

The influence of new technologies on architecture and urban planning

Paper presented to the international ARCPEACE conference on human settlements held in Lima, Peru in November, 1997 by Geoffrey Payne¹

Introduction

It is a great privilege and a pleasure to be able to participate in this important conference and I would like to start by expressing my gratitude to ARCPEACE for its generosity in making it possible. The issues with which the conference is concerned are of immediate importance to all who live and work in cities and especially for those responsible for planning and managing them.

My paper attempts to address options for innovation in planning methods, land rights, sanitation technologies and information systems, which can enhance the ability of local communities, professionals and activists to increase control over new development and changes in existing urban areas. Only in this way can we hope to involve citizens in public life and create sustainable communities in which all people, not just a fortunate minority, can fulfil their potential. As my time is limited, I will now deal separately with each of these aspects.

Planning methods

The City Summit in Istanbul in 1996 endorsed the Habitat Agenda, in which all countries agreed to the active participation of private sector developers, NGOs and local communities in decisions on urban development and the formulation of shelter policies. This new strategy will have far reaching implications for the role of the public sector in urban development. At present, many urban development authorities develop land themselves for allocation according to various social and financial criteria. This may involve the development of public land, or the acquisition and development of land held under private or customary tenure.

In future, this direct approach is likely to be replaced by more indirect methods in which public sector agencies act as facilitators, or enablers, to support action by others. This change of strategy marks a radical move to increase the range of stake-holders in the development process. However, it leaves open the major question of how such a strategy is to be put into practice.

One approach which deserves consideration is the use of site development and urban design briefs prepared by, or on behalf of, a local authority to invite a range of interested parties to respond with proposals for specified sites. In some cases, these are known as RFPs - Requests For Proposals. The aim of the approach is to encourage more market sensitive and demand led approaches, whilst reducing the burden on scarce public sector resources.

How can such briefs be prepared and implemented? Experience varies widely, but all have a common theme - to specify the minimum social, financial and environmental requirements which need to be included in a proposal in order to obtain planning approval.

A good brief will be just that - brief. It should also be *clear* and based on criteria that are *realistic* in terms of yielding an acceptable return in investment by developers in return for the reduction in risk involved. Two types of briefs may be considered applicable to different contexts; a site development brief which is synonymous with economic feasibility studies and urban design briefs which provide guidelines for physical and spatial development.

Site development briefs

A good brief should:

- Be based on a realistic assessment of the likely development costs (including finance), selling prices and potential profit margins for each project component
- Specify the minimum social and environmental requirements of the local authority
- Concentrate on specific aspects of public concern

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- Distinguish between those aspects which are mandatory and those which are preferred, but optional
- Be clear, concise and unambiguous, providing only the information required by potential developers.

Options for including non-profitable elements, such as housing for low-income groups, will be increased if provision is permitted for a proportion of more profitable components. The balance of these will vary according to local site characteristics and social preferences, but should always be evaluated in terms of market costs and current commercial rates of interest. Information should include:

- The site location, boundaries and access points.
- Land area and topographic details.
- Existing uses, if any.
- Details of ownership and rights.
- The history of the site and the reasons for its being available for development.
- Any restrictions on permitted uses and their location.
- Requirements regarding public open space, road reservations, landscaping and public amenities.
- Requirements regarding minimum plot size, set-backs or floor area ratios and initial density levels.
- Requirements regarding building materials and construction systems for initial development, together with initial services provision.
- Requirements regarding the extent and nature of any non-profitable, social, or environmental components to be included.
- Details of any financial or other contribution, such as subsidies, by the public sector.
- Any requirements regarding phasing, especially for less profitable components.
- List other factors which would generate a public or communal benefit.
- Indicate the proportion of lower income households to be included in the development.

Urban design briefs

These have an additional objective. They seek to ensure the provision of appropriate, good quality environments. Unlike planning, urban design is concerned with three dimensions, the creation of urban form and the spaces between buildings. It is particularly concerned with the design and form of the public realm.

Urban design has two means of achieving policy objectives; design guides and design briefs. The former are general documents which specify the range of architectural forms and treatments which will be acceptable over a wide area, whilst briefs ensure that the urban design potential of a specific site is maximised.

