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The Sana'a Urban Development project was designed to be the first in a series of urban development activities to receive continuing support from the World Bank. Consultants proposed the upgrading of two urban neighbourhoods, one in Sana'a, the other in Hodeidah, as well as one sites-and-services project in Sana'a. Both projects in Sana'a were adopted in the budget of the World Bank, whereas the implementation of the project in Hodeidah was postponed.

The broad objectives of urban development, encompassing institutional as well as physical development, were examined in preliminary studies for the Sana'a project, and subsequently channelled into the specific arrangements for the improvement of the Musayk area of Sana'a and the development of the Sawad Sawan site.

These arrangements included:

- a pilot project of land registry;
- mortgage credit finance for homeowners (loans for building materials);
- technical assistance throughout the period of implementation;
- physical design of infrastructure; and
- design of demonstration houses in Sawad Sawan.

This paper deals with one of three development projects in Sana'a, the sites-and-services scheme for the Sawad Sawan district.

The Sawad Sawan scheme was targeted for 2,000 households with incomes in the range of the lowest 30 percent of the urban population. The number of households and their demographic characteristics were derived from sample surveys carried out by the consultants, from the 1975 census statistics, and from studies made by other consultants.

The general objectives of this project as defined by the World Bank were:

- to address the housing needs of low-income groups;
- to be financially self-supporting so as to be replicable on a large scale; and
- to be a demonstration that would initiate a series of urban projects to receive continuous Bank support.

The Bank recommended an average project density of 80 households per hectare, which would result in a population density of about 450 people per hectare.

Growth of Urban Populations

On the basis of the analysis of previous planning studies, the 1975 census and sample surveys carried out during the project, the Bank consultants arrived at the following conclusions:

- 1) The analyses of the growth of the built-up areas of Sana'a and Hodeidah that were made in late 1980 by the project team showed that the actual growth rates were 6.3 percent for Sana'a and 7.5 percent for Hodeidah.
- 2) Since these two towns account for a considerable percentage of investment, there is no reason to think that Ta'iz developed at a faster rate, especially since the site presents certain restrictions.
- 3) The secondary centres developed at quite different rates between 1975 and 1980. In the Hodeidah hinterland, the al Marawiah-Bajil route (Sana'a road) was favoured over the Bayt al-Faqih-Zabid route (Ta'iz road), and only Amran, Dhamar, and Ibb-Jiblah saw considerable growth on the central plateau.
- 4) If new routes reinforce the tendency toward rapid growth on the part of the small urban centres, and especially on the part of seats of government, the absolute increases in the population of these towns will remain low because of the originally small size of these centres.
- 5) The rural areas already have a very high population density in terms of arable land and, except for certain isolated projects, there is no reason to think that the population has grown considerably in these areas.
- 6) There is therefore a basic contradiction between the use of a high rate of natural growth and a small increase in the number of emigrant workers.

A threefold increase in funds transferred from abroad in constant value would tend to indicate that the number of expatriate workers underwent a considerable increase between 1975 and 1980.

In view of the foregoing, the growth in the population between 1975 and 1980 was estimated on the basis of the following assumptions:

- annual growth rates for the three major urban centres based upon those observed in the cases of Sana'a and Hodeidah and upon a figure of 6 percent for Ta'iz (as was the case of Sana'a);
- stabilization in the rural population;
- a twofold increase in the number of short-term expatriate workers;
- a natural growth rate of 2.2 percent in the resident population, which corresponds to a growth rate of 2 percent in the *de jure* population after incorporation of the other assumptions.

Given this situation, 75 percent of all migration from the countryside is to other countries and 25 percent to the urban centres. In the latter case, two-thirds of the migration is to the three major urban centres — Sana'a, Ta'iz and Hodeidah.

Population Growth in Sana'a

In 1962 it was estimated that the population of Sana'a had already reached 55,000 inhabitants and that approximately 35,000 of these inhabitants lived in the old city. In 1972 the sample survey conducted by Italconsult recorded 77,922 inhabitants, but the survey conducted by Central Planning Organisation (C.P.O.) estimated the population at 91,795 inhabitants, of whom 5,400 were temporary residents. The difference between the two figures may stem from the fact that the Italconsult survey did not take into account the population of institutions, temporary emigrants, and the population of the villages close to the urban core, which were subsequently incorporated into the city.

