Future Frameworks for Next Technologies

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Proponents of sustainability in the built environment have, to a large extent, spent the last quarter century working and reworking ideas and innovations that originated in the 1970s or earlier. Until recently, and with brief interludes following the 1973 OPEC oil embargo and the 1989 Iranian Revolution, little of this work could be said to have enjoyed high profile political support, adequate funding, or a significant chance of breaking into the mainstream. The area has been characterised by frontier spirit, high levels of personal commitment and idealism, firm belief in the rightness of the technologies that were being developed and demonstrated and a tacit acceptance, on all sides, that they would remain marginal for the foreseeable future.

This picture now appears to be changing. As a result, the position and approach of proponents of Sustainable Building is also changing and maturing. The community has begun to develop the confidence to engage in discussion, to propose courses of action, to develop and demonstrate technologies in the expectation that they will be listened to, acted upon and adopted. The need to consider the future of technology has never been more pressing, and this theme represents a major opportunity for this community to move this process forward.

Despite this positive state of affairs, we must recognise that any discussion of "future frameworks for next technologies" runs a number of risks. Human attempts to foresee the future of technology with any accuracy, or to manage it, have never been high and there are powerful reasons for thinking that the problem is more difficult now than ever. Specific risks include:

Basing our discussion on a static rather than dynamic interpretation of sustainability. The simplest useful analogy for the history of human development is probably the progress of a cyclist, who lurches from one dis-equilibrium to the next. Viewing the goal of sustainability, implicitly or explicitly, as a stable stationary state, in William Morris's phrase, an epoch of rest, is unlikely to lead to a useful discussion of future technologies.

Short term optimism versus long term pessimism. One of the most often-quoted remarks of Arthur C. Clarke is that, "When it comes to technology, most people overestimate the impact in the short term and underestimate it in the long term." We frequently forget the amount of effort required to turn a breakthrough such as the transistor into useful technology such as the computer. On the other hand, very few people who worked to build the foundations of electronic computing were able to foresee the overwhelming impact of ever-cheaper computing on human society.

Timidity disguised as prudence. The desire not to appear foolish may inappropriately limit the range of speculation and discussion in which we are prepared to engage. This is likely to manifest itself as a preference for discussing the short term over the medium or long term, a tendency to address problems that are likely to be rendered irrelevant by other parallel developments.

Technological eschatology. This term refers to irrelevant and poorly infirmed speculation based on a view of technology as a process capable of producing an

indefinite series of rabbits-out-of-hats. A tendency towards *technological eschatology* is perhaps most often displayed by economists who, from Simon to Lomborg, have taken the view that technological development will always overcome resource constraints. On the other hand, this criticism of such economists may simply be a function of their critics' own tendency towards timidity disguised as prudence.

It is likely that discussions under this theme will display all of the above failings and others that we have not been able to list, but that in most cases we will not know which is which for some decades.

The title of this theme implies a broad definition of technology. At its most basic, technology is the physical expression of human ingenuity, but such a definition would impose too tight a boundary on the discussion. Rather than focus on the physical manifestation of technologies, it may be more useful to focus on the space within which they develop and are appropriated, managed and discarded. This consists of a complex of resources and resource constraints, human needs and desires, scientific knowledge and economic and social processes within the scientific and technological community and in society as a whole. In the long term, the most important constituents of this technology space are the technologies themselves, which interact, compete and cohabit in ways that closely resemble the component species of biological eco-systems.

The biological analogy is likely to be a valuable one at a number of levels. Biological systems do not develop at a constant rate. There is considerable evidence that evolution is punctuated and that events, such as abrupt shifts in climate, are often followed by qualitatively new evolutionary developments. Three facts suggest that human technology is approaching such an event. The first is climate change, which requires the development and implementation of coherent and integrated strategies both to mitigate the rate and extent of change and to adapt to its many impacts. The second is the approaching peak in depletion curves for oil and natural gas, which requires the evolution of coherent sets of successor technologies – renewables and/or nuclear, hydrogen, fuel cells, heat pumps etc. – for energy production, storage, distribution and use. The third, which has no obvious analogy in the natural world, is the complex of processes underway in human society whose components are globalisation, the on-going IT and information revolutions and, to use Manuel Castells' phrase, the rise of the network society. It seems to us that the starting point for our discussions must be a recognition of the unprecedented nature of the times in which we find ourselves.

