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Brick Nationalism: Silver Bricks or Sun Dried Ones?

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While this building material supports a shiny political campaign in the form of a silver brick laid at Ayodhya, the on-ground situation of brick kilns in India remains grim, with the exploitation of both labour and the environment. To change this scenario, an array of solutions for brickmaking, including compressed stabilised earth blocks, need to be made mainstream. The decentralised, skill-based technologies in brickmaking are the answer to mitigate environmental deterioration and enhance skill development.

The Make in India programme was launched in 2014 with the aim of encouraging indigenous, local manufacturing. The indigenous brick that has been elevated through recent political symbolism from a humble building material to a national symbol in India needs special attention in this regard. Brickmaking contributes to 0.7% of India's gross domestic product (GDP) and employs the nation's largest workforce after agriculture (BEE et al 2019). While the Prime Minister of India has laid a symbolic 40-kilogram (kg) silver brick at Ayodhya recently, this seemingly simple building material comes with heavy social

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and environmental concerns. The brick has been a significant political symbol; in the 1980s, thousands of bricks from different regions of India were collected for building the temple in Ayodhya (Husain 2020). The contribution of bricks made the common people believe that they were a part of the right-wing narrative of nation-building.

As the brick gains political meaning, instead of admiring the silver brick at Ayodhya, we must instead turn our attention towards its making. The process of making bricks is adversely affecting the environment and the lives of millions of workers who toil in inhuman conditions at brick kilns (Jitendra 2015). There is extreme abuse of material and human resources. Even though the Indian Constitution, through the directive principles (Articles 39[b] and [c]) asks for national policies to control the material resources of the community so that they are distributed as best to facilitate common good, this is not done. The directive principles also emphasise that the operation of the economy should not be detrimental to common resources and interests. In the case of the brick industry, "earth" needs to be seen as a natural resource, to bring about a change in the way we build. The question to be asked is whether we really need these brick kilns and if there could be an alternate way to make our buildings. The policy around the production systems of the brick industry should address the ecological issues and focus on improving the plight of labourers at these sites.

Figure 1: A brick kiln in South India. Image Courtesy: Author

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Ecological Exploitation

The pandemic is a stark reminder that human interference has meddled with ecology, and the global networks that we are so proud of are, after all, not great (University of Exeter 2020). The construction industry exploits natural resources, whether it is fuel, land or minerals. The abuse of natural resources results in the extinction of species and the emergence of new ones, including viruses such as the one we are seeing today. To contain these imbalances, decentralised, smaller and regional production systems instead of global chains are necessary. Another important aspect, especially in the construction industry, is to look at alternate construction materials to be brought into mainstream use.

While there are ways to use material from within the site or use waste to reduce the ecological footprint of construction material, our construction practices have not encouraged it so far.

The Replacement of Fired Bricks to CSEB

"April World Economic Outlook projects global growth in 2020 to fall to -3 percent and the cumulative loss to global GDP over 2020 and 2021 from the pandemic crisis could be around 9 trillion dollars, greater than the economies of Japan and Germany, combined" (Gopinath 2020). Development and profits have been built with environmental costs and the aftermath of the pandemic is sure to have heavy costs on the environment.

Compressed stabilised earth blocks (CSEBs) or adobe are unfired, do not emit any pollution, and can be made with earth available on most sites, free of cost. The use of earth from within the site has a much lesser ecological footprint than getting fired bricks from kilns. CSEBs could be produced only in as much quantity as the construction may require. These solutions need to be contextual, local and sustain the ecological relationships. Fly ash is a by-product of coal that is burnt at the thermal power plants, but the dictum of the Indian government in February 2020 to use 25% of fly ash in all bricks has not been implemented, with the reason that there is unavailability of an adequate supply of fly ash (*Times of India* 2020). Another excuse for the inability to use fly ash in bricks is that kilns are not located near the thermal plants. With increased displacement of material, there is not just an increase in the cost of transportation, but also the embodied energy of the construction process. Embodied energy is the total energy required in the processing of the material, including its displacement. The use of CSEBs may be a feasible option, as compared to fly ash bricks. CSEBs are stabilised with 5% to 7% of cement and the earth is compressed with machines and dried naturally with sunlight (these are therefore also known as sun-dried bricks). The biggest benefit of sun-dried bricks is that they are labour-intensive. Also, these bricks are not fired in traditional kilns that use fuel. Using sun-dried bricks would mean less pollution, using bricks with much lower embodied energy, while providing employment to a large number of people. For a populous country, providing work to and building skills of the population should be one of the primary goals. The answer may not be in one solution but in

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having an array of decentralised, regionally effective solutions that ensure enhancing the skill of the local workforce too.

