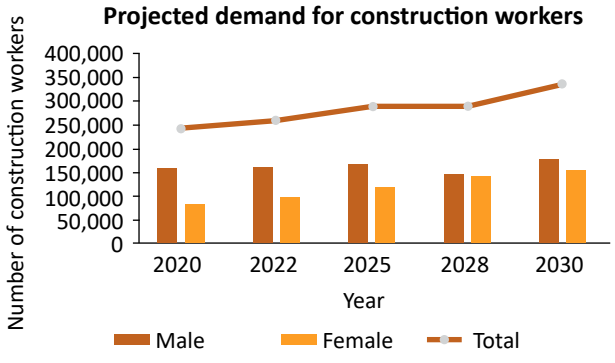
Karnataka has a significant population of migrants that moves from one region to another within the state. Most people migrating from the districts are engaged in construction-related activities. These people are generally illiterate and unskilled labourers; they gain skills through experience while on the job[31].

According to the Karnataka Skill Development Plan, the construction sector employed 9.6 percent of the total workforce of Karnataka in 2017, amounting to 3,660,646. The demand for construction will continue to rise as can be observed from Table 5 and Figure 9[32].

Table 5: Projected demand for construction workers in Karnataka

Year	Male	Female
2020	158,623	85,435
2022	161,882	97,993
2025	168,466	119,894
2028	147,768	141,290
2030	178,877	155,380

Figure 9: Projected demand for construction workers in Karnataka



Incremental employment demand in Karnataka for semi-skilled and unskilled labour is shown in Table 6 and Figure 10.

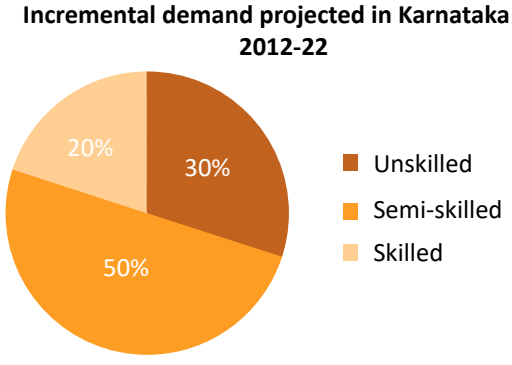
30 National Skill Development Council, 2013. District wise skill-gap study for the state of Karnataka.
31 Ibid.
32 Karnataka Jnana Aayoga, 2017. Karnataka Skill Development Plan.

Table 6: Projected demand of construction workers based on skill level in Karnataka

Level of skill	Projected demand 2012-22[33]
Unskilled	409,450
Semi-skilled	682,417
Skilled	272,967 (skilled + highly skilled)
Total	1,364,834*

***Note:** The figure reported here is based on the sum of the data given in the report.

Figure 10: Projected demand of construction workers based on skill level in Karnataka



Manpower requirement in the green building segment: Since Karnataka is one of states to have the maximum green built area as of 2019, the green building segment certainly poses demand for workforce with relevant skills. The state provides incentives for using renewable energy. Additionally, the Confederation of Indian Industry (CII)-IGBC and Confederation of Real Estate Developers' Association of India (CREDAI) signed a memorandum of understanding (MoU) to jointly focus on Bengaluru to push green building adoption. This presents an ecosystem that can lead to skilling of youth to meet the increasing demand of a growing green building segment in the state.

Maharashtra

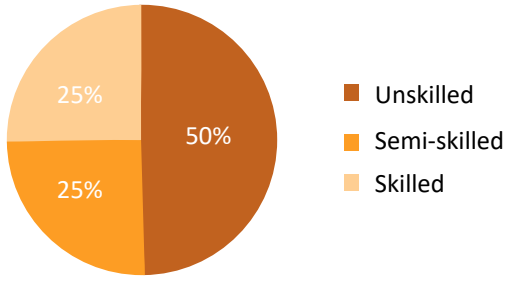
In Maharashtra, real estate, ownership of dwellings and business services and construction account for 22 percent of the state's GDP. It has emerged as a thriving sector in the state contributing significantly to employment as well. The drivers for this are not just commercial construction but also high levels of residential construction taking place in the state[34].

The total incremental demand projected for the construction and building sector between 2018 and 2022 is 1,569,722. The maximum demand is for unskilled human resources, followed by a semi-skilled and minimally skilled workforce[35].

Table 7: Projected demand for construction workers based on skill level, Maharashtra

Level of skilling	2012-22
Unskilled	1,328,828
Semi-skilled	685,981
Skilled	685,981

Figure 11: Projected demand for construction workers based on skill level, Maharashtra



- Incremental demand for manpower in the sector is very high in the state. However, there is a mismatch between the demand and supply of manpower;
- Some major barriers to skill development are:
  - Lack of good quality institutes in backward areas
  - Accessibility of the institutes, i.e., connectivity by road
  - Lack of other facilities such as access to clean water and sanitation facilities;
- There is a pronounced preference for jobs in Mumbai, followed by Pune, Nashik and Aurangabad; and
- The youth's preference is to work with well-known multinational corporations, highlighting the need to improve the perception of small and medium scale industries and entrepreneurial opportunities in the construction sector.

33 National Skill Development Council, District wise skill gap study for the state of Karnataka.
34 National Skill Development Council, District wise skill-gap study for the state of Maharashtra.
35 Ibid.

Manpower requirement in the green building segment: Being the state with highest number of LEED certified projects, Maharashtra has huge potential for growth of the green building segment due to supportive schemes. These include additional FAR for green buildings, mandate for existing buildings and all new government buildings to carry out development and renovation as per the relevant IGBC Green Building Rating System as well as to expand the green building segment in Mumbai and Pune basis CII-IGBC and CREDAI guidelines. An additional thrust also comes from the fact that Sectoral Skill Development Committees established by the state have identified construction as a high demand trade and prioritized the skilling of youth in this industry.

Uttarakhand

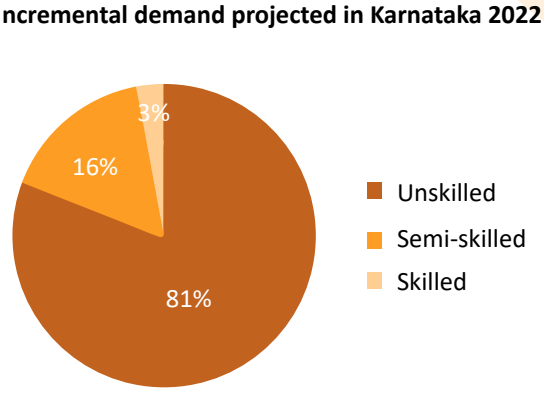
Human resource demand in the construction and real estate sector is projected to be 356,380.

Construction is a priority sector in terms of the requirement of unskilled, semi-skilled and skilled manpower in the state. The sector is projected to have a maximum demand of workforce in unskilled job roles, followed by semi-skilled and skilled workforce.

Table 8: Projected demand for construction workers based on skill levels, Uttarakhand

Skill level	2017	2022
Unskilled	223,498	288,668
Semi-skilled	44,148	57,021
Skilled	8,278	10,691
Total	275,924	356,380

Figure 12: Projected demand for construction workers based on skill levels, Uttarakhand



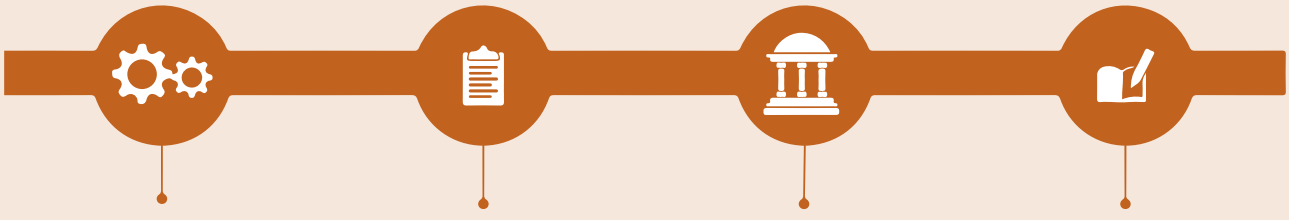
Odisha

The total incremental demand and supply **gap** for skilled jobs in the building, construction and real estate services sector is projected to be 14,060 from 2011 to 2026[36]. Khurda and Mayurbhanj districts in Odisha have particularly high potential labour growth in the building, construction and real estate services sector[37].

GROWTH DRIVERS OF EMPLOYMENT OPPORTUNITIES IN THE GREEN BUILDING SECTOR

1. **Limited resources and increasing urbanization:** Increased urbanization has placed enormous demands on resources and infrastructure. In the face of continuous pressure exerted on natural resources for anthropogenic activities, and constantly shrinking supply of resources, it is imperative that resources are used sustainably. This need will drive an increase in construction of green buildings.

Figure 13: Growth drivers of employment opportunities in the green building sphere



36 National Skill Development Council, 2011. Skill gap assessment for the state of Odisha.
37 Ibid.

Research conducted by Dodge Data and Analytics reinforces this reasoning. The research found that over 80 percent respondents highlighted two most important reasons for adopting green building construction: reduction in energy consumption and reduction in water consumption[38].

2. **Investors:** Investors are becoming increasingly aware of the importance of energy conservation and responsible business conduct. They weigh in with their proactive attitude toward sustainability issues, including ethical sourcing of material, GHG emission reduction through energy conservation and harnessing renewable energy and minimizing negative environmental impacts of activities. Additionally, embracing responsible business practices reduces risks for communities the business operates in. Reduced risks contribute to building a reputation which attracts investors. Thus, green construction makes business sense, which drives growing employment opportunities in the sector. Research by the Royal Institution of Chartered Surveyors (RICS) reveals that investors and occupiers believe that conventional buildings in India would be at risk in the future if they fail to meet energy ratings or sustainability requirements by investors[39].

3. **Regulatory changes:** Changes in construction regulations including building codes and new technologies are foreseen in response to the increasing awareness around green buildings and their advantages for the environment and occupants' health. Compliance with these regulations entails the need for industry professionals who are aware of relevant regulations to ensure compliance.

4. **Incentives:** The government's focus on scaling up green building adoption has resulted in the provision of incentives to developers for buildings that are certified through green building rating systems, such as those by IGBC and GRIHA. Availing these benefits would also require professionals who are aware of various green building codes.

These drivers combined with a shortage of trained labour in the sector is opening up employment opportunities at a rapid pace, while also highlighting the need to train the workforce and include women in the workforce to meet demand for trained labour.

1.3 IMPLICATIONS OF COVID 19 ON THE SECTOR

COVID- 19 impacts on construction industry[40]

In India, construction activity slows down during the monsoon season and runs at full capacity between the months of March and June. Thus, the industry is hit particularly hard because the lockdown due to the Corona pandemic.

According to a report by KPMG, impact of COVID- 19 on the building and construction sector is projected to be high, particularly on following areas:

- High impact on the price of key raw materials due to halt in manufacturing of cement, steel and other building materials
- High impact on sourcing of building material and labour due to shutdown of production processes
- Disrupted supply chain would result in delayed construction
- Labour force would be highly impacted as the real estate sector will see estimated job loss of approximately 30 percent

A report published by KPMG notes that, "unlike sectors like financial services, retail, manufacturing or IT, construction engineering sector requires the physical presence of a large workforce – both skilled and unskilled – in concentrated circles. There are, generally, low levels of technology integration in such projects, which fall even lower in government and public sector projects".

Many reports have covered the fall in the jobs and employment due to the COVID 19 pandemic and the lockdown, leading to significant rise in reverse migration. As construction is sensitive to economic cycles, construction enterprises and workers are

38 Dodge Data and Analytics, 2018. World Green Building Trends 2018: India.
39 RISC, 2018. Perceptions of value premiums and workplace productivity in green office buildings in India.
40 KPMG, 2020. Reviving the Construction Sector in India post COVID- 19; Potential impact of COVID- 19 on the Indian economy.

particularly vulnerable to the drastic decline in economic activity resulting from the pandemic. Increased health risks associated with COVID-19 have exacerbated decent work deficits in the sector [41]

The exodus of migrant workers or informal sector workers (a bulk of whom find employment in the construction industry in Tier I and Tier II cities), took a toll on the supply chain due to a ban on inter-state travel. It also pushed up operating costs as commodity prices (raw materials for the construction industry) were in short supply. Though the Union Government took the decision of recognizing the pandemic as a Force Majeure incident, the onus was on the construction industry to deal with the double whammy of COVID in addition to the already existing sluggish conditions. As the second biggest employment generator, the impact of COVID on the construction sector, thus led to the lowering of GDP not only in real estate but also several associated sectors.[42]

In India, as part of the Pradhan Mantri Gareeb Kalyan Yojana package in response to the pandemic, the Mahatma Gandhi National Rural Employment Guarantee Act (MGNREGA) has been allocated additional budget worth to increase MGNREGA wages.[43] MGNREGA is a public employment programme enacted in law in 2005, and may be instrumental in ensuring paid employment in the context of the crisis, especially for affected groups, such as women73 and to migrant workers returning to rural areas. MGNREGA can contribute to build the infrastructure towards more resilient livelihoods in rural India, as there is great emphasis on infrastructure to help cope with drought [44]

In order to kick-start the economy and revive the Construction sector, it is imperative that the Governments, employers' and workers' organizations, and other sectoral stakeholders initiate measures for safe return of migrants and safe working conditions. This should extent provision through social support structures and economic safety nets.

41 ILO. Good Practices and Challenges in Promoting Decent Work in Construction and Infrastructure Projects. Points of consensus at the Global Dialogue Forum on Good Practices and Challenges Promoting Decent Work in Construction and Infrastructure Projects 19–20 November 2015. Thorsten Schulten and Karin SchulzeBuschoff. 2015, K. "Sector-level strategies against precarious employment in Germany: Evidence from construction, commercial cleaning, hospitals and temporary agency work", WSI-Diskussionspapier 197, Wirtschafts- und Sozialwissenschaftliches Institut, Hans-Böckler-Stiftung.

42 Impact of Covid-19 on the construction sector - People - Construction Week Online India https://www.constructionweekonline.in/people/16438-impact-of-covid-19-on-the-construction-sector

43 ILO. Country policy responses (COVID-19 and the world of work) 16 December 2020. India Ministry of Minister of State for Finance & Corporate Affairs, "Pradhan Mantri Garib Kalyan Package" 26 March 2020. Business Standard "FM allocates Rs 40,000 crore more for MGNREGA to support migrants" 18 May 2020

44 ILO. "COVID-19: Job creation through employment-intensive public works programmes". 5 May 2020; ILO. "COVID-19: The role of public employment programmes and employment guarantee schemes in COVID-19 policy responses" 29 May 2020. Gentilini U., Almenfi, M., Dale, P., Blomquist, J., Natarajan, H., Galicia, G., Palacios, R. & Desai, V. Social Protection and Jobs Responses to COVID-19: A Real-Time Review of Country Measures. World Bank 2020

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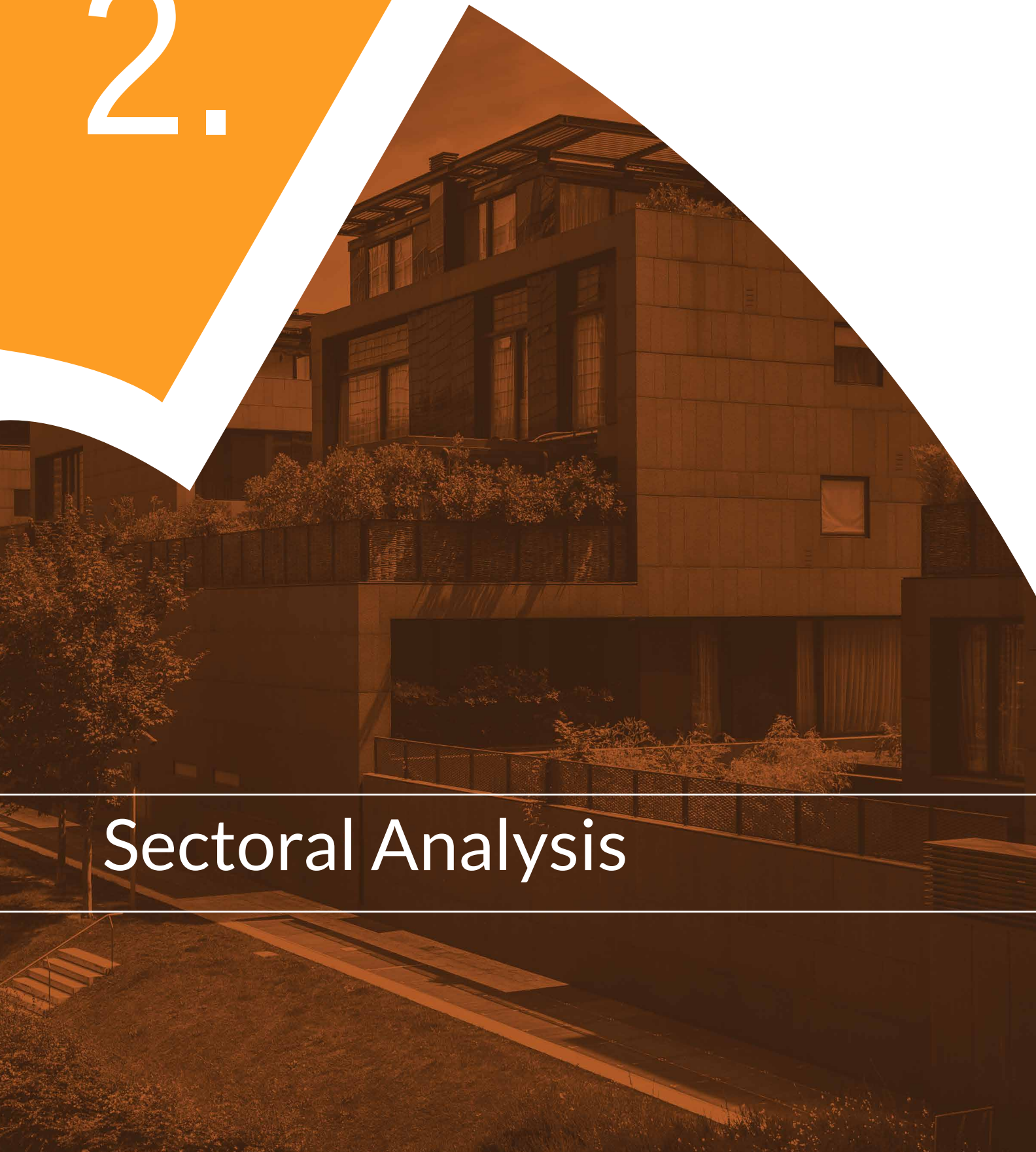


Sectoral Analysis

In line with the boundary of the study, scoping of green jobs is done across the value chain of a green building.