In central areas, a considerable degree of control may be required over development proposals, especially if the site is in an area of historic, touristic or economic importance. In primarily residential neighbourhoods, however, development control requirements can be restricted to key areas of the public domain, leaving residents to decide on the use of their plots and the form of the immediate environment. The views of *all* stake-holders should be sought before finalising a brief, in order to maximise public acceptance. A good urban design brief should contain the following sections:

- An analysis of the site, indicating the reasons for the brief, the character of any existing development and the pressures for change which proposals should address. Connections and links to streets, land uses and buildings should be shown in detail, together with any site conditions which will influence development options. Any transport or parking requirements should also be specified.
- A statement of design objectives which lists the physical and spatial qualities to be encouraged and those which will not be acceptable. These may include reference to the scale and form of new buildings, their relationship to communal and public spaces and landscaping requirements. In many cases, the morphology of existing settlements can suggest options for future development. Any restrictions on building heights, set-backs, or floor area ratios, would be specified.
- Controls to be exerted over proposed developments and the sanctions to be imposed in the event of non-conformity.

It is important to invite a wide range of stake-holders to assess proposals prepared by communities, or developers on the basis of the brief. This will increase support for the decisions reached and promote a transparent decision-making process. Time taken at this stage can also result in considerable savings later by reducing the risk of local hostility to proposals.

Development and design briefs provide an opportunity for local authorities to initiate proposals without having to apply time consuming, unpopular and inefficient land acquisition and development procedures. They are cost effective means of increasing public control over urban development and increasing the participation of a wide range of stake-holders.

For developers, they have the major advantage of specifying *in advance* the requirements necessary to obtain planning approval, so reducing risk and saving the time require din processing proposals. Once a decision is reached, work can start on site immediately, saving substantial costs, especially in countries with high rates of inflation and associated interest rates. A proportion of these savings can then be passed on to the community at large. However, even good briefs can only reduce the risk of inappropriate development. Success, as always, will depend upon each actor accepting the need for socially and environmentally responsible development.

Reforming the regulatory framework

At present, a substantial and increasing proportion of urban populations live outside the legal framework of urban development in various illegal, unauthorised or unregularised settlements. They do not usually do this by choice. What forces people into the informal sector is the unacceptable costs of conforming to the requirements imposed by legal, officially sanctioned, development. It is a truism that urban populations are increasing at twice the rate of rural populations and informal settlements are growing at twice the rate of legal urban areas. The effect of this is to deny a large section of the population, most of whom are poor, the full rights and responsibilities of citizenship. Unless this trend can be reversed, development in its fullest sense, will be difficult or impossible to achieve.

Once again, a major question is how can this trend be reversed, especially in view of the increasing role of market forces in national development and the commercialisation of urban land and housing markets which they entail? What are the options facing under-resourced governments to protect the poor whilst stimulating efficient and dynamic economic development?

One option is to reform the regulatory framework of planning and building standards, regulations and administrative procedures. Even when well intentioned, these impose costs which prevent many households from obtaining legal access to land and housing. By making a distinction between *initial* minimum standards and *long term* objectives, the lowest rung of the housing ladder can be made accessible to the majority and the process of incremental improvement found throughout informal settlements can be incorporated into planned development.

Land tenure and property rights

Access to secure and affordable land is a pre-requisite of any housing policy intended to meet the needs of all sections of the population. Surprisingly, however, the subject of urban land tenure did not receive detailed attention until the 1980's and even now, there is a lack of adequate empirical evidence on different approaches on which policy makers can base proposals².

One complication in assessing land tenure options is the unique nature of land as a resource. Not only is it of a finite quantity, but each location possesses different characteristics to every other. Furthermore, tenure systems reflect the attitudes and priorities which every society places on land as a resource and on relationships between individuals, groups and society as a whole. Rights to land also exist within a regime of rights in general, so that societies which place a high priority on the rights of the individual can be expected to have a different tenure system to those which give priority to the community. Under conditions of rapid urbanisation and urban growth, competition for land intensifies and accessibility will increasingly be influenced by the tenure policy operating³.

² This section of the paper draws heavily on Payne, G Urban Land Tenure and Property Rights: A Review published by Intermediate Technology Publications, London 1997.

³ For the purposes of this paper, land tenure can be defined as the mode by which land is held or owned, or the set of relationships between people concerning land or its product. Property rights can similarly be defined as a recognised interest in land or property vested in an individual or group and can apply separately to land or development on it. Rights may cover, *inter alia*, access, use, development or transfer and, as such, exist in parallel with ownership.

In formulating or implementing policies, it is important to note that a wide range of tenure categories exist in the urban areas of most developing countries. These may include statutory, customary, religious and various informal systems, each of which will be affected by a change in policy. It is therefore important to review the full range of categories and their relationships, including all informal categories. In making this assessment, an estimate should be made of the extent to which lack of security has inhibited investment in housing improvements. The most important factor is to identify informal categories according to criteria relating to their de facto level of security and the level of access they provide to services and credit. In most cities, settlements known by a single term such as *piratas*, *barrios* and *bastis*, subsume a wide range of important distinctions.