Population and Buildings in Sana'a, 1972-80

Year	Reference	Population	Buildings	Inhabitants per Building
1972	C.P.O. Survey	91,795	16,662*	5.5
1975	Census (15)	138,625	23,578	5.9
1979	U.D.P.	177,395	30,067	5.9
1980	U.D.P.	188,511	31,951	5.9

*households

The census taken in 1975 recorded a population of 134,588 inhabitants, within the zone defined above. A comparison with the figure given above indicates a growth rate of 13 to 14 percent, but it is difficult to compare a census and a sample survey. After adjustment, the results of the census indicated a total population of 138,625.

At the same time, the population figures for the largest villages immediately outside the city were 4,139 inhabitants for al-Rawdah and 1,312 inhabitants for Haddah. Approximately ten villages within a radius of 30 kilometres of the city recorded between 1,000 and 2,000 inhabitants.

Because of the rapid rate of growth the population of Sana'a, by 1980 a new estimate of the city's population was required. This estimate was made by counting the buildings in each sector and comparing the results. The work was carried out by using aerial photographs dating from 1979 and maps at scales of 1:5,000 and 1:2,000 made on the basis of these photographs. On-site inspections made it possible to determine what changes had taken place during the previous two years.

It was assumed that the built-up part of the old city had not changed, which was confirmed by the study conducted in 1978 by Shankland Cox Partnership for UNESCO, and that the average number of inhabitants per building remained constant.

The growth rate of the population between 1975 and 1979 was found to be 6.3 percent per year. There was also probably an increase in the number of inhabitants per building in the oldest quarters, but this is difficult to measure. There is no reason to

assume an increase in occupancy rate in the newer structures, because for the most part they represent new construction built by the occupants themselves.

The population of Sana'a was therefore estimated to be 190,000 inhabitants in early 1980, or approximately 200,000 inhabitants for the entire urban area if one takes into account the villages located immediately outside the city (al-Rawdah, al-Jiraf, Haddah, etc.), which will soon be incorporated into the city itself.

Although high, the growth rate of 6.3 percent was still lower than had been projected. However, between 1975 and 1979 a large number of buildings appeared that were not yet completed in 1980, which means that the built-up area grew faster than the population during this period.

On the basis of trends observed between 1975 and 1980, it can be assumed that the population will continue to grow at the same rate over the short term, which would result in a population of 270,000 for the urban area by 1985. But on-site inspections made in December 1980 tend to indicate a slow-down in construction in the outlying quarters. It is still too early to decide whether this represents a real change in the trend or is simply a brief aberration.

In view of the inherent uncertainty in population growth parameters, long-term population projections are very tenuous. Simply extrapolating with a growth rate of 6 percent per year, would yield a population on the order of 650,000 by the year 2000, or a population three times the size of the present population. This is, of

course, only an order of magnitude since migration, which plays an important role in the growth of the city, can undergo significant fluctuations.

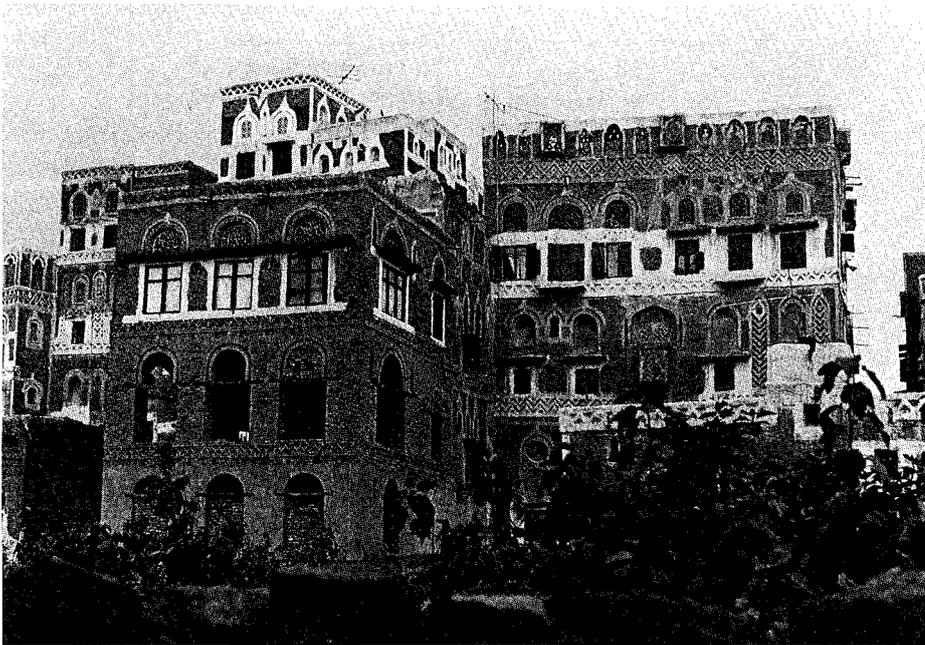
An analysis of the population density of the various census sectors shows that it can go as high as 600 inhabitants per hectare in the old city. The average for the area located to the east of Wadi Sailah is close to 400 inhabitants per hectare, but this area is devoted almost exclusively to housing and has very few roads. An analysis based upon large sectors including public facilities, business and industry, and empty areas is more indicative of actual land occupancy.