GREEN BUILDING VALUE CHAIN

The green building value chain includes the stages of site selection, assessment of impact on the environment, selection and sourcing of construction material, and operation of the building including maintenance and ensuring an enhanced living experience for its inhabitants. The last stage of the value chain is management of the demolition waste, which should be recycled or repurposed to maximize resource conservation and minimize disposal as waste.

A green building value chain adopted by ILO is shown in Table 13.[45]

Table 13: Green building value chain adopted by ILO

Value chain	Core occupations		
Conceiving, planning, designing and advising	- Construction company managers and business functions - Architects and civil/structural/environmental engineers - Architectural technicians/technical drawing specialists - HVAC, electrical, mechanical, sanitary, building services engineers/designers - Surveyors - Energy and water efficiency and waste management analysts, consultants and advisors		
Construction, installation and maintenance	Building site supervisors, site engineers and site architects		
	Conservation	Insulation/ weatherization	Bricklayers, carpenters, plasterers, glaziers, masons, roofers, painters, decorators
		Efficient heating & cooling	Plumbers and heating installers, maintenance technician, HVAC installers, electricians and IT technicians
		Conservation of electric power (other than electric heating & cooling)	Electricians and installers of energy management systems
		Water conservation	Plumbers, rainwater harvesting designer, installer and helper, water treatment operator and helper, after sale service technician
	Building level renewable energy (and high efficiency energy) systems	Heating/cooling	- Installers/maintainers of solar thermal systems - Installers/maintainers of wood pellet and other biomass heating systems - Heat pump installers/maintainers
		Electricity	- Installer/maintenance technician of solar photovoltaics - Installer/maintenance technician of small-scale wind energy system
End-of-life	Construction & demolition waste management		- C&D waste collector, segregator and recycler

45 ILO. Greening of the building sector is held back by skill shortages. Skills-led strategies can drive green building forward.

Value chain	Core occupations		
Controllers			- Energy auditors - Inspector, certifier, quality controller
Enablers			- Policy makers - Urban planners - Financing - Educators and information providers - Researchers
Manufacturing and distribution			Manufacturers and distributors of green building materials and products

Figure 16 provides an overview of the process flow of a typical green building, starting from site selection to demolition at the end of its life. Figures 16A to 16F outline key activities undertaken across various stages of the process flow.