Tenure policy should seek to enhance the *clarity*, *efficiency* and *equity* in the registration, transfer and use of land and property. The key to success is to ensure that tenure systems minimise land market distortions, balance the interests of all parties (especially land-owners, occupiers and tenants), are familiar to local people and are easy to administer.

It is commonly assumed that the most desirable form of tenure is freehold, since this maximises the benefits of private ownership, use, development and transfer to the individual owners. However, policies which involved the provision of titles to informal settlements may overlook several key factors, including:

- The impact upon other social groups, especially tenants, who may be forced out of their properties by higher rents.
- The demand that it will stimulate from residents in other informal settlements.
- The possibility that it will encourage the growth of more informal settlements.
- The risk of 'downward raiding' by higher income groups, and
- Discrimination against other forms of tenure which may be more appropriate for large sections of the population, especially lower income groups.

A common objective of tenure policy is to increase access to formal credit, since titles are widely used as collateral for loans. However, most financial institutions will determine loans primarily upon the ability of the borrower to repay the loan, so that collateral is a secondary factor. Credit agencies are also increasingly willing to lend moderate amounts of money without requiring titles as collateral. Yet even a modest increase in tenure security may, in itself, stimulate investments in land development and house improvements. This situation is likely to be particularly sensitive in informal settlements accommodating a significant proportion of tenants. Any major change in tenure status in such areas may result in substantial displacement of low income tenants.

In countries where more than one tenure system operates, it may be desirable to build on existing laws and practices, rather than further complicate matters by introducing new ones. Administrative procedures for registering land and property rights are frequently over-complex, time consuming and inefficient. Simplifying these and placing responsibility in a single agency can achieve a marked improvement in land administration. I understand considerable improvements have been made in this respect in Peru.

Tenure policy should always be sensitive to the social, cultural and economic circumstances of the target groups and take due account of indirect ramifications. No single tenure category is capable of meeting the needs of all sections of society. The best approach may therefore be to provide a choice of tenure options, so that households can select the one most suited to their needs and be able to change easily from one to another.

For informal settlements, this need not involve legal titles, let alone freehold. In many cases, certificates of use, or official statements that settlements will not be removed, have been sufficient to encourage residents to invest in housing and environmental improvements. The determining factor is the minimum level of security *as perceived by residents*, not professionals. This implies that improving *rights to land and property*, rather than de jure tenure status, can meet the twin objectives of reducing land market distortions and improving tenure security for the poor. Applying incremental property tax rates can also enable the poor to meet the obligations of full citizenship.

Innovative sanitation systems⁴.

Access to clean water and basic sanitation can radically improve public health and contribute to the need for high birth rates. Most countries in the world provide, or aspire to, systems of sanitation which involve individual connections of a water closet into a public mains sewer system. These mix urine and excreta and transport the resulting sludge across the urban area to a central treatment plant, or point of disposal untreated into the sea, or local rivers.

The technology on which these systems are based was developed in the mid-nineteenth century in Britain and other European countries to counter the spread of cholera and other environmentally born diseases. As such, it has only been in general use for about a century, during which cities have grown larger and more complex than ever before.

A major reason for the popularity of conventional sewerage systems is that by pulling a handle or lever, the wastes vanish from sight without leaving any smell. However, this does not solve the problem of human wastes; it simply passes it elsewhere. Among the limitations of this approach are the following:

- They are completely dependent upon large quantities of treated water, even though data suggest that 280 million people in urban areas lack access to safe water, even for drinking and nearly half of urban populations in the South lacked a water supply into their home⁵.
- The capital and operating costs of public sewer systems are beyond the reach of all but the most affluent households in many cities of the South. Yet according to one study⁶ the choice of sanitation technology has the greatest potential to reduce infrastructure costs.
- The mixing of solid and liquid wastes results in effluents which require expensive treatment if they are not to cause serious pollution when discharged into water courses. The former may cause disease if people come into contact with the sewage, while the latter may deplete oxygen in receiving water courses, killing fish and causing smells.
- Leakage, which can be extensive in poorly maintained systems, compounds pollution of the water table, creating major health risks.
- Cities are simply growing too fast for conventional sewer systems to keep pace. The low level of existing provision would require massive capital investment to increase connections in line with demand, making it impractical for general application.

In view of these limitations, it is important to develop alternative systems which are more affordable, flexible and ecologically efficient. At the same time, it will be necessary to win popular and professional acceptance of new technologies by retaining what has become widely known, for good reasons, as 'the convenience'.