Carbon Emissions

While the world is finding ways to mitigate environmental deterioration, it is important to look at energy audits and carbon dioxide emission comparisons for the CSEB and the conventional fired earth brick. A CSEB (brick) creates 22 kg CO2/tonne compared to 200 kg CO2/tonne generated by common fired clay bricks (Walker 1995). This means, on an average, CSEB emits just 10% carbon dioxide and consumes less than 10% of the input energy compared to similar fired clay and concrete masonry units. These comparisons are stark and undeniable. The conventional fired earth bricks have much higher embodied energy than the CSEB or unstabilised earth blocks such as adobe blocks. Most bricks used in the construction industry are fired earth bricks. These are made by mixing clay and then fired in kilns. Around 250 million units of these are produced in India each year (Maithel 2013). On the other hand, CSEBs are made with soil, sand, and a stabiliser. The stabiliser is used in a very small quantity and could be in the form of cement, which constitutes only about 5% of the total mix. These bricks are compressed and cured over 28 days, unlike the conventional bricks that need to be fired. CSEBs are stronger than the average kiln-fired brick and have a higher dry compressive strength (9.2 megapascals [MPa]) in comparison to many other options such as fired bricks (5.6 Mpa) or the aerated concrete block (2.8 Mpa) (Auroville Earth Institute nd). On average, the Indian kiln-fired or the wire-cut brick consumes 3.6 times more energy, primarily because of its firing in a kiln (Jagadish et al 2017). The wire-cut bricks are a type of kiln-fired bricks that are cut to precision to provide a particular finish and are left unplastered. These surfaces have become a style statement in projects, which are often marketed and sold as environmentally friendly at a premier price by builders and designers. However, as pointed out earlier, these surfaces have much higher embodied energy.

Apart from this, the operation of Indian brick kilns is detrimental to the environment because of the emission of gases and the fuel types used. While the ecological benefits of CSEBs outweigh the conventional fired brick, it is a chance for altering the dire, exploitative labour conditions at these brick kilns. In CSEB making, 40% of the cost is for labour, 30% towards equipment and 30% towards raw material. The investment of labour is higher in the production of CSEBs and the workers are upgraded with specialised skill and livelihood (Auroville Earth Institute nd). The other variations to earth bricks are in the form of adobe bricks using stabilisation with natural materials such as straw.

Local Technologies

There have been years of institutional and financial investment in research on local, environmentally better solutions for building material, but India has not really used this research and investment to change its production systems for the better. One noteworthy

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example, however, is that of Bengaluru. In the 1970s, the Indian Institute of Science, located in Bengaluru, started a centre called ASTRA, a cell for Application of Science and Technology to Rural Areas, now known as the Centre for Sustainable Technologies (CST). ASTRA primarily dealt with energy, building and environment. It provided research and experiments in earth bricks and in subsequent decades Bengaluru architects manifested this important research into built structures. Bengaluru scores over other Indian cities in the number of structures built using CSEBs (Govind 2015). This indicates how the city has taken to scientific research around earth bricks and started to visibly change the urbanscape through its built environment. Though there is still a long way to go, it has potential.

Figure 2: One of the thousands of houses using CSEBs in Bengaluru, under construction in 2019. Image Courtesy: Deepak Godhi (www.thelivingstudio.in)

Machine, People and Skill

Scientific advancements and ecological solutions are always questioned with respect to scalability or the possibility of production in large numbers, and the case of CSEB or other alternative earth bricks is no different. The policy decisions should not be to shift completely to new technology and scale that up massively, but instead to encourage a range of solutions. When an array of technologies are introduced in the mainstream, such as the CSEB, adobe, fly ash bricks, etc, apart from the fired brick, the market is distributed among these production systems and products, leading to a better choice and gradual shift. As Kaup Jagadish, who was associated with ASTRA and Indian Institute of Science for many decades, notes,

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> "A combination of mechanisation and human labour, as in the case of handlooms in India is needed, where the yarn is mechanically produced but the weaving of the cloth is done manually. Mechanisation and manual processes are used in an efficient combination to balance employment and energy consumption. Similarly in the construction industry, some amount of mechanisation is inevitable but it has to be wisely used to balance environmental concerns and material demand." (Joseph 2018)

Mechanisation or automation, like everything else, has benefits in the right context. In the context of India, the overall mechanisation needs to be looked at keeping the population, youth and diversity in mind. Only when labour is not treated as merely an economic commodity and the skills of the worker are enhanced, the perils of an exploited workforce in a brick kiln will disappear. The mechanisation of construction industries should be in tune with the enhancement of the skill development of the workers. When the skills of the labourer are at sync with the technological advancement, could there be an equitable work environment?

There have been concentrated efforts to make indigenous, regionally specific press machines for CSEBs. The research from ASTRA mentioned earlier led to the development of one such soil block press called the "MARDINI," developed by M R Yogananda and his team in Bengaluru. This manually operated press machine produces enough force to make a dense CSEB in various sizes and shapes. It uses manual skill and force and does not require the energy from electricity, diesel or any other fuel. Such low-cost machines that use skilled person-power and non-conventional energy can produce an array of building blocks in diverse conditions.

Alternate solutions now need to be mainstream, and to do this, earth bricks in all its variations will play a vital role. What may be more patriotic than laying a silver brick in Ayodhya would be to enable an environmentally sustainable nation.

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