Figure 16: Activities across Green building value chain

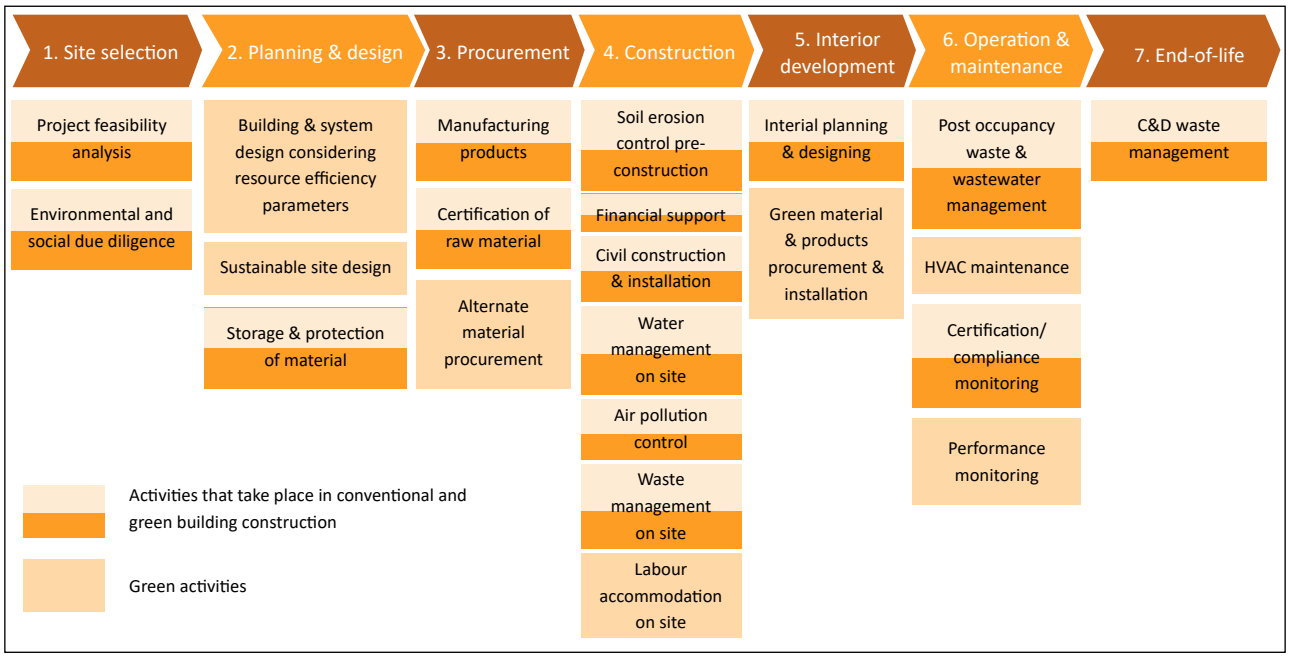


Figure 16A: Stage 1- site selection; Stage 2- planning and design

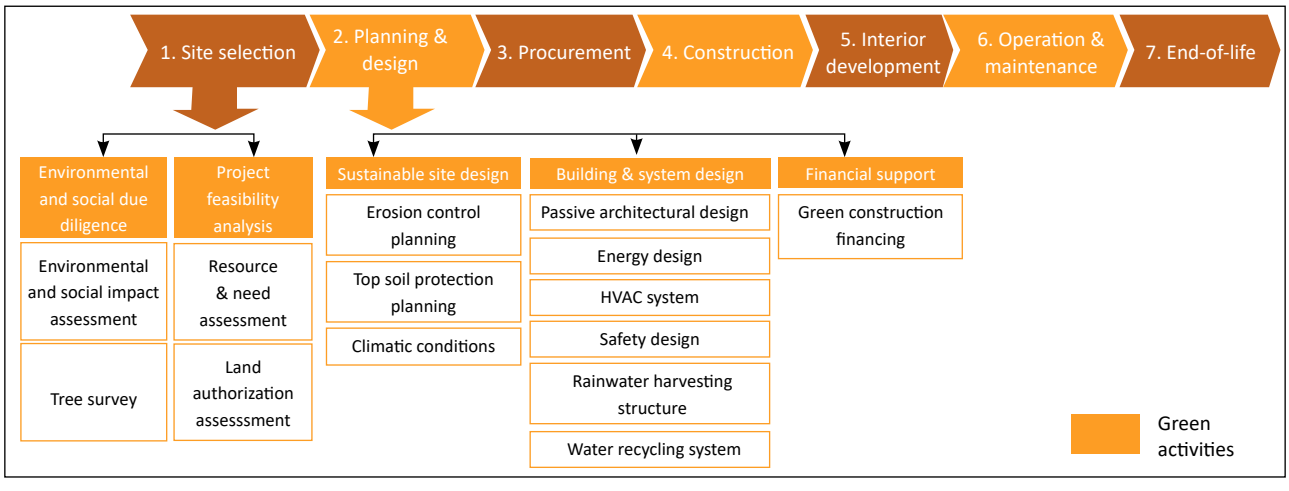


Figure 16B: Stage 3- procurement

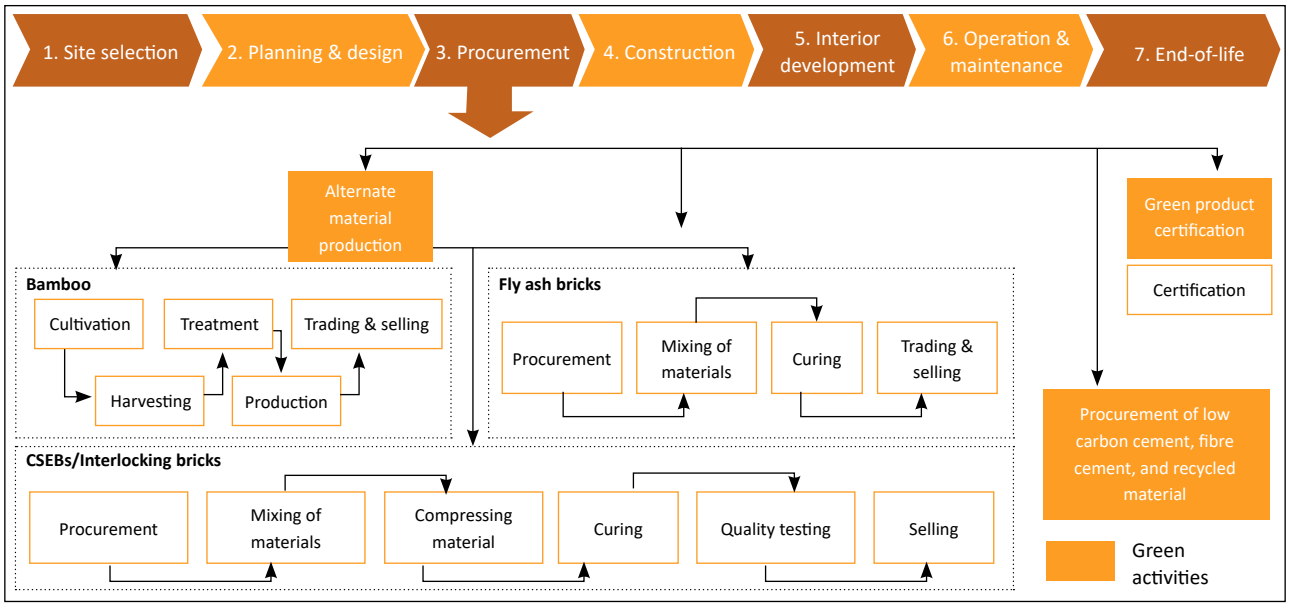


Figure 16C: Stage 4- construction

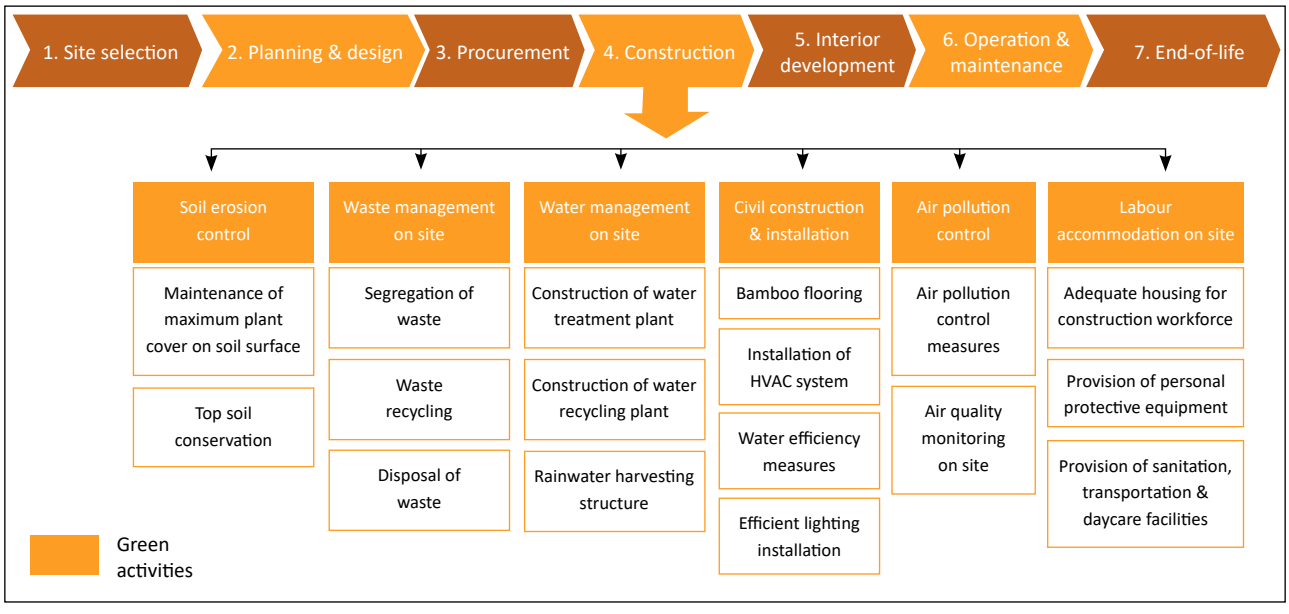


Figure 16D: Stage 5- interior development

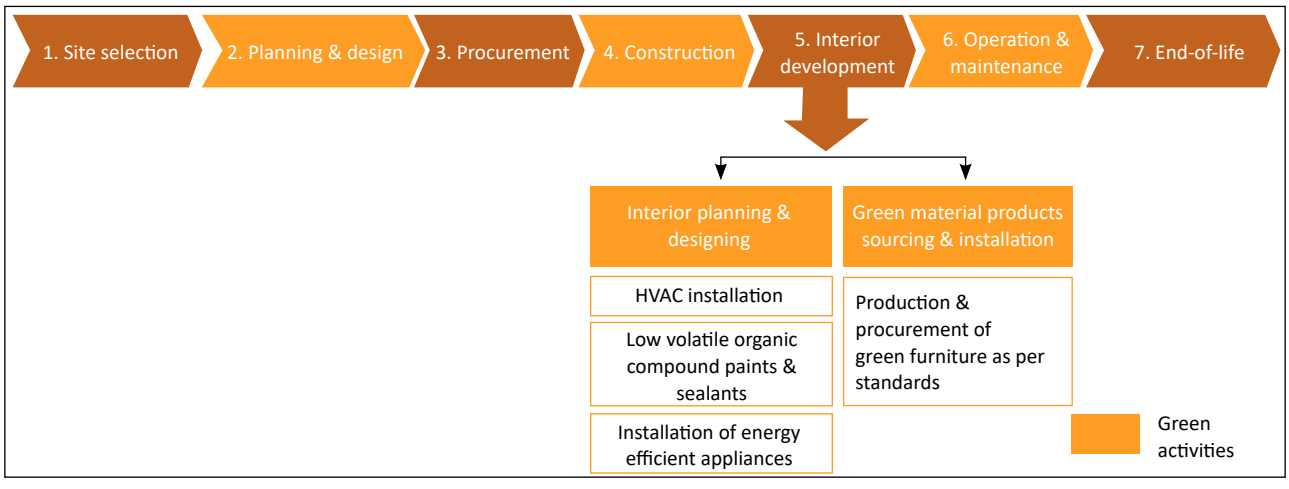


Figure 16E: Stage 6 - operation & maintenance

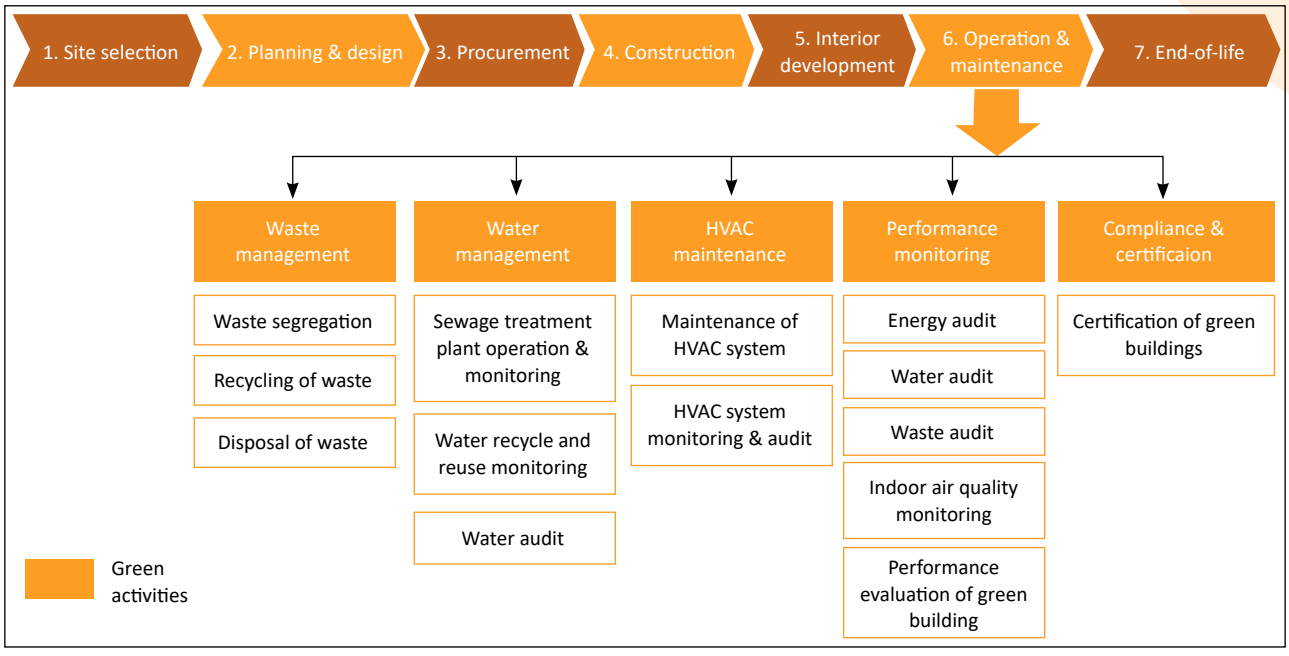
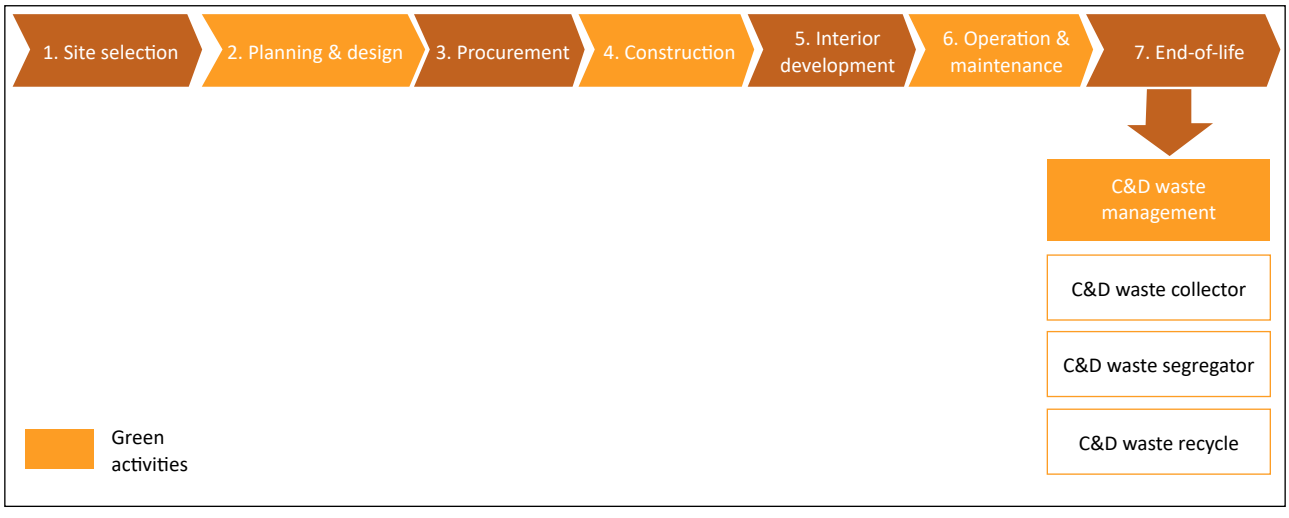


Figure 16F: Stage 7 - end-of-life



WOMEN AND GREEN JOBS

While examining potential jobs and gaps in the green jobs sector, it is imperative to pay significant attention to the issues of gender equality. The concepts of gender equality and social inclusion are especially pertinent to the Indian economy. The country's labour market is characterized by gender inequalities as traditional structures assign women and men to roles which in turn create gender differentiated expectations, with implications for equitable, sustainable economic and social development. Training unskilled and semi-skilled women for roles in green building sector not only alleviate shortage of labour but also achieve the overarching goal of sustainable development through poverty alleviation and women's empowerment.

Women's participation in construction is largely limited to roles that are either highly skilled or unskilled. Highly skilled roles in which women's participation is observed are architect, façade designer, interior designer, etc. Unskilled roles include helper and loader on the construction site. It is rare to observe participation in semi-skilled roles that are technical in nature, such as those of plumber, electrician; and skilled roles such as structural engineer, site supervisor, HVAC maintenance technician, etc.

There is a stark wage disparity between men and women workers in the construction sector. There are also challenges related to lack of training in women that leads to stagnation in their professional development. Skill development through numerous women's empowerment initiatives carried out through various organizations usually provide training in traditional roles, such as beautician, sewing, etc., which further perpetuates gender biases. Very few training programmes for women target provision of technical skills. It is possible to benefit women from the developing green economy, especially due to the unprecedented opportunity to educate and train a diverse set of workers, including women in roles that are traditionally dominated by men.

Job Roles across the Value Chain and Women's Participation

The job roles identified across the green value chain include those that include activities and require qualifications that serve make the value chain green. In India, women's participation across the value chain in various roles is limited to skilled and unskilled roles. Women are commonly observed in roles that are either highly skilled, such as, passive architect, environmental engineer, or roles that are in unskilled category, such as loader - unloader on the construction site.

Figure 17 demonstrates the existing and potential job roles for women in India. Existing job roles are the roles where women's participation is commonly observed at present. Potential roles are those that exist across the value chain but where women's participation, at present, is rare or none.

Figure 17: Job roles with women's participation and potential job roles

1. Site selection	2. Planning & design	3. Procurement	4. Construction
Roles with Women's Participation • Architect	**Roles with Women's Participation** • Architect • Green building consultant • Environmental engineer • Health, Safety & Environment (HSE) Steward • Façade designer	**Roles with Women's Participation** • Bamboo grower • Fly ash bricks-entrepreneur • Sales and marketing-certified green products • Seller	**Roles with Women's Participation** • Architect • Environmental engineer • Façade designer • Health, Safety & Environment (HSE) Steward
Other Roles • Structural engineer • Ecological surveyor	**Other Roles** • Façade installer • Energy efficiency analyst • Waste water treatment & recycling technician	**Other Roles** • Alternate material procurement & quality control manager • Lab technician for material testing • CSEB & fly ash machine operator • Chemical applicator for bamboo treatment • Technician for curing-CSEB & fly ash brick • Product grader • Trader	**Other Roles** • HVAC technician • Façade installer • Scaffolder • Wastewater recycling plant technician • Wastewater treatment plant helper • Credit underwriter

5. Interior development	6. Operation & maintenance	7. End-of-Life
Roles with Women's Participation • Architect • Sales & marketing-certified green products • Green building consultant **Other Roles** • Energy efficiency analyst	**Roles with Women's Participation** • Post occupancy-waste recycler • Green building consultant • Safai karamchari • Certifiers **Other Roles** • Facility manager • Utilities operator • Energy auditor • Waste auditor • Water auditor • Indoor air quality auditor • Wastewater recycling plant technician • Wastewater recycling plant helper • Quality controllers • Energy managers	**Roles with Women's Participation** **Other Roles** • C&D waste processor

Table 14: Conventional job roles

Conventional Job Roles	
• Helper mason • Assistant mason • Mason general • Mechanic • Electrician	• Plumber • Façade installer • Assistant construction fitter • Assistant scaffolder • C&D waste collector

In addition to green job roles, there are various conventional job roles (Table 14) that are part of the conventional building value chain but are not green. However, greening of these roles can be done by incorporating skills required in green building. Women's participation in these roles can be encouraged and increased through skilling as well as Recognition of Prior Learning (RPL).

JOB ROLES AND THEIR REQUIREMENTS

Not all the job roles identified across the value chain have clearly outlined qualification and skill requirements. However, various sector skill councils have developed qualification packs (QPs) for defining these requirements for some roles. For the job roles that do not have an existing QP, there is a potential for developing them.

Table 15 identifies some job roles across the green building value chain and the National Skills Qualifications Framework (NSQF) levels as per their QPs developed by various sector skill councils.

Some highly skilled roles mapped across the value chain do not have QPs. However, the responsibilities covered under these roles and their qualification requirements are well-defined. These roles are shown in Table 16.

Table 15: Job roles and their NSQF levels

Job roles	NSQF level
Helper mason	2
Mason general	4
Construction painter & decorator	4
Plumber (general) helper	1
Plumber (general)	3
Assistant electrician	3
Construction electrician - LV	4
Wastewater treatment plant helper	3
Wastewater treatment plant technician	4
Helper façade installer	2
Façade installer	4
Recyclable waste collector & segregator	4
Safai karamchari	2

Table 16: Green job roles without QPs but well-defined responsibility and qualification requirements

- Architect
- Structural engineer
- Green building consultant
- Environmental engineer
- Façade designer
- Energy efficiency analyst
- Credit underwriter

Other job roles mapped against the value chain do not have existing QPs or well-defined job responsibilities or qualification requirements (Table 17). Therefore, there is potential and need for developing QPs to define qualifications and skill requirements for these roles to, subsequently, develop training modules for them. Further, these roles also need to incorporate RPL to recognize the skills already acquired and practiced by workers in these roles.

Table 17: Roles for which QPs can be developed

- Certified green products - sales & marketing
- Alternate material - entrepreneur
- Fly ash bricks - sales and marketing
- CSEB & fly ash machine operator
- Alternate material quality control manager
- HVAC installer
- HVAC technician
- Alternate material expert
- Trader
- C&D waste collector
- C&D waste processor

CHALLENGES

A significant proportion of employment in the construction sector is unregulated/ informal which leads to numerous challenges. Some challenges are inherent to the sector while others impact women more than their male counterparts in the workforce.

a) **Challenges Identified in the Sector**

1. **Seasonal nature of construction activities:** The nature of construction activity is seasonal which is why a significant portion of the unskilled and semi-skilled workforce that is hired is made up of the migrant population. Often workers leave the construction site to work on farms for the rest of the year. Since their employment is temporary, they do not pursue even short-term training since that would take the time away from income generation. Additionally, since the workers on construction sites are hired on a project basis, the contractor or developer sees no value in providing training to them that would be beneficial to workers and contractors over a long period of time.

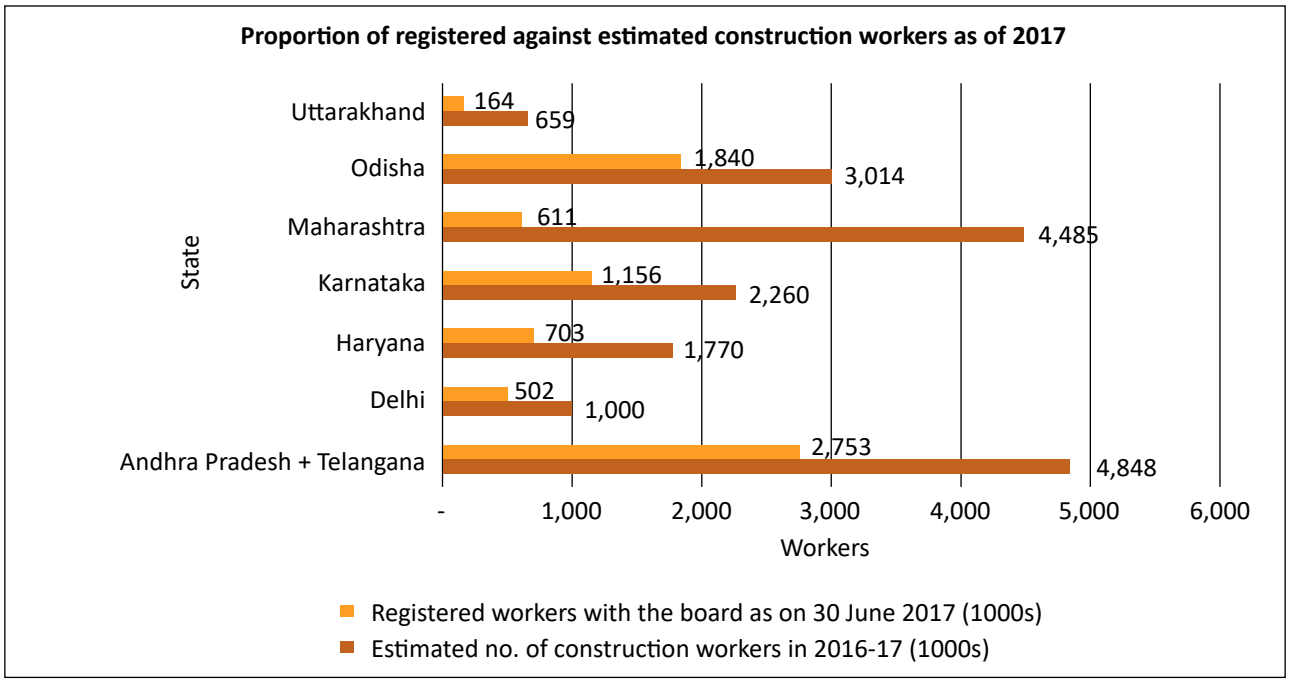
2. Due to the temporary nature of employment of unskilled labour force, the contractors pay little to no attention to the living conditions of workers. It is common for workers to stay in a single-room temporary housing with poor ventilation, and no/limited access to clean water supply and hygienic sanitation facilities.

3. **The sector is highly fragmented and unregulated:** A large proportion of construction workers in India is still unregistered. For instance, in 2011, only 9.8 million construction workers of the total 38 million in the country were registered[46]. As of 30 June 2017, merely 37 percent of the total estimated construction workers in the country was registered with the Construction Workers Federation of India[47]. The percentage of registered construction workers in the states covered in the study is shown in Figure 18[48].

   This makes regulation of wages, among other aspects regarding the well-being of workers, enormously challenging.

4. **Negative perception of the industry:** The common view is that there is little room for career progression for people in semi-skilled and unskilled job roles. This stems from the negative perception of the job that is associated with a lower quality of life and poor career growth, discouraging female participation significantly.

Figure 18: Percentage of registered workers against estimated construction workers



46 NSDC, 2013. Human resource and skill requirements in the building construction and real estate sector.
47 Construction Workers Federation of India. State-wise positions of Number of Workers Registered, Cess Collected and Amount Spent under the Building and other Construction Workers Acts,1996 along with the % of expense. Accessed on 28 March 2020.
48 https://www.cwfigs.org/images/pdf/new/compare%20table%20of%20statewise%20table%20%209-12-17.pdf

Skill gap in formal and informal segments of green construction: According to an ILO study, governments in industrializing countries such as India are establishing policies and frameworks to offer financial incentives to facilitate growth of the green building sector. However, often these initiatives lack a training component. Thus, lack of skills is a major bottleneck that needs to be addressed for the sector to expand[49]. This is further negatively impacted by the challenges faced by women in accessing training where it is available. The women-specific challenges are discussed in detail below. A major reason for skill gaps is the lack of awareness in smaller builders and contractors on codes and standards, energy efficiency guidelines, certification and rating programmes. Such lack of awareness holds back the growth of the sector, thereby limiting the job opportunities it can offer.

b) Women-specific Challenges

1. **Fragmented industry making enforcement of regulations a challenge:** Due to the highly fragmented nature of the industry, its regulation and that of heavy contracting leads to women in unskilled roles receiving much lower wages than their male counterparts. Thus, wage disparity is a growing concern in the informal segment. Because of lower wages women receive, they are discouraged from joining construction work and encouraged to stay at their village homes to look after the family and farming.