In addition to the well known pit latrine and similar systems, what other options exist? Some include the following:

Shallow sewers

These work in the same way as conventional sewer systems, but are cheaper because sewers are laid at shallow depths, reducing the cost of excavation and allowing small chambers to be used instead of much more expensive conventional manholes.

They are appropriate where rights of way are narrow, so that they can be laid through gardens and yards. A good example is in the Brazilian condominium system.

Sewered interceptor tank systems

These are also known as Settled Sewerage systems. They are designed on the assumption that there will be an interceptor tank, normally some form of small septic tank, on every connection to the sewer. Solids settle in the interceptor tanks, provided that they are periodically desludged. The sewers thus need to be designed to transport liquids only and this means that they can be smaller and laid to flatter gradients

⁴ The author wishes to acknowledge the advice, material and comments on drafts of this section of the paper of Kevin Tayler of Gilmore Hankey and Kirke International and Professor Duncan Mara of Leeds University, both of the UK.

⁵ United Nations An Urbanizing World UNCHS 1996

⁶ Cotton, A and Franceys, R Services for Shelter Liverpool University Press, 1991

than conventional sewers. Caution is required in case the interceptor tanks cease to function or are not desludged when full.

Sewer connections to septic tanks

A variation on the basic interceptor tank system is to provide shared septic tanks, serving 5-20 houses, from which the effluent is discharged to the sewers. In this system, the connections from houses to septic tanks are designed as conventional sewers and the sewers downstream from the septic tanks to sewer interceptor tanks standards. Interceptor tanks at the end of community built systems will protect the main sewers from any solid materials carried by the branch systems and the approach may therefore be attractive to sewerage authorities which are concerned by the prospect of direct discharges from community built sewers into their own.

Communal toilets

These take two forms: public toilets, which are open to everyone and communal toilets that are reserved for a number of families. In India, the former work best when somebody charges for their use, while the latter can work well where the user group can be defined.

Treatment options

Sewered disposal systems must incorporate treatment if they are not to pollute the environment. The expensive and inflexible nature of conventional systems has led to considerable interest in decentralised treatment systems.

Waste stabilisation ponds are one option. These consist of a series of ponds through which sewage flows are passed. Natural biological processes in the ponds reduce the organic load of the sewage to a point where it can be discharged without harming the receiving water course. They require very little maintenance and can operate without power, though they require a large area of land, which makes them inappropriate in areas where land costs are high.

In recent years, so called 'small footprint' treatment systems which require little land have been developed, mainly in industrialised countries. Some, such as the Australian Memtec system, rely on membrane technology and are claimed to be able to remove up to 99 percent of all contaminants, including human wastes, bacteria, viruses, heavy metals and oil. Their suitability for use in developing countries has still to be established.

Other treatment systems depend on anaerobic processes to reduce the organic load of sewage. Anaerobic waste stabilisation ponds are the simplest option in this category and can remove 50-75 percent of the organic load in the right conditions. This means that they will normally have to be followed by secondary aerobic ponds which, as already noted, have a relatively large land take. Another aerobic system which is attracting interest is the up-flow anaerobic sludge blanket reactor system (UASB). The UASB system was developed in the Netherlands, but a few have been built in India. Preliminary evaluation suggests that small UASB reactors may be suitable for decentralised treatment.

In El Salvador, Guatemala and Mexico, experiments are taking place with solar heated toilets. These may consist of a unit installed in the vault to increase evaporation, or a collector (such as a blackened piece of aluminium sheet) placed on top of the pit and exposed to the sun. Composter toilets have also been tested in some countries, though they require very careful use and maintenance. Other options are described in a British television programme produced called 'Human Waste' a copy of which can be viewed at the conference if required.

Selecting the preferred option

The choice of technology most appropriate for specific conditions will depend on the following factors:

- Social attitudes and practices.
- Costs and levels of affordability.
- Density levels.
- Settlement layouts.
- Environmental conditions. (In El Salvador, Vietnam and Guatemala, experiments are being carried out with toilets which separate urine and faeces, though it is too early to assess their performance).

Disseminating information on technologies and planning options to stakeholder groups

It is one of the fascinating aspects of housing that no single profession can claim a monopoly of knowledge or wisdom. In fact, even the combined efforts of *all* professions have failed so far to prevent urban living conditions from deteriorating further. This lends support to the view that only the active participation of *all* stake-holder groups, including above all local communities directly affected by the planning process, can improve matters. To achieve this, they need to be informed of the issues and options available to help them improve their communities.

