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Frontier technologies for construction: Some suggestions

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The construction industry of India is hopelessly fragmented. More than 90 percent of the industry consists of small operators who use traditional and non-formal techniques and skills with predominantly local materials; these are the labour contractors or sub contractors. This is the ground reality wherein one is forced to specify materials and methods to cater to this situation. A handful of high-tech contractors are exception to this.

The visibly advanced technologies adopted in our industry are now handled by these very few agencies. If greater development of the industry is to be brought about, specialist agencies should be available to provide such services anywhere, including the equipment required. Frontier technology for us will be nothing more than what has been in use in the developed countries for the last two decades. R&D workers and promoters of technology in India have been demanding this change from the seventies.

Construction continues to be a government-dominated activity. Construction uses substantially low-value and heavy-weight materials. Therefore, they are of local origin. Otherwise, transportation cost makes economics skewed. The dominant presence of unskilled work force for handling these low- value and heavy-weight materials makes compromises in quality, wastage of resources and considerable delays.

At least in major urban centres and at large size projects, the techniques/ methods given below are being adopted which were frontier technologies in developed countries some two decades back. The same is true of all the design techniques including computer-aided design (CAD) in civil engineering. The development of information technology (IT) will make many of our work practices redundant, in office work. However, site practices will be dominated by manual/machine work.

Given below are some techniques which could be adopted widely.

(i) Earthwork by machines even in small building projects. Extensive use of machinery in road, dam and railway projects.

(ii) Ready mixed concrete and pumping of concrete, use of bulk supplied cement. High performance concrete using fly ash/micro silica.

(iii) Form systems -- including slip/ lift/sliding forms

(iv) Reinforcement cutting and bending machines

(v) Construction chemicals and repair materials

(vi) Reinforced earth for retaining walls

(vii) Curtain walling

(viii) Pre-engineered steel/metallic structures

(ix) Colour coated/PVC/FRP sheets for roofing and cladding

(x) Vacuum dewatered concrete system for flooring

(xi) Pressed concrete for paving blocks

(xii) Modified waterproof membranes

(xiii) Precast/prestressed elements for non-bridge structures

(xiv) Metallic space frames for roof

(xv) Controlled demolition systems

(xvi) Aluminium and plastics as construction material

(xvii) Reinforced masonry with high strength blocks

(xviii) Light weight structural/ insulating blocks

Adoption of the above technologies and policies through spcialised services will automatically provide for in-built quality and reduce unskilled manpower. To some extent, this can relieve the acute shortage of formally trained manpower in the open market.

Adoption of these technologies, in order to obtain quality in construction, should be seen as a change in mindset of demanding low cost at low quality. Nobody can give good quality at low cost. For example, pumping and RMC may demand a minimum cement content and consequent high strength. It will reduce pollution at site. Machine-cut bent bars may be more expensive but uniformity in sizes and covers are guaranteed. Form systems may cost more but leak-proof form and consequent good finished surface are by-products.

To prepare for self reliance in frontier technologies in the next two decades, the following activities should be emphasised upon.

- Training for skills in construction concurrent to encourage specialty services for construction.
- Equipment leasing
- Re-orientation of construction documentation, contract documents, procurements in line with e-commerce.
- Increased mechanisation for attaining speed and quality; that is, by eliminating human error)
- Robotics in construction may still be far off, but adaptation for our environment will be necessary.

A few questions

It is strange that despite India being the second largest construction industry in the world, it is not as productive. The following questions should be seriously considered in this regard.

(i) Why did prestressed concrete, as a frontier technology of the sixties, not catch up in the Indian context, except for bridges and a few large projects?

(ii) Why is the productivity, possible in construction through precasting of off-site component manufacture, tax-burdened, even as these contribute to better environment?

(iii) Why does the use of machinery increase the cost of operations several fold even as economy of scale is achieved. Perhaps the economy of scale in manufacture of these equipment would reduce this gap?

(iv) Why is it that Indian R&D in construction sector is mostly on analysis/design/testing - which incidentally is universal and can be borrowed; whereas adaptative/specific problem/ evaluation of technology is not addressed?

(v) Why does the industry complain of inadequacies in education and R&D but refuses to participate in interactive academic and R&D work?

(vi) Even as all CEOs are agreed on the lack of formal training at trades level, efforts made by firms and even government organisations are not touching even the fringe of the grave national problem. Do we feel that if we ignore the problem, it may disappear?

The construction profession as a whole, should deliberate on these perturbing questions which may reveal the reason why India has lagged behind in adopting advanced technologies.

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