Questions posed by this theme therefore include:

The external problems and constraints faced by human societies – in addition to climate change and depletion of oil and gas, availability of building materials, land and water. These will be the primary external drivers of technological development. The magnitude of these problems, coupled with the time spans characteristic of the built environment, make it necessary to consider the technological foundations of the built environment over periods of up to 50 years.

The social and political context - within which "next technologies" are to be developed and deployed. These will be a crucial factor in deciding future technological directions. Technology relates intimately to all levels of social and political context, from global to local, and ranging from high level political commitments to mitigation of climate change

to decades-long developments in frameworks for education and training and shifts in social attitudes.

Economic and demographic context - measured at its crudest by economic and population growth. Human populations are likely to increase by 50% and economies by a factor of 2 or 3 over the next 50 years. The changes implied just by these two factors are enormous. On the positive side, the fact that perhaps half of the global built environment of 2050 has not been built or even planned yet, expands the range of technologies that can realistically be considered. On the negative side, the sheer scale construction that is likely to take place over this period will make the goal of sustainability that much more difficult to achieve.

Technological and infrastructural context - developments outside the construction industry, in energy generation and supply systems, urban form and transport systems, will have a powerful impact on the direction of "next technologies". Proposals and frameworks for next technologies must also take account of dynamics of change within the built environment – physical lifetimes, rates of turnover and how quickly the various sub-systems of the built environment can be upgraded, modified or replaced.

Construction industry context – construction industries in all industrialised countries display powerful tendencies towards rationalisation, modularisation and prefabrication, coupled with steadily increasing impact of Information Technology, globalisation of design and manufacture and the progressive disembedding of the industry's knowledge and skills base.

Goals of possible next technologies - the goal of sustainability has been taken from granted in the development of this theme, but this goal must be translated into concrete and measurable objectives - for example for achievement of factor "x" reduction in resource and waste flows within industrialised economies, the development or transfer of technologies to enable recently urbanised populations to provide themselves with significantly improved shelter, clean water and adequate sewerage. Goals may also include the maximisation of future flexibility and the reduction of uncertainty.

The nature of existing and emerging technologies – advances at the interface between engineering and basic science will provide the engine for development in the longer term. But any technology capable of making a significant impact on the mainstream of the construction within the next two or three decades is almost certainly in existence already. One of the most important functions of this theme will be a review of the nature, capabilities, strengths and weaknesses and requirements of possible next technologies against the background of the preceding topics of discussion.

This brings us finally to Frameworks and to the nature of the papers that we hope will written in response to this call. Attempts to make and implement conscious collective decisions about the nature of next technologies require us to develop strategic and policy frameworks – to foster new technologies, to manage transitions from existing technologies and to build consensus and partnerships for implementation. We must address the question of what needs to be done - politically, scientifically, through research, development and demonstration, in education and training, through building and guiding markets, developing regulation, measuring performance and providing feedback, to provide the context in which appropriate and desirable technologies for a

sustainable built environment and sustainable communities can emerge and make the transition to the mainstream.

We look forward to receiving a wide range of papers in response to this theme, but in particular we would welcome papers that:

- review the interactions between emerging and possible future technologies and the built environment, particularly in the areas of energy supply and conversion, materials production and manufacturing/repair/re-use/recycling.
- describe and evaluate recent experience with developing and introducing frameworks to support new technologies, as the basis for reflection on next steps.
- describe and review current proposals for frameworks to support the development and deployment of new technologies in the medium term (to 2020).
- speculate on the nature of possible technologies to support the built environment in the longer term (to 2050).
- discuss the inter-relationships between new technologies and possible support frameworks and the economic, social, political, cultural and technical context.
- review the implications of new technologies for professional education and training and the need to develop capacities to adapt global information to local political cultural and social contexts.