2. **Gender stereotype and discrimination:** The employers' perception that women are less capable of carrying out tasks that are physically demanding results in the unwillingness of potential employers in hiring women and investing in their skill development.

3. **Lack of corporate policies:** There are no corporate policies that promote recruitment of women and ensure fair wages for them, especially in the informal sector.

4. Semi-skilled roles such as plumbing and masonry are not perceived as ideal for women as these are male dominated roles. Due to this perception, women's inclination to be trained for these roles is very low. Consequently, women's participation in these roles is rare, and there is a gap between demand and supply of skilled workers in the sector.

5. **Workplace safety:** Developers often do not have grievance redressal mechanisms in place for women who are sexually harassed at construction sites, resulting in women discontinuing work. Moreover, developers that do take initiatives in this direction do not go beyond providing awareness and sensitization training.

6. **Lack of woman-friendly construction equipment:** One of the reasons for the limited participation of women in the green building sector is that construction technology in terms of lifting and safety processes are not woman friendly. For instance, many types of safety equipment and apparel have to be form-fitted to be safe because oversized apparel might catch fire or might get caught in running machinery[50]. It was also concluded through stakeholder consultations that traditional centring plates used during building construction are heavy because they are made of either steel or wood, making it a limiting factor for women who are unable to lift them.

7. **Unhygienic work site:** Since accommodation of the workers at the construction site is temporary, it lacks sanitation facilities, which acts as barriers for women entering the construction workforce.

8. **Negative perception of the industry:** Working on construction sites is often viewed negatively by women's family/community. It is only common for a woman to work as labour at construction sites if she is accompanying her husband or other male member of the family.

9. **Lack of day-care facility:** Construction sites in India do not have day-care facilities that women working as labour on the site are entitled to during their work-shift. In this case, it is considered the women's responsibility to take care of the children while male members of the family work at the site.

49 ILO Research Brief, 2011. Greening of the building sector is held back by skill shortages. Skills-led strategies can drive green building movement forward.
50 https://www.comerconstruction.com/construction-industry/challenges-for-women-in-the-construction-industry/

10. **Gender bias is prominent in supervisory roles:** Women are rarely seen working at construction sites in supervisory roles. One of the major reasons for this is that their presence in supervisory roles is not well received by male labourers. Therefore, employers are often reluctant to hire women in supervisory roles at the site.

11. **First- and last-mile connectivity:** The issue of connectivity plays a significant role for women during skill development as well as employment as it is linked to safety concerns. If skill development centres have last-mile connectivity issues and the trainees are not provided transport assistance, it becomes a significant barrier in skill development of women. Further, the issue persists during employment of women. A significant number of construction activities take place in remote areas and if safe and reliable transportation is not provided, women tend to let go of the employment opportunity. Thus, safe and reliable transportation is key to address participation in both training and employment.

Key impacts of the COVID- 19 crisis on the construction sector[51]

- The COVID-19 crisis is expected to hit the labour-intensive construction sector particularly hard. The industry is largely made up of migrant workers that typically stay at construction sites. However, according to a report published by KPMG, as per CREDAI, 30 percent of the total 8.5 million construction workers working at different construction sites in India were staying away from those sites due to the fear of coronavirus infection.
- The 40-day lockdown period, from 25 March up to 17 May 2020, led to reverse migration with workers leaving cities to go to their hometowns/ villages. The cost of manpower is expected to increase in real estate.
- Numerous construction companies across India support the needs of construction workers during the lockdown period. This is further adding to the stress across construction value chain.
- Since a significant portion of construction workers in unskilled job roles are migrant workers, the effect of the COVID-19 lockdown on these workers has been severe – on their economic as well as their health conditions.
- Another challenge that has emerged during the lockdown period is that the help that the government is sending to construction workers is limited to the ones that are registered with construction welfare boards. This essentially eliminates a staggering number of construction workers that are unregistered and goes to show how the challenges faced by unregistered workers become much worse during the times of crisis like COVID. It also highlights the importance of streamlining the informal labour workforce in the sector.

c) Skill Gaps

The construction sector comprises segments such as buildings, demolition and site preparation, electrical installations, plumbing, finishing, etc., requiring skilled human resources. However, the industry faces a shortage of skilled workers. Therefore, for the green building sector to expand, workers with proper training through skill development and skills enhancement programmes and certification are required[52].

Considering the barriers for women in skill development training, efforts should be made to increase the number of women trainers and provide them with certification. A certain percentage of the intake in training-of-trainers programmes should be earmarked for women in institutes. Institutes exclusively for women trainees and trainers may address the issue and should be promoted by the government[53].

In the green building segment, demand for skilled labour in construction, installation and maintenance as well as disposal and recycling aspects will see higher demand[54]. Additionally, some of the most significant skill gaps are also noted in the areas of energy efficiency and maintenance of HVAC systems, among others.

51 https://assets.kpmg/content/dam/kpmg/in/pdf/2020/05/covid-19-assessment-economic-impact-construction-sector.pdf; The Economic Times, 25 March 2020. COVID-19 outbreak: states asked to transfer funds to construction workers' accounts.
52 https://www.comerconstruction.com/construction-industry/challenges-for-women-in-the-construction-industry/
53 ILO, 2018. Skills for green jobs in India.
54 ILO, Greening of the building sector is held back by skill shortages. Skills-led strategies can drive green building forward.

Upskilling the current workforce is required to address the shortage of labour skilled in new technologies and practices which have rendered previous skill sets redundant[55].

To respond to this demand, currently there are formal apprenticeship systems, training programmes offered by industry associations, in-company training, as well as technical and vocational education and training courses offered. However, participation in this training ecosystem must be improved.

NSDC has highlighted inadequacy of skills found in the workforce engaged in construction sector:

- Of the total workforce in the construction and real estate sector in 2022, 97 percent is likely to have had no training before starting work; and
- Nearly 80 percent of employment in real estate is attributable to minimal skills, which causes substantial wastage of time and materials[56].

According to a RICS report, the number of semi-skilled and unskilled construction labourers in India in 2020 is approximately 95.14 million[57].
The widest skill gaps observed in the sector in Maharashtra are observed in minimally skilled and semi-skilled labourers. Key observations regarding these skill gaps are:

- An inadequate number of local people is willing to work in the sector, making it highly dependent on workers migrating from other states to Maharashtra;
- An inadequate number of people are available due to commonly held poor perception of the sector; and
- Inadequate skill sets are available for bar bending, masonry, shuttering, façade building, carpentry, etc.[58]
  - Addressing skill gaps such as those of supervisors to ensure a safe work environment can influence women's participation significantly because an unsafe work environment acts as a deterrent. Stakeholders have highlighted that women are reluctant to work in roles that require field work because of safety concerns;
  - Enhancing skilling of masons to work with fly ash bricks can result in increased use of fly ash bricks in green buildings; and
  - Skilling painters to use low volatile organic compound paints is necessary as those skills are required in green buildings and not for painters using conventional paints.

Table 17: Existing job roles and skill gaps in construction sector

Existing job roles	Skill requirement	Skill gaps
Supervisor	- Technical skills and knowledge of the particular domain - Ability to show and teach the labourers how to do things in the right manner - Planning skills and ability to anticipate and forecast needs of material, tools, manpower and machinery - Ability to read the drawings - Make the materials schedule - Labour management skills - Productivity-driven attitude and goal-setting approach - Maintain a safe work environment	- Skills to communicate with workers and manage them to ensure maximum productivity are not easily available in supervisors. This results in high demand of skilled supervisors - Lack of formal training in technical skills and technical skills available are not up to the level desired by the industry
Mason, plumber, painter	- Basic knowledge of construction engineering - Knowledge of trade skills such as formwork, masonry, carpentry, painting, plumbing, etc. - Skill to coordinate with unskilled workmen - Ability to work at heights - Ability to comply with safety procedures and quality measures - Loading and unloading	- Lack of knowledge on machine operation due to which there is sub-optimal equipment utilization - Understanding of quality control processes - Ability to manage productivity - Tools maintenance - Compliance with safety procedures[59]

55 ILO, 2018. Skills for green jobs in India.
56 Ibid.
57 RICS, 2011.Real estate and construction professionals in India by 2020.
58 NSDC, District wise skill-gap study for the state of Maharashtra.
59 NSDC, Human resource and skill requirements in the building construction and real estate sector.

Table 18: Potential job roles and their skill requirements

Potential job roles	Skill requirement	Green aspect of the role
HVAC technician	- Inspect, repair, modify and install HVAC equipment including refrigeration and air conditioning equipment - Carry out regular preventive maintenance inspections of air conditioning units - Operate a variety of hand and power tools, test equipment - Maintain equipment in an effective and safe working condition; maintain parts and tool inventory	HVAC systems focus on energy conservation
Wastewater treatment and recycling plant helper	- Maintain the working of wastewater treatment plant - Understanding the recycling mechanism to ensure proper treatment of the water - Ensuring work safety, in terms of operations and practices by personnel at the treatment plant at all times	Wastewater treatment and recycling plant is a significant part of a green building, as it focuses on water conservation
Compost plant technician	- Operating and maintaining heavy, motorized equipment used in earth moving, composting and fuel processing operations - Ensuring safety at all times	Compost plant facilitates reduction in residential waste that needs to be disposed
Recyclable waste collector & segregator	- Collect and identify different types of waste, and segregate it at the source or at the collection centre as per recycling/ reuse/disposal requirement - Knowing physical and chemical properties of different kinds of waste, understanding signs and symbols used for waste segregation	Waste segregation and recycling reduces the waste quantities that need to be disposed. It also ensures that material usage is maximized before it is finally disposed
Chemical applicator for bamboo	- Knowledge of chemicals used is a critical skill - Understanding of processes to ensure safety during storage, use and disposal - Understanding of processes of bamboo treatment	Bamboo used in construction and furniture requires chemical treatment to make it suitable for the respective purposes
C&D waste segregator	- Knowledge of equipment - Knowledge of waste type and ability to sort it - Collaboration with potential buyers of the segregated waste	C&D waste segregation facilitates recycling of waste. This reduces demand on resources that need to be extracted. This also results in reduction in the volumes of waste that needs to be disposed in the landfill
Bamboo grower	- Land preparation for bamboo cultivation - Basic farm management - weeding, irrigation, pest control - Ensuring care of the bamboo and its harvest - Following safety protocols during harvesting and safe transportation of the bamboo	Safe harvest practices are crucial for supplying bamboo where needed in the supply chain of a green building such as scaffolding, furniture
Green product seller	Knowledge of green products and marketing skills to emphasize the environmental advantages of a green product	- In a green product business unit, the seller highlights the importance of green products to customers - In an entrepreneurial unit, a green product seller will serve as the linkage between the maker of products and the market - Women are commonly observed in the roles of sales and marketing

Potential job roles	Skill requirement	Green aspect of the role
Fly ash bricks machine technician	- Know-how about the machine and its maintenance - Conduct regular maintenance to ensure smooth running for extended periods of time	- Operating the fly ash machine safely and carrying the fly ash brick production safely ensures that entrepreneurs have a safe work environment - Following the correct procedure to produce bricks of the grade required in the market ensures financial viability of the entrepreneurial unit
Helper for fly ash brick production	Ability to carry heavy weights, assist with curing of fly ash and move it as necessary	
Fly ash bricks machine operator	- Understand the operation of the machine and operate it safely - Knowledge of the fly ash brick production process to ensure quality of certain grade	

3.

Policy and Regulatory Frameworks

Various interventions have been implemented to provide momentum to the green building industry in India. This chapter reviews interventions including policies as well as training institutes in the states of Haryana, Maharashtra, Karnataka, Telangana and Delhi. Additionally, technological changes taking place in the sector to cater to the needs of upcoming green buildings are also reviewed.

POLICY INTERVENTIONS

There are numerous policy interventions in place across the country as well as some that are implemented by specific states.

National Policies

There are numerous policies and initiatives undertaken at the center level to facilitate the construction of such housing that would result in minimum negative impact on the environment.

Figure 14: Overview of national and state schemes promoting green buildings

Centre

- National Mission on Sustainable Habitat
- PMAY-G and PMAY-U
- Green Skill Development Programme
- MoEF&CC (2011) will give priority consideration to buildings and construction projects that have obtained Green Building rating and have submitted proposals for obtaining environmental clearance for them
- Financial assistance provided by the Small Industries Bank of India (SIDBI)
- MoEF&CC notification (2016) regarding the use of fly ash

Delhi NCR

CII-IGBC & CREDAI signed an MoU to jointly focus on 5 major cities in India; one being Delhi NCR

Karnataka

CII-IGBC & CREDAI signed an MoU to jointly focus on 5 major cities in India; one being Bengaluru

Maharashtra

- Government mandate for renovation of existing buildings and development of all new government to comply with IGBC green building rating system
- CII-IGBC & CREDAI signed an MoU to jointly focus on 5 major cities in India; two such cities being Mumbai and Pune

Telangana

- IGBC signed an MoU with the Telangana government to spread awareness on green buildings among students
- CII-IGBC & CREDAI signed an MoU to jointly focus on 5 major cities in India; one being Hyderabad

Haryana

- Incentives for green buildings rated under various categories by IGBC and GRIHA
- Haryana Skill Development Mission

Table 10: Central schemes and programmes

National Mission on Sustainable Habitat[60]
This is one of the eight missions under the National Action Plan for Climate Change formulated to address climate mitigation. Some core objectives are: - Improvements in energy efficiency in buildings through implementation of energy conservation building codes; and - Improved management of solid and liquid waste.
Pradhan Mantri Awas Yojana Gramin
Pradhan Mantri Awas Yojana – Gramin, earlier called Indira Awas Yojana, is a flagship scheme of Government of India. It has been providing assistance to Below Poverty Line families who are either homeless or having inadequate housing facilities for constructing a safe and durable shelter.[61] The scheme aims to provide housing for all by the year 2022. The target set under the scheme is to build 7 million houses in 2020-21 and 6.5 million houses in 2021-22.[62]
Pradhan Mantri Awas Yojana Urban
The mission was launched on 25th June 2015. It aims to provide housing for all in urban areas by year 2022. provides Central Assistance to the implementing agencies through States/Union Territories (UTs) and Central Nodal Agencies (CNAs) for providing houses to all eligible families/ beneficiaries against the validated demand for houses for about 1.12 cr. One of the key features of the scheme is that it **encourages women to apply for loans and become homeowners. Additionally, developers and builders in charge of building houses under the scheme, are instructed to construct the houses with eco-friendly construction material and technology**.[63] To empower women, the mission has included a mandatory provision for the female head of the family to be the owner or co-owner of the house under this Mission.[64]
MoEF & CC (2011) notification regarding environmental clearance
MoEF&CC will give priority consideration to building and construction proposals for obtaining environmental clearance that have obtained Green Building ratings from LEED, GRIHA, IGBC, etc.[65]
Incentives provided by Small Industries Bank of India (SIDBI)
SIDBI provides financial assistance to Green Buildings certified by Accredited Rating Agencies including GRIHA and IGBC by offering concessional rate of interest.[66]
MoEF & CC 2016 notification on use of fly ash
MoEF&CC notification (2016) is regarding the use of fly ash in construction material by developers within certain radius of the Coal/Lignite based thermal power plant. The notification essentially mandates the currently operating Thermal Power Stations and the ones that became functional after the notification, to achieve a specific percentage of fly ash utilization in construction activities.[67]
Green Skill Development Programme
It is an initiative for skill development in the environment and forest sector to enable India's youth to get employment and/or self-employment. The programme aims to develop green skilled workers with technical knowledge and commitment to sustainable development, which will in turn will facilitate the achievement of the Nationally Determined Contributions and Sustainable Development Goals.[68]
National Policy on Skill Development and Entrepreneurship 2015
The objective of the policy is to accelerate skilling at scale with quality. It also aims to provide an umbrella framework to all skilling activities in the country, to align them to common standards and link the skilling with demand centers.[69]
Smart Cities Mission (Ministry of Urban Development, 2015)
The objective is to promote cities that provide core infrastructure and a decent quality of life to their citizens, a clean and sustainable environment and application of 'Smart' solutions. The focus is on sustainable and inclusive development and the idea is to look at compact areas.