The internet is a potentially radical tool in achieving this objective. Whilst it is still mainly available only to professionals and NGO groups, and depends heavily on the English language, costs are steadily decreasing and the technology becoming more user friendly. Cyber cafes are increasingly available in urban areas and there is no reason why access to the internet cannot be made increasingly available to local communities.

The internet provides a wealth of useful (and useless!) information. A recent search for references under the heading of urban development in developing countries produced over 35,000 items! The following is therefore a highly selective list of sites and discussion groups which may be useful as a starting point:

CENDEP participatory sourcebook <http://www.brookes.ac.uk/~e0191751/home.html> (a useful source on participatory planning and rapid appraisal. Also available in Spanish)

Centre for Alternative Technology <http://www.foe.uk/CAT>

Composting toilet systems <http://www.composter.com>

Environmental planning and management dev-habitat@ihnet.it

Forum on developing countries (News, events, help needed/require, links, etc) forum@araxp.polito.it

Garnet (Network in Water Supply and Sanitation) <http://info.lboro.ac.uk/cv/wedc/garnet/grntover.html>

Greener environmental management greenleaf@worldscope.co.uk

Intermediate Technology Development Group <http://www.oneworld.org/itdg/publications/html>

Low-cost sewerage network lcsewerage@mailbase.ac.uk

N-AERUS (Network-Association of European Researchers on Urbanisation in the South)
naerus_list@araxp.polito.it and <http://obelix.polito.it/forum/n-aerus>

Solid waste management and related topics ecoct-p@segate.sunet.se

UN Centre for Human Settlements <http://www/undp.org/un/habitat>

Urban design resource book (RUDI) <http://rudi.herts.ac.uk>

World Bank <http://www.worldbank.org>

Conclusions

The Habitat Agenda agreed at the UN City Summit will entail a massive transformation in the attitudes and practices of all involved in urban development and human settlements. In particular, it will entail a redefinition and restructuring of:

- Institutional roles (objectives, policies and practices)
- Professional skills (both technical and behavioural)
- Educational curricula (especially in encouraging multi-disciplinary approaches and team working).

These should be enough to keep us busy - certainly for the time we have together in Lima!

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Innovative sanitation systems

Conventional systems:

These involve individual connections of a water closet into a public mains sewer system. These mix urine and excreta and transport the resulting sludge across cities to a central treatment plant, or dump them untreated.

This technology has only been in general use for about a century, during which cities have grown larger and more complex than ever before.

A major reason for the popularity of conventional sewerage systems is that by pulling a handle or lever, the wastes vanish from sight without leaving any smell. However, this does not solve the problem of human wastes; it simply passes it elsewhere.

Among the limitations of this approach are the following:

- They are completely dependent upon large quantities of treated water, even though 280 million people in urban areas lack access to safe water.
- The capital and operating costs of public sewer systems are beyond the reach of all but the most affluent households in many cities of the South.
- The mixing of solid and liquid wastes results in effluents which require expensive treatment if they are not to cause serious pollution when discharged
- Leakage, which can be extensive in poorly maintained systems, compounds pollution of the water table, creating major health risks.
- Cities are simply growing too fast for conventional sewer systems to keep pace.

Alternative options:

Shallow sewers

These are similar to conventional sewer systems, but are cheaper because sewers are laid at shallow depths, reducing the cost of excavation. They are appropriate where rights of way are narrow, so that they can be laid through gardens and yards.

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Treatment options

Sewered disposal systems must incorporate treatment if they are not to pollute the environment. The expensive and inflexible nature of conventional systems has led to considerable interest in decentralised treatment systems.

Waste stabilisation ponds are one option.

'Small footprint' treatment systems such as the Australian Memtec system, rely on membrane technology and are claimed to be able to remove up to 99 percent of all contaminants.

Other treatment systems depend on anaerobic processes to reduce the organic load of sewage. Anaerobic waste stabilisation ponds are the simplest option in this category and can remove 50-75 percent of the organic load in the right conditions.

Another aerobic system which is attracting interest is the up-flow anaerobic sludge blanket reactor system (UASB). The UASB system was developed in the Netherlands, but a few have been built in India. Preliminary evaluation suggests that small UASB reactors may be suitable for decentralised treatment.

In El Salvador, Guatemala and Mexico, experiments are taking place with solar heated toilets. These may consist of a unit installed in the vault to increase evaporation, or a collector (such as a blackened piece of aluminium sheet) placed on top of the pit and exposed to the sun. Composter toilets have also been tested in some countries, though they require very careful use and maintenance.

Several options are presented in a British television programme 'Human Waste' which is available for viewing at the conference.

Selecting the preferred option

The choice of technology most appropriate for specific conditions will depend on the following factors:

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