Socio-Political Dimensions of Introducing Novel Green Cement For Slum Development In Mumbai, India

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Abstract:

Novel technologies can have great potential to benefit those at the bottom of the socioeconomic pyramid, but actualizing them is often a significant and confusing challenge. Exemplifying this, herein the socio-political prospects for introducing a novel cement with significant ecological and economic benefits will be discussed. Dimensions include pervasive socio-political challenges, regulation, conflicts of interest, and imbalances of power. Possible interventions are described, and in this case, an open-source approach favored.

In Mumbai, India, 3,000 slum pockets, often characterized by overcrowding and poverty, occupy 16\% of land area and are home to over 50\% the city’s population of 12 million (SPARC 2004). The UN’s Agenda 21 for Sustainable Construction in Developing Countries identifies the cost,
quality, and accessibility of building materials as part of the problem (Shah 2001; UNEP 2002). Further, a goal of the Indian Draft National Slum Policy is to “…enable households to have access to better technology and materials at cheaper prices (Ministry of Urban Affairs and Employment 2001).” In particular, cement and its products (concrete, blocks, etc.) are central to both housing and infrastructure (e.g. water, roads, sanitation) and cement alone accounts for up to 10% of the cost of slum improvement projects. Amongst alternatives like masonry and wood construction, mass concrete (monolithic, poured on site) is the material of choice for slum development in India, as it is typically the quickest, most trusted, most familiar, and requires the least skilled labor (Achrekar et al. 2010). Despite these advantages, cement is often cost prohibitive to low-income individuals, and its global manufacture produces 5% of anthropogenic CO$_2$ and requires substantial energy.

In response to the need for more sustainable building materials for slum improvement, a range of alkali-activated cements (AACs) was designed and developed over 6 months at the Indian Institute of Technology (IIT), Bombay. In contrast to typical product development, social justice was the primary goal, so specifications were driven primarily by the potential benefits to slum dwellers. Consistent with other AACs (Pacheco-Torgal et al. 2008; Phair 2006), and amongst other advantages, they compete in performance with OPC, and reduce cost by up to 44% and CO$_2$ and energy production by up to 92%. They comprise ground granulated blast furnace slag (GGBFS) from the iron industry, coal fly ash from power production, the common alkali chemical Na$_2$CO$_3$, and a nominal amount of OPC.

While such a material has a number of advantages, introducing it to the market in general is a significant challenge, let alone in such a way as to benefit the underprivileged. Thus, AACs provided a case study for the socio-political aspects of using it to benefit slum dwellers. The methodology included interviews with non-governmental organization (NGO) slum advocate Society For Promotion of Area Resource Centers (SPARC) and two major cement companies, and primary and secondary literature sources.

Key challenges of the context of India in general and Mumbai in particular were found to include caste, perceptions of slum dwellers, bureaucracy, corruption, and political instability. First, a lingering caste system plays a strong role in the culture and politics of India (Sen 1993; Witsoe 2011), implying expectations for occupation, income, and social standing both at the individual and group levels, and forming “vote banks” which influence political structure. Second, the perception of slum dwellers varies widely. Some understand slum dwellers to be driven people seeking opportunity and upward mobility, often having moved from rural areas to cities, while others see them as naïve or even exploitive drains on public land and resources (Burra et al. 2003; The Economist 2007). Third, the weight of hierarchy and bureaucracy is pervasive; any change is likely to require a major shift in a multitude of formal and informal operations, a condition which further discourages people from enacting change. Fourth, corruption is prevalent at all levels. However, it is possible that the lower castes, including slum dwellers, use this tool most to their advantage (Witsoe 2011). Fifth, political instability means that sustained progress, or even political and regulatory predictability, cannot be guaranteed beyond a single term of political office.

The status quo of slum development is that builders competitively bid on publicly announced projects funded by government bodies. In the case of Mumbai, the commissioner is typically a
program under the auspices of the Mumbai Metropolitan Regional Development Association (MMRDA). In lieu of cash payment, land and development rights, floor-space-index (FSI) or transferrable-development rights (TDR) are granted to the developer, and the cost of constructing the tenements is borne by the builder (Burra 2005; Patel 2005). Slum dwellers occupy the new tenements for free or with a heavy subsidy (though most often without any long-term arrangement for maintenance). Builders, who control the design and construction process, are essentially rewarded (with remaining FSI and saved funding) for building the smallest and cheapest slum tenements possible. In this system, the government minimizes its spending on slum improvement, manufacturers are incentivized to limit costs at the expense of quality and safety, and builders are incentivized to provide tenements of minimum size and cost. The flow of decisions is such that slum dwellers are arguably the group most affected by the process, but have the least input.

In light of this context, summarized by a SWOT analysis (Strengths, Weaknesses, Opportunities, and Threats), possible interventions that leverage the novel AAC were devised and analyzed. These include traditional commercial licensing, slum-dweller-owned small-scale manufacture, SPARC-led construction, and open source dissemination. In this case, the AAC developed is not patentable due to prodigious prior art, so an open source intervention would be recommended if suitable local advocates are found.

While this study has been limited to AACs in Mumbai, it is hoped that these findings also inform socially motivated technology efforts in other regions and for other technologies.

Note: This abstract is based on (A. J. Moseson 2011, Chapters 6 and 7), (A. Moseson and Slaton 2011), and (A. J. Moseson et al. 2011).

References


(2002). *Agenda 21 for Sustainable Construction in Developing Countries: CSIR Building and Construction Technology*.