60 National Mission on Sustainable Habitat.
61 Pradhan Mantri Awas Yojana – Gramin
62 Ministry of Rural Development, Target Number of Houses under Pradhan Mantri Awaas Yojana- Gramin (PMAY-G) from 2019-20 to 2021-22.
63 Banking Mantra, Bank of Baroda, 2019. How the Pradhan Mantri Awas Yojana is a futuristic, beneficial scheme?
64 Pradhan Mantri Awas Yojana- Urban.
65 https://www.grihaindia.org/sites/default/files/pdf/Griha-incentives/green-rating.pdf
66 SIDBI, 2014. SIDBI scheme for financing green buildings.
67 Central Electricity Authority, Report on fly ash generation at coal/ lignite based thermal power stations and its utilization in the country for the year 2017-18.
68 MoEF&CC, Green Skill Development Programme.
69 National Policy on Skill Development and Entrepreneurship, 2015.

Energy Conservation Act

- The Energy Conservation Act (EC Act) was enacted in 2001 with the goal of reducing energy intensity of Indian economy.
- Bureau of Energy Efficiency (BEE) was set up as the statutory body on 1st March 2002 at the central level to facilitate the implementation of the EC Act.
- The Act provides regulatory mandate for: standards & labeling of equipment and appliances; energy conservation building codes for commercial buildings; and energy consumption norms for energy intensive industries.

Energy Conservation Building Code (ECBC)

- The Energy conservation building Code (ECBC) is a standard for energy efficiency standards for design and construction for buildings of minimum conditioned area of 1000 Sq. mts and a connected demand of power of 500 KW or 600 KVA.
- To spur energy-saving building construction, the Bureau of Energy Efficiency (BEE) launched the Energy Conservation Building Code (ECBC) in 2007.

Support to Training and Employment Programme for Women

Ministry of Women and Child Development administers STEP scheme as a Central Sector Scheme[70]. The scheme aims to provide skills and competencies that enhance women's employability as well as equip them to become self-employed/entrepreneurs:

- The Scheme aims to benefit women in the age group of 16 years and above pan India.
- The grant under the Scheme is given directly to an institution/ organisation including NGOs, and not the States/ UTs.
- The assistance under this Scheme is available in any sector for imparting skills related to employability and entrepreneurship.

As observed, there are various policies that facilitate or incentivize adoption of energy efficient building and construction activities that utilize fly ash. However, the policy framework supporting other alternative construction material, such as recycled plastic, recycled construction and demolition waste, etc., is non-existent. While these materials can be utilized in green buildings as construction materials, according to construction agencies, such as the Central Public Works Department, Indian laws permit the use of only naturally sourced building material. Indian standards specifications related to aggregates for concrete, laid down by the Bureau of Indian Standards, require that concrete can be made only with naturally accessed materials. Construction agencies often cite this rule as a reason for not being able to use recycled construction and demolition (C&D) waste[71]. Thus, policies supporting the adoption of other green construction material by developers and manufacturers in the construction sector should be formulated or updated to boost the uptake of the numerous green construction materials in commercial as well as residential building sectors. Such measures in the policy landscape can also tap into a significant potential of jobs for women when coupled with women-centric skill development initiatives.

State-level Schemes

In addition to the nationwide schemes/policies, there are state-specific interventions undertaken by institutions in various states to promote and facilitate the expansion of green buildings:

- One such initiative has been undertaken by IGBC in collaboration with CII-CREDAI to advance the green building movement in India. Under this MoU, IGBC and CREDIA will jointly focus on five major cities in India – Bengaluru, Delhi NCR, Hyderabad, Mumbai and Pune – to carry out green building projects and deliver tangible benefits[72]; and
- Another initiative has been undertaken by BEE to launch ECBC. Numerous states have notified ECBC and have incorporated it in their municipal building byelaws. Upon notifying ECBC, all new buildings above a certain contract demand or connected load or built-up area, have to comply with the minimum energy performance requirements. Andhra Pradesh, Haryana, Karnataka, Kerala, Punjab, Rajasthan and Telangana have been top-performing states in this regard[73].

70 Ministry of Women and Child Development. Support to Training and Employment Programme for Women.
71 Centre for Science and Environment, 2014. Construction and demolition waste.
72 https://igbc.in/igbc/html_pdfs/CREDAI%20MoU%20pdf.pdf
73 Alliance for an Energy Efficiency Economy, 2018. State energy efficiency preparedness Index.

Some initiatives implemented by the states selected for this study are described in Table 11.

Table 11: State-level schemes and programmes

Delhi NCR
• The Government of Delhi has mandated that all government buildings implement ECBC. The code outlines best strategies for energy-efficient design and construction[74]. • Tax rebates are offered as incentives to buildings that certified as green[75]. • Additional FAR is offered as incentives to buildings that have features such as rainwater harvesting, water recycling, waste-water treatment and passive/energy efficient design[76].
Haryana
• The Town and Country Planning Department offers additional FAR for green buildings rated under various categories by IGBC and GRIHA. • Haryana Skill Development Mission has a target of skilling 58,051 youth during the FY 2019-20
Maharashtra
• The Urban Development Department offers additional FAR for green buildings rated under various categories by IGBC. • The Public Works Department has mandated that the renovation of existing buildings and development of all new government buildings be carried out as per relevant IGBC green building rating system. • CII, IGBC and CREDAI signed an MoU to jointly focus on five major cities in India; two of which are Pune and Mumbai. • The Government of Maharashtra set a target of skilling 45 million people with employable skills between 2012 and 2022[77]. For this, the Maharashtra State Skill Development Society has been established. The state has also formed the State Management Committee of Skill Development Initiative for Maharashtra and Sectoral Skill Committees. Trades in high demand identified by the Sectoral Skill Development Committees include the construction sector, among others.
Karnataka
• CII, IGBC and CREDAI signed an MoU to jointly focus on five major cities in India, one being Bengaluru. • There are incentives for reduction in electricity tariff by using of renewable energy[78].
Telangana
• IGBC signs an MoU with the Telangana government to spread awareness on green buildings among students. • Green building ratings have not been incentivized in the state. • CII, IGBC and CREDAI signed an MoU to jointly focus on five major cities in India, one being Hyderabad. • The Telangana State ECBC was enacted in 2014 to establish minimum requirements for energy-efficient design and construction of buildings. The code is mandatory and is applicable to newly constructed commercial and non-residential buildings that have a plot area of more than 1,000 sq. m or a built-up area of more than 2,000 sq. m. However, it does not apply to factories, individual homes and multi-family residential buildings[79].

TECHNOLOGICAL INTERVENTIONS

Innovation is the backbone of technologies employed in green buildings. Parallel demand for innovative technologies would require workforce in manufacturing, research, certification and development of green building products, materials and technologies. Consequently, innovation in the following areas is seen as a crucial requirement in green buildings and will accelerate the expansion and development of green buildings.

A significant number of noteworthy technological interventions revolve around energy efficiency and designs that are responsive to solar energy received by the building. Some of these are:

1. **Dynamic façade:** This acts as a filter between indoors and outdoors and benefits users by providing appropriate shade, sunlight and ventilation. There are various types of façades, one of which is made up of thousands of small, sandblasted glass circles, each of which is affixed to a central rod. Sensing and responding to humidity

74 World Green Building Council, 2015. Green building city market brief.
75 The Energy and Resources Institute, 2016. Formulation of policy incentives for promoting green buildings in Tamil Nadu.
76 Ibid.
77 Maharashtra State Skill Development Society, Organisation profile and vision.
78 The Energy and Resources Institute, 2016. Formulation of policy incentives for promoting green buildings in Tamil Nadu.
79 NRDC International- India, 2017. Online compliance system for ECBC for Hyderabad. 2017

and temperature inside the building, these rods pivot automatically to regulate the flow of air through the façade[80].

2. **Cool roofs:** These are designed to reflect more of the sun's rays and prevent the warm or cool air inside from escaping through the top of a building. Lowering the temperature of the roof this way results in lower energy consumption for air-conditioning in the building[81].

3. **Electro-chromic smart glass:** It uses a small amount of electricity to charge ions on a window layer to change the light reflectance. Smart glass provides the ability to choose how much light should be blocked. A 25 percent reduction in heating, ventilation and air conditioning (HVAC) costs is expected through this technology[82].

Apart from these features, technology continues to evolve to improve performance in areas such as water efficiency, insulation and increased use of environment-friendly material, as illustrated in Figure 15.

TRAINING INTERVENTIONS AND INFRASTRUCTURE

There are numerous institutions in India that provide skill development trainings. Through a wide network of 15,042 industrial training institutes, spanning the country, over 2.28 million candidates have been enrolled (in the trades training of one-year and two-year duration) and special focus is laid on enrolment of women, which has resulted in nearly 97 percent increase their admission in 2018. Women trainees in 2018 totalled 173,105 as compared to 87,799 in 2014[83]. In addition to institutions established by various central and state governments, there are also private companies as well as non-governmental organizations (NGOs) that have established training centres focusing on training people in the construction sector. Additionally, NGOs in this area can be potential implementation partners from the construction skills development, capacity building and outreach perspective.

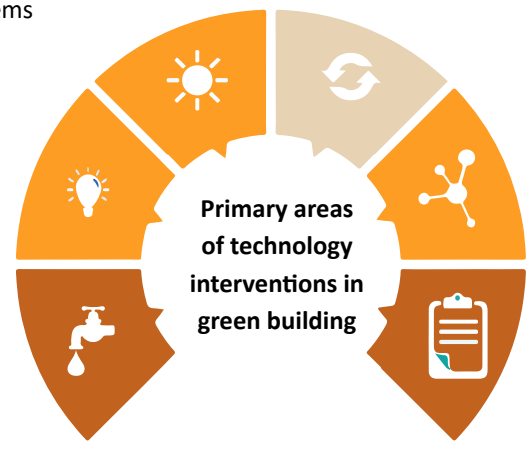
Some training institutions are as listed below; a detailed list of training institutions can be found in **Annexure 2.**

Figure 15: Primary areas of technological innovations in green buildings

Renewable energy
- Building integrated photovoltaic energy systems
- Solar water heaters

Lighting
- LED lighting
- Solar lights
- Lighting controls and automation

Water
- Rainwater harvesting
- Wastewater treatment & reuse
- Water efficient fixtures, such as low flow fixtures



HVAC
- Energy efficient cooling/heating system
- Solar based HVAC system
- High efficiency fans and lights

Materials & products
- Fly ash bricks, CSEBs
- Double glazed windows, certified wood, low volatile organic compound paints, high performance glass, wall and roof insulation

Architecture & planning
- Passive architecture design
- Daylight integration
- Facade glazing

80 World https://gizmodo.com/5-smart-building-skins-that-breathe-farm-energy-and-g-1254091559
81 https://home.howstuffworks.com/home-improvement/construction/green/10-technologies-used-in-green-construction.htm#pt8
82 Ibid.
83 Ministry of Skill Development and Entrepreneurship, 2019. Women get a special focus under Skill India Mission.

1. **National Skill Development Corporation**
   - The National Skill Development Corporation (NSDC), a first-of-its-kind public private partnership in India, was established in 2008 to facilitate the development of the growing Indian workforce through skill training programmes. NSDC aims to promote skill development by facilitating for-profit vocational institutions. It also provides funding to build scalable and profitable vocational training initiatives. A significant part of the organization's efforts is directed at building partnerships with the private sector and towards developing skills in the unorganized sector in India;
   - The objective of the organization is to "contribute significantly to the overall target of skilling up of people in India, mainly by fostering private sector initiatives in skill development programmes and to provide funding"[84];
   - It provides funding for skill development either as loans or equity and supports financial incentives[85];
   - As of July 2019, NSDC established training partnerships with 462 partners, 11,000 training centres and placed 5.06 million people[86]; and
   - NSDC also provides e-skilling programme in vernacular languages as well as in English. Courses include construction courses on masonry, rural toilet construction, assistant mason, helper - bar bender and steel fixer, helper - shuttering carpenter and assistant electrician.

2. **Skill Council for Green Jobs**
   - The organization is a not-for-profit, autonomous and industry-led society launched as an initiative by the Government of India and is aligned to the National Skill Development Mission. Between 2017 and 2025, it aims to train 1,320 trainers and certify 1,000,320 learners[87].

3. **Centum Work Skills India**
   - This is the result of partnership between Centum Learning and NSDC. It aims to enhance the skills of millions of youth across the country to empower them to pursue livelihood opportunities. Construction is one of its core focus areas;
   - Centum partners with government departments and agencies such as the Ministry of Rural Development, NSDC and various other state governments, public sector units and corporates to provide training[88] such as
     - Vocational training
     - Up-skilling programmes
     - Behavioural training; and
   - Centum Learning also implements corporate social responsibility projects through the Centum Foundation for various corporates by providing livelihood skilling to underprivileged youth including people with disabilities. The foundation conducts programmes impacting national issues in the field of skill development, women's welfare and empowerment, and vocational training among others[89].

4. **SEWA Delhi**
   SEWA Delhi links construction workers with the Delhi Building and Other Construction Workers' Welfare Board to register workers, secure social security entitlements and advocacy for legal recognition. It runs several programmes in Delhi to equip girls with appropriate skills to be gainfully employed and to connect them to local college student mentors and professionals.

5. **Sobha Developers (Karnataka)**
   Sobha Developers has established the Sobha Vocational Training Centre through which functional vocational training and paid apprenticeships in carpentry are provided to youth from poor families[90].

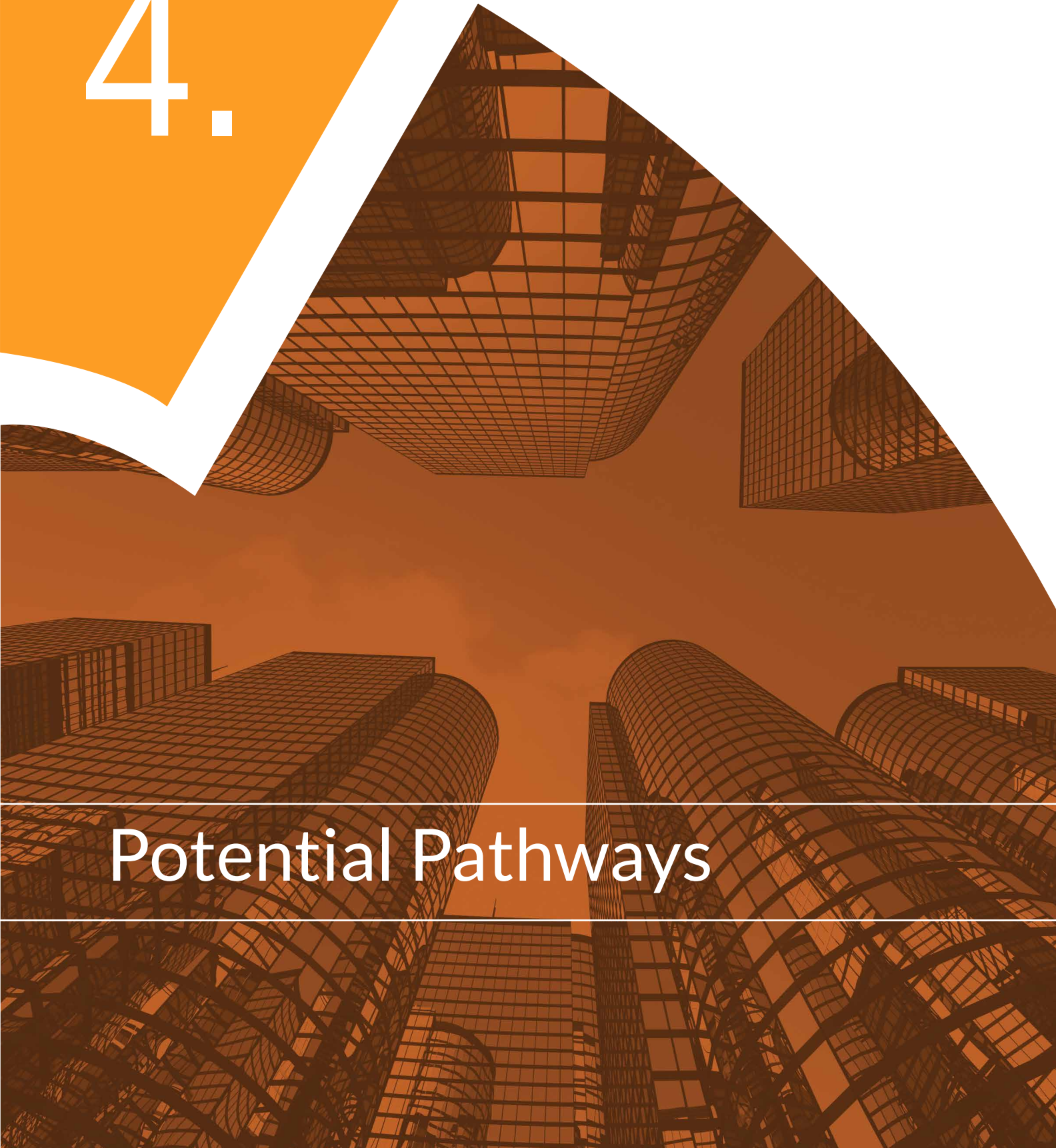
84 NSDC, Vision and mission.
85 Ministry of Skill Development and Entrepreneurship.
86 NSDC.
87 Skill Council for Green Jobs
88 https://www.centumlearning.com/business-areas/vocational-education-and-training/index.php
89 https://www.centumlearning.com/business-areas/corporate-social-responsibility-partnerships/index.php
90 https://www.sobha.com/sustainability-csr.php

Table 12: Training institutions and offered courses

Institutions/organization	Training courses offered	Training centres/trainees
National Skill Development Council	Also provides e-skilling programmes in vernacular languages as well as in English. Courses include construction courses on masonry, rural toilet construction, assistant mason, helper - bar bender and steel fixer, helper - shuttering carpenter, assistant electricia[91]	- 9 centres by training partners in Haryana - 6 centres by training partners in Delhi - 19 centres by training partners in Karnataka - 103 centres by training partners in Maharashtra - 3 centres by training partners in Telangana - 27 centres by training partners in Odisha - 205 centres by training partners in Uttarakhand[92]
Construction Skill Development Council	Carpenter, plumber, mason, fitter	Minimum of 10 and maximum of 30 trainees per trade for each partnership
National Institute for Entrepreneurship & Small Business Development	Development programmes for the artisan from cane & bamboo crafts from the Forest Research Institute	
L&T Construction Skills Training Institute	Bar-bending and steel fixing, masonry, plumbing, electrician, scaffolding	Trained over 50,000 technicians since its inception in 1995[93]
Mahila Housing SEWA Trust	Basic masonry, toilet unit construction and basic plumbing, carpeting, bar bending and electrification	Provided certified training to 11,000 construction workers[94]
Learnet Skills Limited	Fitter - fabrication, helper - mason	Imparted training to 1.6 million individuals pan India
National Academy of Construction	Electrical house wiring, plumbing and sanitation, building carpentry, masonry, bar bending, welding, and painting and decoration	Target: 1,00,000 technicians per annum
Vishwakarma Skill University	Assistant mason, general, assistant bar bender and steel fixer, assistant shuttering carpenter, assistant scaffolder, assistant construction painter and decorator, assistant false ceiling and drywall installer, plumber general, mason tiling and helper electrician	

91 E-skill India. Courses from construction sector.
92 https://nsdcindia.org/about-us
93 L&T. Construction Skill Training Institute
94 Mahila Housing SEWA Trust. Annual report 2015-16.

4.



Potential Pathways

Boosting women's participation across the green building value chain not only addresses industry demand for skilled workforce but also helps achieve an overarching goal of sustainable and equitable development through women's empowerment. Skilling women and mainstreaming them require comprehensive measures that include policy support and localized training programmes, among others.

TARGETING IMPACTS OF COVID-19 THROUGH POLICY INITIATIVES IN THE GREEN BUILDING SECTOR

As the government provides stimulus assistance to counter impacts of COVID-19 on the construction industry, policy imperatives can be put in place to provide a thrust to the green building sector as well. Some of these measures that can be implemented are described below.

Fiscal Stimulus for Construction

Green conditionality: Buildings that receive support from the government as part of the stimulus package may be required to have a 'green conditionality', to set the bar higher for their environmental performance. Such a conditionality can be established using three criteria:

- **Reward performance:** Buildings with higher energy or low-carbon performance goals should be rewarded with higher financial incentives[95];
- **Incentive:** Incentives should be provided for certification of green rating and labelling through a systematic inclusion of energy efficiency and other environmental criteria in public and private procurement documentation; and
- **Accelerate national climate policy:** Short-term economic stimulus programmes in the sector should be aligned to the country's sustainable development policy.

Preferential treatment for green buildings: Preference should be given to green construction projects, for example, through priority processing of building permits. A similar approach has been followed by MoEF&CC for obtaining environmental clearance that have obtained green building rating by LEED, GRIHA, IGBC, etc. Other measures could include:

- **Replacement programmes:** Replacement programmes for equipment and appliances such as energy efficient lighting or household appliances through bulk purchasing or installation programmes that provide financial incentives such as subsidies to suppliers or households; and
- **Green energy generation:** Incentives to households or private investors for incorporating green energy generation and use in their buildings.

PILLARS FOR PROMOTING ECO-ENTREPRENEURSHIP AMONG WOMEN

As efforts are made to ensure that participation of women from marginalized communities grows in the green construction sector in unskilled and semi-skilled job roles, it is crucial to facilitate their development in entrepreneurial roles as well. This twin-pronged approach would not only provide women with sources of income for sustenance but also give them opportunities to develop managerial skills through management of entrepreneurial units.

In India, women constitute 14 percent of the total number of entrepreneurs, of which 75 percent employ five or less people. The top five Indian cities with women entrepreneurs are Bengaluru, Delhi NCR, Mumbai, Hyderabad and Chennai[96].

Government Schemes that Facilitate Eco-entrepreneurship

There are multiple schemes offered by the government that could be leveraged to aid women who are keen to establish entrepreneurial units. Some of these schemes are listed in Table 19.

95 International Institute for Sustainable Development, 2020. COVID-19 stimulus spending green construction means building back better.
96 https://www.startupindia.gov.in/content/sih/en/women_entrepreneurs.html

Table 19: Government schemes to aid women entrepreneurs

1. Prime Minister Employment Generation Programme	The maximum cost of the project/unit that is admissible is: - Manufacturing sector: INR 2.5 million - Business/service sector: INR 1 million[97]
Rate of subsidy based on location of project	- General category 15% (urban), 25% (rural), Special 25% (urban), 35% (rural) - The balance amount of the total project cost would be provided by banks as term loan and working capital
Eligible beneficiary	- Any individual, above 18 years of age, who has passed at least Class 8 - Only new projects considered under the scheme - Self-help groups (including those belonging to below the poverty line households if they have not availed of benefits under any other scheme) - Institutions registered under the Societies Registration Act, 1860; production co-operative societies, and charitable trusts are also eligible
2. Credit Guarantee Trust Fund for Micro & Small Enterprises	Ministry of Micro, Small and Medium Enterprises and SIDBI jointly established a trust named Credit Guarantee Fund Trust for Micro and Small Enterprises to implement a credit guarantee scheme for micro and small enterprises: - The corpus is contributed by the Government of India and SIDBI - 75% of the loan amount to the bank is guaranteed by the trust fund[98]
3. Pradhan Mantri MUDRA Yojana	The scheme provides loans of up to INR 1 million to the non-corporate, non-farm small/micro enterprises[99]. Micro Units Development and Refinance Agency Ltd. (MUDRA) supports development of the micro enterprise sector in India. A MUDRA loan is extended for a variety of purposes which provide income generation and employment creation, including equipment finance for micro units as well as transport vehicle loans[100] This support can be availed of by women entrepreneurs who set up fly ash brick manufacturing units or bamboo furniture-making units for investing in equipment
4. Deendayal Antyodaya Yojana - National Rural Livelihoods Mission	Aided in part through investment support by the World Bank, the Mission was launched by the Ministry of Rural Development, Government of India, in June 2011[100] It creates effective institutional platforms for the rural poor, enabling them to gain an increase in household income through sustainable livelihood enhancements and improved access to financial services The mission believes in mobilizing the capabilities of the poor and equipping them with capacities such as information, knowledge, skills, tools and finance to facilitate their participation in the economy of the country.

RECOMMENDATION FOR IMPROVING WOMEN'S PARTICIPATION IN THE GREEN BUILDING SECTOR

Lack of public awareness was identified as a top challenge to expanding green building efforts by half of Indian respondents in a survey conducted by RICS. There is also relatively low client demand. Together, both of these challenges suggest a greater need for education of developers and consumers in India to create demand for green buildings[101]. There are challenges identified in previous sections that need to be tackled to address the skill gap requirement in semi-skilled and unskilled job category in construction sector as well.

A multi-faceted approach should be followed to increase women's participation in green construction, including:

i. Improving the industry's perception and highlighting opportunities by organizing visits to leading construction organizations in the sector, and focusing on women working in the sector in roles that are considered unsuitable for them;

ii. Involving industry leaders in assessments of market needs and required corresponding skills. This would minimize the gap between industry requirement and skills acquired by women, thereby improving their employability; and

97 Ministry of Micro, Small and Medium Enterprises.
98 Ibid.
99 Pradhan Mantri MUDRA Yojana.
100 Pradhan Mantri MUDRA Yojana, Start-up India.
101 Deendayal Antyodaya Yojana – National Rural Livelihoods Mission.
103 RICS, 2018. Perceptions of value premiums and workplace productivity in green office buildings in India.

iii. Facilitating entrepreneurial opportunities: Entrepreneurship opportunities are a significant source of employment for women in the green construction sector, as they have a strong place in procurement across the value chain. To ensure viability of entrepreneurial undertakings by women, it is crucial that they are:
   - made aware of the seed grant available to them
   - provided financial literacy
   - given training related business development and technical know-how.

1. Informal and temporary employment

i. As informal employment leads to non-standardized wages for women in unskilled job roles, it is crucial that the women are registered to ensure that they receive benefits they are entitled to such as minimum wages, safe work environment, access to crèche facilities. Registration of workers and provision of crèche facilities should be ensured through regular audits; and

ii. The temporary nature of employment of unskilled workers leads to employers being disinterested in providing them skill development training, as the contractors are likely to have a new informal workforce the next season. If training is provided, it is rarely provided to women in unskilled and semi-skilled job roles. This results in no career progress for women in unskilled job roles, despite their working in the sector for years. This issue can be addressed by RPL. RPL can be used to assess the knowledge/ skill levels of workers who may not have gone through formal education or skilling programme. It is particularly relevant for the workers in unskilled job roles in construction, since a majority of them learn on the job and there is no recognition for such informal learning.

   An RPL mechanism should be devised to recognise the learning that workers acquire through on-the-job experience, and not formal training. RPL not only recognizes the prior learnings of construction workers to formalize their employability but also streamlines a large segment of informal workers working in unskilled job roles in the industry. Contractors can play a significant role in implementing this measure as most employment in the Indian construction industry takes place through contractors. In such a scenario, contractors should be incentivized to conduct RPL for women working on the sites, in turn linking it with the company's social performance. Regular audits should be held to assess these measures.

2. Skill development by industry: The private sector should play an active role in providing the skills required by the industry. This would address the issue of information asymmetry between the youth and industry requirements. Thus, businesses that invest in skill development benefit from having more workers with the right skills for respective roles.

   This should be coupled with internships/ apprenticeships as part of the skill training.

3. Decentralized training centres: Based on the concentration of construction activity, decentralized training centres should be developed, whenever feasible. Decentralized training infrastructure can, to a certain degree, address the issue of last mile connectivity and accommodation for women trainees, which often pose as significant barrier.

4. Enhance attractiveness of vocational training programmes: Often vocational programmes are perceived negatively and considered less desirable by the youth, resulting into reduced number of trainees. The programmes should provide trainees with industry exposure and trainers from the industry should also be invited as visiting faculty. Trainees should be made aware of placements of previous trainees. In achieving this, it is crucial that relevant data are collected and made available on different communication channels. The importance of outreach cannot be overstated in creating a better perception of vocational training programmes among potential trainees.

5. Developing women-friendly construction equipment and processes: Considering the challenge that the lack of women-friendly construction equipment and processes pose to women's participation, it is imperative that alternatives are developed for women. There are some companies that are working to provide custom-fitted items designed for safety of women on worksites, including hard hats for smaller heads[104]. Additionally, there are centring plates that are made of recycled plastic and lighter than traditional plates. These plastic centring plates not only benefit the environment by reusing plastic but are relatively easier for women to carry thereby enhancing the potential of women to be engaged on construction sites.

6. Encouraging women eco-entrepreneurs: Women in remote areas away from industrial jobs, who are unskilled or semi-skilled, can be engaged in the workforce by encouraging and educating them

104 https://www.comerconstruction.com/construction-industry/challenges-for-women-in-the-construction-industry/

about eco-entrepreneurship opportunities. Such entrepreneurship units in remote areas not only provide employment to others in the region but also address concerns around last-mile connectivity and safety. Eco-entrepreneurship also results in increased asset ownership and can lead women to financial independence.

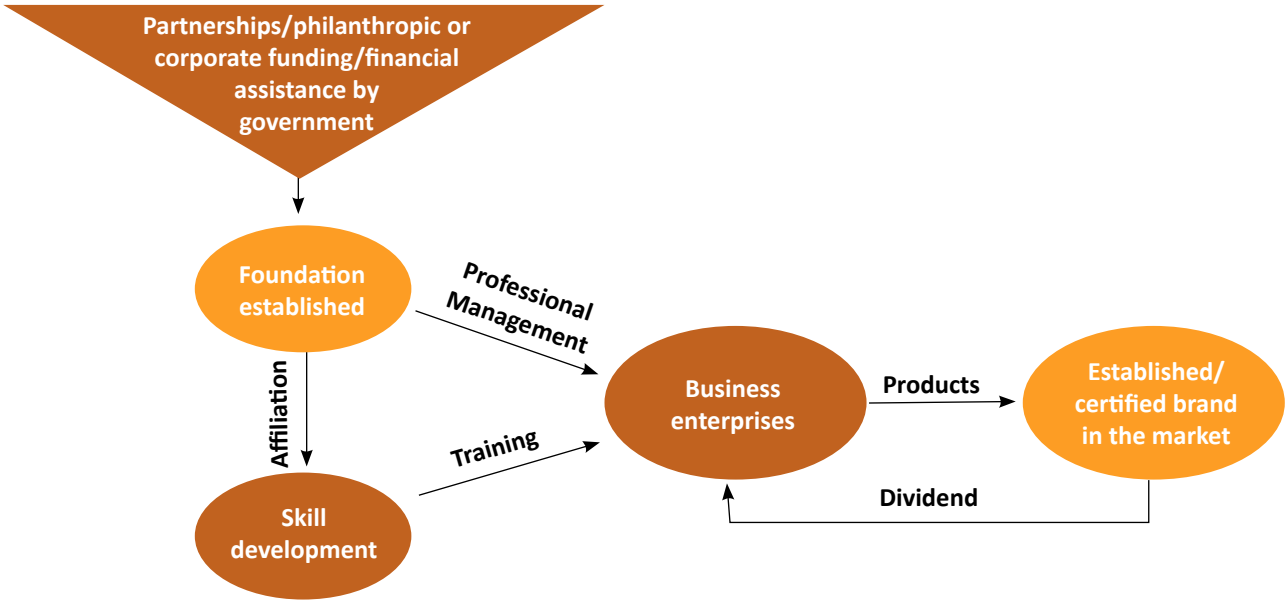
Evidence of Successful Eco-entrepreneurship

Industree Foundation

Industree Foundation was established in 2000 to establish an organized creative manufacturing ecosystem for ownership-based micro-entrepreneurs. The foundation's approach assists communities in identifying and assessing their conventional skill base, helps them organize into production units and develop products that are appealing for modern markets, while creating a consistent demand of sustainable products at the lowest possible costs.

The model adopted by Industree is illustrated in Figure 19[105] showing that the foundation was established with assistance from loan/seed money received from government/philanthropic organization. The foundation affiliates with a skill development institute or establishes its own training centres that provide training to its members who make products that have a niche market with the possibility of expanding in the sustainable business arena. The products are supplied to certified brands in the market through business enterprises

Figure 19: Business model adopted by Industree Foundation



established by the Foundation. The dividend generated through this is reinvested into business enterprises that develop products, thereby helping them sustain the business.

Through this approach, the Foundation has tripled the incomes of artisans it works with. This approach not only integrates artisans in the creative industries sector but also helps them generate income.

Mahila Housing SEWA Trust

*(**Note:** This is a cooperative and not an entrepreneurial undertaking. However, considering its alignment with the objective of the study, a review of the case would add value in terms of developing strategies for enhancing women's participation in green building segment.)*

SEWA is a trade union registered in 1972. It is an organization of poor and self-employed women workers, aimed at protecting the interest of women working in the unorganized sector. Member women are those who earn a living through their own labour or small businesses.

Mahila Housing SEWA Trust (MHT) is SEWA's sister organization working to equip women with skills required in construction. The objective stems from the fact that a significant portion of India's construction workers are women, but they face glaring disparity in terms of compensation, work security (days of work guaranteed) and basic workplace amenities. Women construction workers are predominantly found in unskilled job roles such as loaders/unloaders of bricks and other construction material, cement mixers,

105 https://industree.org.in/about-us/

stone breakers. They are rarely seen in roles such as carpenters, masons, plumbers and electricians. Responding to the sector's demand for skilled labour, workers in skilled roles have seen a rise in their wages but informal manual labour has not. To address this issue, MHT trains primarily women in developing their construction skills through Karmika School of Construction Workers.

Area of training: MHT's Karmika programme trains women in basic masonry, toilet unit construction, basic plumbing as well as carpeting, bar bending and electrification.

Target group: The usual age group of trainees is between 20 to 40-year-old women who possess basic reading and writing skills. Women from minority groups and households where the woman is the sole earning member are especially encouraged.

Training time: Three to six months for each batch to complete the training. The group is tested at the end of the training.

The organization has also built partnerships with private companies in the construction sector to upskill women construction workers on modern machinery. These organizations include Larsen and Toubro and Gujarat Ambuja Cement Limited.

An important aspect of MHT's approach is its reliance on decentralized training centres, which ensures that they are accessible by marginalized populations in rural and remote locations. If such a decentralized approach is also developed for production of alternate construction material, the unskilled and semi-skilled workforce can be trained and leveraged as it addresses the challenge stemming from last-mile connectivity.

Mikki Devi: A Women Entrepreneur in Fly Ash Brick Production in Araria District, Bihar

Mikki Devi had some help while setting up Bhawani Shankar Fly Ash Bricks, her entrepreneurial unit. Land for the unit was provided by the Mukhiya of the village as was other much-needed support. A government credit-linked subsidy, offered to entrepreneurs through the Prime Minister's Employment Generation Programme, was availed of and Development Alternatives provided her with the machines.

Mikki Devi manages the end-to-end process of fly ash bricks, starting with the purchase of raw materials from suppliers and to marketing of the final products. When she first established the unit, her knowledge about standard brick size and brick costing was very limited. She also lacked the skills to assess the profitability of her unit. Thus, despite high demand for fly ash bricks, she was considering closing the unit because she lacked in know-how of marketability. However, this scenario changed after Fly Ash Brick Quality Rating System's interventions, developed by Development Alternatives in collaboration with Shakti Sustainable Energy Foundation. Mikki Devi started using this verification system to know about and ensure that production of standard quality bricks lead to enhance their marketability. Additionally, she also became satisfied with her now profitable business as it crossed the break-even point within six months of the intervention.

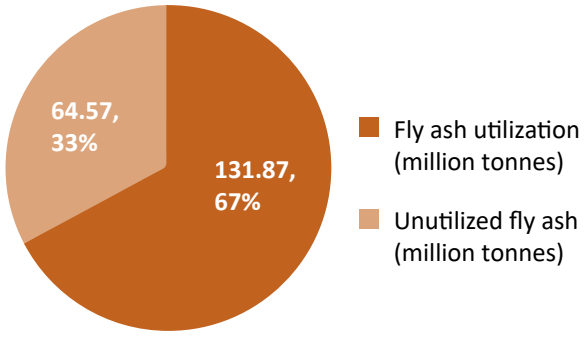
Mikki Devi hires 15-20 people in her unit, of which two or three are women. These women carry out task that are not physically demanding such as curing the bricks. Currently, Mikki Devi's unit manufactures 8,000 bricks per day.

Women can be trained to establish entrepreneurial unit such as that of Mikki Devi's

Fly ash utilization has been mandated by MoEF&CC through a notification on 3 November 2009. It mandates that thermal power stations must achieve 100 percent fly ash utilization and ensure that the fly ash generated by them is utilized in accordance to the requirements of the notification.

Fly ash generated in India during the year 2017-18 had a utilization rate of 67 percent[106].

Figure 20: Fly ash utilization in 2017-18



Gap: The target of 100 percent utilization of fly ash was not achieved in the states of Karnataka, Maharashtra, Odisha and Telangana as of 2017-18. Fly ash utilization in 2017-18 in these states is shown in Table 20.

Table 20: Fly ash utilization in 2017-18

State	Fly ash utilization in % (2017-18)
Karnataka	55.79
Maharashtra	68.05
Odisha	66.33
Telangana	45.26

106 Central Electricity Authority, Report on fly ash generation at coal/ lignite based thermal power stations and its utilization in the country for the year 2017-18.

Addressing the Gap

- Skill development centres to be set up for training women to establish entrepreneurship undertakings for production of fly ash bricks. The model can follow similar models as those established by Industree Foundation and Mikki Devi.
  - The training centres led by women can be developed to train women in fly ash brick production;
  - Various fly ash brick production entrepreneurial units can be organized to establish a foundation that, when assisted with initial funding, can provide skill development to other women in the region and hire them upon completion of the training;
  - Once training is completed, capacity building for financial literacy should be done;
  - An NGO with long-term expertise in supporting women in entrepreneurship should be engaged with the goal of developing a business plan;
  - Once established, the units can supply standardized, graded fly ash to buyers in the market, such as green building architecture firms and developers, or a construction material company that then provides its goods to larger players in the market;
  - The dividend earned should be invested back into the foundation so that the skill development of other women is continued.
- Women who have successfully completed training are employed in green building construction should form self-help groups or community-based organizations so that they can provide support in terms of guidance to women who are new to the area. Further, associations should be formed to support women who work in the sector and need support such as day-care facilities. SEWA implements a model where it provides a day-care facilitates of construction women-workers.
- Financial assistance can be potentially received through the Pradhan Mantri Mudra Yojana, National Rural Livelihoods Mission, and Credit Guarantee Trust Fund for Micro and Small Enterprises.

Akshya Shree: A Bamboo Handicraft Entrepreneur

Founded by Tripura-based Akshya Shree in 2017, Silpakarman is a for-profit social enterprise that works with artisan clusters to fashion a contemporary range of products that includes furniture, home décor products, and others.

Silpakarman works with clusters and artisans in rural parts of India. It uses indigenous fibres such as bamboo to craft a range of products and provides livelihoods to the artisans. The organization has partnered with five artisan community clusters to manufacture a product range from kitchen utility products, wall hangings, lamps to furniture.

First, bamboo is sourced from tribal areas and cut by Silpakarman's cutters. For furniture, the bamboo is treated with chemicals. For home utility and interior décor, organic processes are used. After the treatment is complete, the bamboo is sent to the artisan clusters where it is cut and shaped. The products are then sent to Silpakarman's warehouse in Agartala for edible oil finishing and final quality checks. After this stage they are ready to be sold[107]. The organization is able to generate income for over 250 craftspeople.

Build Up Nepal and Practical Action Partner to Support Entrepreneurs

Build Up Nepal and Practical Action support a growing number of entrepreneurs in Rasuwa and Nuwakot in Nepal to produce earth bricks. The organizations worked with Jan Jagaran Mahila Sangh and Sustainable Social Service to identify local entrepreneurs in earth brick production. Build Up Nepal provides training regarding CSEBs production and construction. The project has successfully helped people in the region to be able to build affordable houses that are earthquake resistant.

Asian Development Bank's Decentralized Rural Infrastructure and Livelihood Project

The Decentralized Rural Infrastructure and Livelihood Project was implemented in Nepal with the help of a loan received from Asian Development Bank. The project is administered by the Department of Local Infrastructure Development and Agricultural Roads. It aims to:

- Conduct road construction and rehabilitation;
- Construct trail bridges;
- Construct small community infrastructure; and
- Provide life skill training, especially to rural women.

107 Read more at: https://yourstory.com/herstory/2019/10/woman-entrepreneur-bamboo-artisans-tripuraAkshay

Women in rural areas of Nepal are particularly affected by the lack of infrastructure, especially in remote areas where it results in limited access for women to market produce, access health and education services or find employment. The situation is exacerbated by the fact that a large number of men migrate to urban centres to find employment and women have to generate income to support the family. In light of these conditions, the training provided to women in construction proved to be invaluable as it provided them with skills, employment and a dignified life. There was no disparity between wages paid to women and men, and the latter welcomed an opportunity to be skilled in order to be gainfully employed.

The project has trained 3,159 persons, of which 1,054 were women. In the village of Dhobi, the project had a target that 40 percent of all workers on the infrastructure initiatives it finances be women, which was exceeded with women making up 43 percent of workers[108].

4.1 SOME SUGGESTED ACTION PLANS FOR CONSIDERATION

This section discusses the implementation roadmap to increase women-owned and -operated eco-entrepreneurship units.

Action plan

Figure 21: Action plan to establish women-run entrepreneurial enterprise

1 Need assessment of alternate construction material

Region specific need assessment of alternate construction material in the states

- Industry consultant
- Raising awareness among women about opportunities the sector has to offer as well as potential financial assistance through government or other institutions
- Potential partnerships for connecting entrepreneurs with companies to provide women's unit market access

2 Identifying entrepreneurs and capacity building

- Potential entrepreneurs to be assessed for relevant required skills
- Collaboration among current institutions for infrastructural and institutional support

Through this network of institutions, indentified candidates should be provided:

- Financial literacy training
- Skilling for operation and maintenance of the equipment
- Skilling for the raw material sourcing, processing and grading
- Training on regulatory aspects of establishing and running a business unit from compliance perspective

3 Funding

- Engaging funding agencies for seed money – governmental and others including multilateral organizations

4 Market access

- Tie ups between women entrepreneurial units and industries in the region with demand for alternate construction material
- A consortium of women entrepreneurs should be formed to create a brand, which provides greater visibility to the green products in the market, enhancing their salability
- Women in this consortium should be trained for job roles in material testing, and marketing and selling

5 Handholding

- Connect women entrepreneurs to a network of support systems in the region
  - Institutions/ cooperatives that provide day-care facility, legal advice, mentoring

6 Monitoring

- Implementing agency to carry out periodic assessment to access the viability of the business
- Seeking industry feedback on the quality and timeliness of supply of material
- Incorporate the feedback in future implemetation of new units to guide

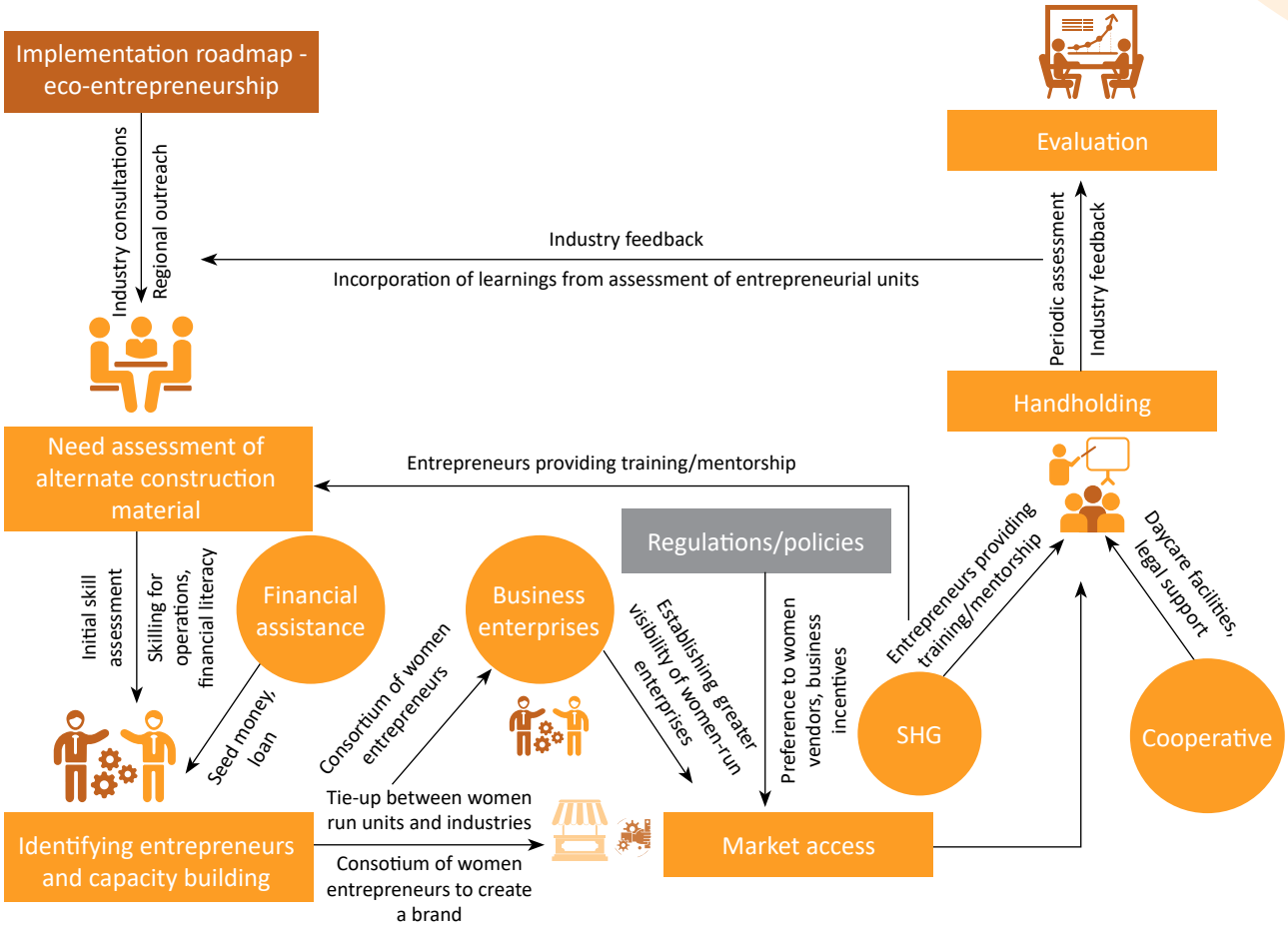
Aligning policy/regulatory landscape

- Government institutions to implement regulation around giving preference to women vendors
- Incentives designed for industries that source a certain percentage of the construction material from women-run entrepreneurial units

108 https://www.adb.org/results/helping-women-and-building-infrastructure-nepal

The implementation roadmap (Figure 21) is discussed below in detail along with the model illustration (Figure 22).

Figure 22: Model to estalish women operated eco-entrepreneurship unit



Need assessment of alternate construction material

The initial phase is focused on region-specific assessment of the need for alternate construction material. Consultation with the industry existing in the region will ensure that endeavours of establishing entrepreneurial units is guided by sound assessment of demand by the industry:

- Industry consultations to identify demand for construction material and its supply in the region;
- Measures to raise awareness about self-employment opportunities would nudge women to break gender norms; and
- Women should be made aware of the potential financial assistance that can be received from the government through schemes such as Pradhan Mantri MUDRA Yojana, Prime Minister Employment Generation Programme, Credit Guarantee Trust Fund for Micro and Small Enterprises, etc.

NEED ASSESSMENT OF ALTERNATE CONSTRUCTION MATERIAL

POTENTIAL PARTNERS

Private: Larsen & Tourbo Limited, Ambuja Cement Limited, DLF Limited

Other: Construction Skill Development Council, Building Material and Technology Promotion Council, Mahila Housing SEWA Trust, Sector Skill Council for Green Jobs

Identifying entrepreneurs and capacity building

Identification of potential entrepreneurs should be based on the assessment of women's initial skill level, financial awareness, entrepreneurial inclination, etc. Collaboration among current institutions for infrastructural and institutional support should be done, which can be leveraged to impart training on:

- Financial literacy;
- Skilling for operation and maintenance of the equipment;
- Skilling for raw material sourcing, processing as well as grading the end-product;
- Training on regulatory aspects of establishing and running a business unit from compliance perspective; and
- Partnerships with training institutes for training and, in turn, also be a trainer.

IDENTIFYING ENTREPRENEURS AND CAPACITY BUILDING

POTENTIAL PARTNERS

Private: L&T Construction Skill Training Institute, Ambuja Cement Limited, DLF Limited, L&T Financial Services

Government: State nodel institutes such as Maharashtra States Skill Development Council, Skill Development, Entrepreneurship and Livelihood Department (Karnataka), Ministry of Women and Child Development, Ministry of Skill Development and Entrepreneurship

Others: Skill Council for Green Jobs, Construction Skill Development Council, Building Material and Technology Promotion Council, The Nudge Foundation, Sehgal Foundation, Development Alternatives, Mahila Housing SEWA Trust, TATA STRIVE, Sobha Developers

Funding

Funding agencies would be engaged at this stage to provide seed money to women entrepreneurs for the acquisition of the necessary equipment to establish the manufacturing/processing unit.

Government funding schemes/organizations for entrepreneurs include:

- Pradhan Mantri MUDRA Yojana;
- Credit Guarantee Trust Fund for Micro & Small Enterprises; and
- SIDBI.

Other potential funding agencies can include industry organizations, foundations, angel funding institutes as well as multilateral/international organizations.[109]

FUNDING

POTENTIAL PARTNERS

Government: Small Industries Development Bank of India, Credit Guarantee Trust Fund for Micro & Small Enterprises, MUDRA Bank

Other: CREDAI CSR Foundation, Sobha Developers, Asian Development Bank, The World Bank - Women Entrepreneurs Finance Initiative (We-fi)

109 Ministry of Micro, Small and Medium enterprises, Pradhan Mantri MUDRA Yojana, Start-up India.

Market access

A sound synthesis of the entrepreneurial unit with construction companies/developers is crucial and begins by establishing market access. Market access can be strengthened if entrepreneurs organize to form a larger unit.

- Tie ups should be sought between women entrepreneurial units and industries in the region with demand for alternate construction material;
- A consortium of women entrepreneurs should be formed to create a brand, which provides greater visibility for their green products in the market, enhancing their saleability;
- Women in this consortium should be trained for job roles in material testing, marketing and selling; and
- Women entrepreneurs should be made aware of digital platforms such as Mahila E-haat[110] that can be used to market and sell their products[111]

MARKET ACCESS

POTENTIAL PARTNERS

Government: State nodel institutes such as Maharashra States Skill Development Council, Entrepreneurship and Livelihood Department (Karnataka), Ministry of Women and Child Development; Mahila E-haat

Private: Construction companies/developers such as L&T, Ambuja Cement Limited, DLF Limited, K Raheja Corp, Biome Environmental Solutions, Industree Foundation, Space Design Consultants

Handholding

Once the enterprise is established, entrepreneurs are likely to need support with respect to day-care facilities, ongoing mentoring as well as legal advice, where applicable. To address this need, they should be connected with the existing network of support systems in the region. Simultaneously, women who are established as successful entrepreneurs should also be organized into a self-help groups that guides new entrepreneurs.[112]

HANDHOLDING

POTENTIAL PARTNERS

Government: Ministry of Women and Child Development - Support to Training and Employment Programme for women (STEP), Working Women Hostel

Other: Mahila Housing SEWA Trust, SEWA, Ministry of Women and Child Development - Rajiv Gandhi National Creche scheme for the Children of Working Mothers, Startup India, Startup Oasis, Women Entrepreneurs for Transformation, Women Entrepreneurs India

Monitoring

Consistent monitoring is critical to identify aspects that facilitate and enhance women's entrepreneurship. Periodic monitoring and evaluation should be carried out to identify factors that persist as challenges and those that facilitate the successful operation of the business unit. Such assessment also guides the upgradation/implementation of upcoming business plans.

- Implementing agency to conduct periodic assessment to assess the viability of the business;
- Seek industry feedback on the quality and timeliness of supply of material; and
- Incorporate the feedback in future implementation of new units to guide.

110 Ministry Mahila E –haat, Ministry of Women and Child Development.
111 K. Raheja Corp.
112 Start-up Oasis, Women Entrepreneurs India.

MONITORING

POTENTIAL PARTNERS

Government: Construction Skill Development Council, Sector Skill Council for Green Jobs, Startup India,

Other: SEWA, Construction companies/developers such as, L&T, Ambuja Cement Limited, DLF Limited, K Raheja Corp, Women Entrepreneurs for Transformation

Aligning regulatory landscape

A supportive regulatory landscape acts as an enabler throughout the implementation of the eco-entrepreneurship roadmap. Policy-level initiatives should be designed to boost the market access of women entrepreneurs and facilitate sourcing of their products in the market through industry tie-ups.

- Policy should be designed to implement regulation around giving preference to women vendors; and
- Incentivizing industries that source a certain percentage of the construction material from women-run entrepreneurial units.

Intended impact

Women's entrepreneurships set up with assistance from the government have impacts in social, economic, environmental and institutional spheres listed in Table 21.

Table 21: Impact of government schemes to aid women entrepreneurs

Social	Economic	Environment	Institutional
• Women's empowerment • Contribution of women in economic activities • Improvement of social status of women through employment • Women's participation further encourages it, which gradually shifts the biases against women to understanding their abilities when provided with support	• Increase in income of women as they gain formal employment • Income from employment can facilitate long-term economic well-being of employed women through acquired training and skills, and formal employment	Engaging women in green building construction has environmental advantages as it replaces environmentally harmful material with the less harmful or environment-friendly material	Stronger institutional support and community network as a result of self-help groups and associations that provide guidance, mentoring and day-care facilities to women working in the sector

Potential stakeholders in different states

The following is a list of potential stakeholders to partner and collaborate with in each state:

Delhi

- SEWA Delhi
- Building Material and Technology Promotion Council
- Space Design Consultants

Haryana

- Sehgal Foundation
- Shri Vishwakarma Skill University
- DLF Limited
- Haryana Skill Development Mission

Maharashtra

- Maharashtra State Skill Development Society
- L&T Construction Skills Training Institute
- TATA SRIVE Skill Development Centre
- Learnet Skills Limited
- K. Raheja Corp.

Karnataka
- Skill Development, Entrepreneurship and Livelihood Department
- Sobha Developers
- The Nudge Foundation
- Skill for Progress
- Biome Environmental Solutions

Telangana
- Nirmaan Organization
- National Academy of Construction
- WE Hub[113]

Uttarakhand
- Uttarakhand Skill Development Mission
- VKJ Projects Pvt Ltd[114]
- Alaya Design Studio[115]

In addition to state-specific partners, there are also other potential partners that could provide support in the form of training or funding.

Training
- National Skill Development Council
- Sector Skill Council for Green Jobs
- India Green Building Council
- Construction Skill Development Council
- National Institute for Entrepreneurship and Small Business Development
- Building Material &and Technology Promotion Council
- Startup India
- Development Alternatives
- Mahila Housing SEWA Trust
- Federation of Indian Women Entrepreneurs
- Centum Learning Limited

Funding
- Asian Development Bank
- SIDBI
- The World Bank - Women Entrepreneurs Finance Initiative[116]
- Prime Minister Employment Generation Programme

Schemes to facilitate women's entrepreneurial undertaking
- Pradhan Mantri MUDRA Yojana
- Credit Guarantee Trust Fund for Micro and Small Enterprises
- Support to Training and Employment Programme for Women, Ministry of Women and Child Development

113 WE Hub.
114 VKJ Projects Pvt Ltd.
115 Promoting sustainable products in Uttarakhand.
116 Women Entrepreneurs Finance Initiative, the World Bank.

5.

Annexures

ANNEXURE – 1 TRAINING INSTITUTES

- **Construction Industry Development Council:** The council has been set up jointly by the Planning Commission, Government of India, and the Indian construction industry. It undertakes activities including training at various levels, organizing workshops, welfare programmes for construction workers, grading and placement. It provides numerous training programmes on semi-skilled job roles in the construction sector, including carpenter, plumber, mason, fitter, and so on[117].

- **Building Material and Technology Promotion Council:** The council organizes structured training programmes on various themes including sustainable construction and green construction practices, use of bamboo in building and housing construction. In the past, it has organized training programmes for masons, plumbers, artisans; conducted skill development training on manufacturing process of fly ash bricks; and entrepreneurship development programmes for low-cost housing technologies[118].

- **National Institute for Entrepreneurship and Small Business Development[119]:** The institute is a premier organization of the Ministry of Skill Development and Entrepreneurship, engaged in training, research, etc., to promote entrepreneurship and skill development. Major activities that it carries out include training of trainers and entrepreneurship-cum-skill development programmes, among others. As of March 2018, the institution has trained 11,46,209 persons through 44,035 different training programmes since inception.

  It also provides e-learning modules of entrepreneurship development programme. The modules educate candidate about central government schemes and subsidies for setting up an enterprise and how the services can be availed.

  The programme is designed for school students with 10+2 education, and undergraduate and post-graduate students. Trainees are assessed post completion of the training and are certified at the end of it. The completion certificate allows the trainees to avail of benefits of the Prime Minister Employment Generation Programme.

- **Jan Shikshan Sansthan:** The institution's aim is to provide vocational training to non-literate and school dropouts in rural areas by identifying skills that have a relevant market in those regions. It provides essential skill training, thereby uplifting the rural population and creating new opportunities for them in the region.

- **Shri Vishwakarma Skill University, Haryana:** One of the goals of the university is to equip its students with skills to enable them to become job ready and pursue their career aspirations through various career opportunities. The institution also partners with industry players to assess their current and future needs.

- **Skill Development, Entrepreneurship and Livelihood Department, Karnataka:** The Government of Karnataka has set up the department to help the youth acquire skills and expertise to enhance their employability. The aim of the department is to regulate, standardize, promote, implement and monitor all skill development initiatives in the state[120].

- **Maharashtra State Skill Development Society:** The Skill Development and Entrepreneurship Department of Maharashtra has established the Society to boost skilling of the youth as well as support entrepreneurship initiatives in Maharashtra. It is the single nodal agency for planning, coordination, execution and monitoring of skill development initiatives in the state[121].

- **Federation of Indian Women Entrepreneurs:** This is a national organization, founded in 1993, and committed to entrepreneurship development in the country. The federation provides a networking platform for women, technical know-how, skill development and training. It serves as a platform for businesswomen where their opinions, ideas and visions are collectively and effectively taken up with policy makers and various other agencies for the development of women entrepreneurs[122].

Private sector

In addition to institutions established by central and state governments, there are also private companies that have established training centres focusing on training people in the construction sector.

117 Construction Industry Development Council.
118 Capacity Building Programmes, Building Materials & Technology Promotion Council.
119 National Institute for Entrepreneurship and Small Business Development.
120 Department of Skill Development and Entrepreneur and Livelihood.
121 Maharashtra State Skill Development Society.
122 Federation of Indian Women Entrepreneurs.

1. **L&T Construction Skills Training Institute:** L&T established a Construction Skills Training Institute in late 1995 in Chennai to promote construction vocational training in India. The institute has been developing a skilled workforce through structured training that enables both new entrants and less experienced workers in the industry, to improve their knowledge and competencies in the respective trades[123].

   Jobs for which training programmes are provided include bar-bending and steel fixing, masonry, plumbing, electrician, scaffolding, to name a few. The training targets candidates that are between the ages of 18 and 35. Training for certain roles is also provided to candidates who have not cleared Class 5[124].

   Depending on the trade, the duration of training varies from 200 hours spread over one month to 600 hours spread over three months. The mode of training is such that 80 percent of it is practical training and 20 percent is classroom training[125].

   Trade competency tests at all levels are conducted periodically to determine the knowledge and skill standards attained by the trainees. Technicians who successfully complete the training under the continuous assessment programme are awarded the respective trade certification[126].

2. **DLF Foundation:** DLF Life Skill Training Centres provide training in various trades including plumbing, welding, electrician[127]. The foundation has established DLF Life Skill Programme centres across India, including cities such as Noida, Gurugram, Nashik, Bengaluru and Hyderabad[128].

3. **Tata STRIVE Skill Development Centre, Maharashtra:** Tata STRIVE is the skill development initiative of the Tata Community Initiatives Trust, to address the pressing need for skilling India's youth for employment and entrepreneurship. It targets people from financially challenged backgrounds and familiarizes them with the evolving work environment. The core philosophy of the initiative is to create courses that build a trained workforce across the entire industrial spectrum as well as develop entrepreneurial talent in India[129].

   Courses for job roles such as assistant electrician (aligned to Construction Skill Development Council of India standards for the role of assistant electrician) are offered in Mumbai, Nashik, Pune and Hyderabad. There are also extension centres across Delhi, Bengaluru, Pune, Thane and Virar, among other cities.

Some non-profit organizations that provide skill development training in the construction sector in the states covered in the study, are:

State-specific organizations

1. **Haryana**
   - **Sehgal Foundation:** The foundation works with rural communities to create sustainable programmes for managing water resources, increasing agricultural productivity, and strengthening rural governance. Grassroots programmes target three of rural India's most pressing issues: water security, food security, and social justice[130]. Emphasis on gender equality and women's empowerment is driven by the realization that human rights are central to developing every person's potential. Due to this fundamental focus on gender equality and empowerment, the foundation can be a potential partner in implementing initiatives for skill development for women in the construction sector.

     Moreover, the foundation has a vast network active in rural parts of Haryana, Karnataka, Maharashtra and Telangana, which can be leveraged to train women in construction skills development[131].

2. **Maharashtra**
   - **Learnet Skills Limited:** Learnet Skills Limited is a joint venture between School net India Limited (School net), formerly IL&FS Education and Technology Services Limited and NSDC. It was set up in 2011 to address the increasing demand of trained manpower for jobs created in various sectors. As a result of this, the primary focus of the organization is to make students work ready.

123 Construction Skills Training Institute.
124 Ibid.
125 Ibid.
126 Ibid.
127 DLF Foundation.
128 Ibid.
129 STRIVE.
130 Sehgal Foundation.
131 Ibid.

Training for courses such as fitter- fabrication, helper- mason and plumber is provided[132].

3. **Karnataka**
   - **The Nudge Foundation:** The foundation has a centre for skill development and entrepreneurship to enable robust skills development mechanisms at scale. The programme aims to deliver India's most effective and cost-effective skill development programmes. It offers fully residential programmes and ensures 100 percent placement of the trainees. More than 3,500 trainees join the programme every year and successful completion is conducted with support from more than 20 corporate partners and over 50 employers[133]. The foundation has partnered with organizations such as Rockefeller Foundation, NSDC, UNDP, NITI Aayog and KPMG, to name a few. The foundation is active in Bengaluru, Delhi and Jharkhand.

   - **Skill for Progress:** Skills for Progress was established 50 years ago. The organization was founded based on the need for skill training for the development of young students and dropped-out students from underprivileged and tribal communities. So far, the organization has imparted training to 3.8 million people.[134]

     It has partnered with numerous organizations to implement its skill development programmes such as NASSCOM Foundation, Habitat for Humanity India, NSDC, L&T, TATA Motors Kaushalya, FICCI, etc. The organization is active in Maharashtra, Telangana and Odisha, among others states across India.

4. **Telangana**
   - **Nirmaan Organization:** Nirmaan Organization was established in 2007. One of its focus areas is skill development and entrepreneurship. It has a presence in eight Indian states: Telangana, Karnataka, Maharashtra, Andhra Pradesh, Goa, Chhattisgarh, Rajasthan and Kerala[135]. It has partnered with over 35 corporate, government and philanthropic organizations. Through its flagship programmes, the organization has trained more than 1,500 women and over 150 women have successfully pursued micro level entrepreneurship opportunities.

     Although the organization does not focus on skill development in the green construction sector, the network of experts in the organization and the access the organization has to target populations in various states can be leveraged to make constructions skills training accessible to women in those geographic regions.

   - **National Academy of Construction:** The academy was established in 1998. Today there are 110 centres throughout Telangana and Andhra Pradesh and provides training in 21 trades. The academy targets training 1,00,000 technicians per annum.[136]

     Various courses are offered by the academy including, but not limited to, electrical house wiring, plumbing and sanitation, building carpentry, masonry, bar bending, welding, and painting and decoration. People who have cleared Class 8 or, in some cases, Class 5, are eligible for enrolling in the training programmes[137].

132 Learnet Skills for Life.
133 The Nudge Foundation.
134 Skills for Progress.
135 Nirmaan Organization.
136 National Academy of Construction.
137 National Academy of Construction.

ANNEXURE – 2 STAKEHOLDER INTERACTION

Peer Reviewers to the sectoral studies

Sectoral Chapters	Peer Reviewer
Renewable Energy	Dr. Srinivas Shroff Nagesha Rao, *Chief Executive Officer, REC Foundation*
Green Construction	Suneel Padale, *Director Programs, CARE India*
Green Transport	Hitesh Vaidya, *Director, NIUA*
Water Management	Moho Chaturvedi, *Consultant Water Resources and Environment*
Carbon Sinks- Forests	Vishaish Uppal, *WWF India*
Carbon Sinks- Marine Fisheries	Ramya Rajagopalan, *Independent Researcher*

Sr. No.	Name	Expert/organization	Designation	Status of interaction
Green construction				
1.	Mr. Vasudev Suresh	Indian Green Building Council	Chairman	Complete
2.	Ms. Aakriti Sachdeva	GRIHA	Project Officer	Complete
3.	Ms. Alankrita Soni	Individual expert		Complete
4.	Ms. Vandana Bhatnagar	National Skill Development Corporation	Chief Programme Officer	Complete
5.	Ms. Salonie Muralidhara	Self Employed Women's Association	Senior Associate	Complete
6.	Mr. Aditya Galotkar	L&T Financial Services	Senior Manager, Group CSR & Sustainability	Complete

Disclaimer:

Due to COVID 19 pandemic and the travel restrictions, the report is purely based on secondary sources and information obtained by KPMG from organisations, experts and through stakeholder interactions. This report sets forth information based on the completeness and accuracy of the facts stated and any assumptions. The comments in the report are not intended, nor should they be interpreted to be legal advice or opinion.

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