In 1975, when the city was still developing beyond the inner core in a relatively uniform manner, the average population density figures ranged from 70 to 130 inhabitants per hectare in the newly developed areas depending upon the degree of continuity of the newly developed areas and non-residential land uses.

Housing Types in Sana'a

In general, the following types of housing are found in Sana'a:

- 1) traditional housing of the old city and the Jewish quarter, which are multiple-storey buildings of brick or stone construction;
- 2) traditional houses with gardens built in the central area before the revolution;
- 3) traditional houses without gardens built in the central area near the old quarters or along the main arteries of the central area before the revolution;
- 4) recent single-family houses, most often with gardens;
- 5) traditional houses without gardens built after the revolution;
- 6) recent buildings intended for mixed occupancy in the center of the city;
- 7) planned housing projects (Madinat al-Handi, al-Duhai, etc.); and
- 8) shanty towns (Akhdam).



Sana'a, Yemen Arab Republic. Traditional housing with a recently constructed addition in the foreground.

Photo: C. Little/Aga Khan Awards.

The last two categories are very recent and not very widespread. Categories (4) and (5) account for most of the construction in the extensions out from the central core.

Except for the planned housing projects representing about 5,000 housing units, the impact of which will only be felt in the years to come, housing construction has traditionally been left to private initiative. Private housing production covers a wide range of types, from multiple-storey stone buildings to one-room concrete block houses; but the nature of production is roughly identical.

Between 1975 and 1980 approximately 1,500 housing units per year were built by private initiative. In actual fact, however, it seems that the number of housing starts was much higher because almost 4,500 buildings that were either under construction or had their foundations in place were counted in 1979.

This phenomenon has to be understood in the economic context of the time. Funds transferred from abroad by expatriate workers had tripled. Transferred funds generally stimulate housing construction, which is spread over a varying number of years depending on available means. Moreover, purchasing a lot and then construction materials is the most popular type of investment and savings. But this system, which worked acceptably in the past, seems to have reached its limit because of the lack of available land, the scarcity of labour, and the stagnation in transfers of funds from abroad since 1978.

Municipal Administration in Sana'a

The following ministries are involved in various aspects of municipal administration.

- 1) The Ministry of Municipalities and Housing is responsible for environmental health (solid waste removal, food hygiene, pest control, public toilets), municipal parks, municipal councils, low-income housing, physical planning (implementation of the five-year master plan as it relates to urban density and street patterns), building permits, and budget approval, staffing and funding for all these activities.
- 2) The Ministry of Public Works is responsible for land registration and the construction of public buildings.
- 3) The Ministry of Health is in charge of hospitals, disease control, health centres and nursing clinics.
- 4) The Ministry of Education is responsible for the operation of all primary and secondary schools, and adult literacy centres.
- 5) The Ministry of Interior is in charge of police services, traffic control, vehicle registration, driver licensing, investigation of traffic accidents, fire protection.
- 6) The Highway Authority is responsible for the construction of paved urban roads and inter-city roads.
- 7) The National Water and Sewerage Authority operates and maintains the water supply system and sewerage facilities.
- 8) Yemen General Electric Corporation is responsible for power supply and distribution.
- 9) Yemen Transport Company operates public transport.

The above agencies all provide urban services. No formal structure for coordinating their activities at the municipal level existed at the start of the Urban Development Project. This role devolved upon the Ministry of Municipalities and Housing, which in fact has played the role of development entrepreneur, procuring, organising and coordinating the resources necessary to implement the project.

In 1980 municipal revenues in Yemen accounted for one percent of the total

municipal expenditures, the difference being paid from the national treasury. Consequently, and especially since it was a pilot project, the Sana'a sites-and-services scheme was designed to be self-financing, that is, the costs of development would be tailored to, and ultimately borne by, the future residents ("beneficiaries" in World Bank terminology).

Partial financing of house constructions in the form of loans for building materials was incorporated into the institutional setup in coordination with the Housing Credit Band, a financial institution recently established in Yemen.

In 1976 the Yemeni government passed a land registry law, providing for centralisation of land registry with provision for establishing proof of title. The implementation of this law was delegated to the Ministry of Public Works. The consultants prepared a pilot land registry project to be applied in Sawad Sawan, based upon the Torrens Title System.



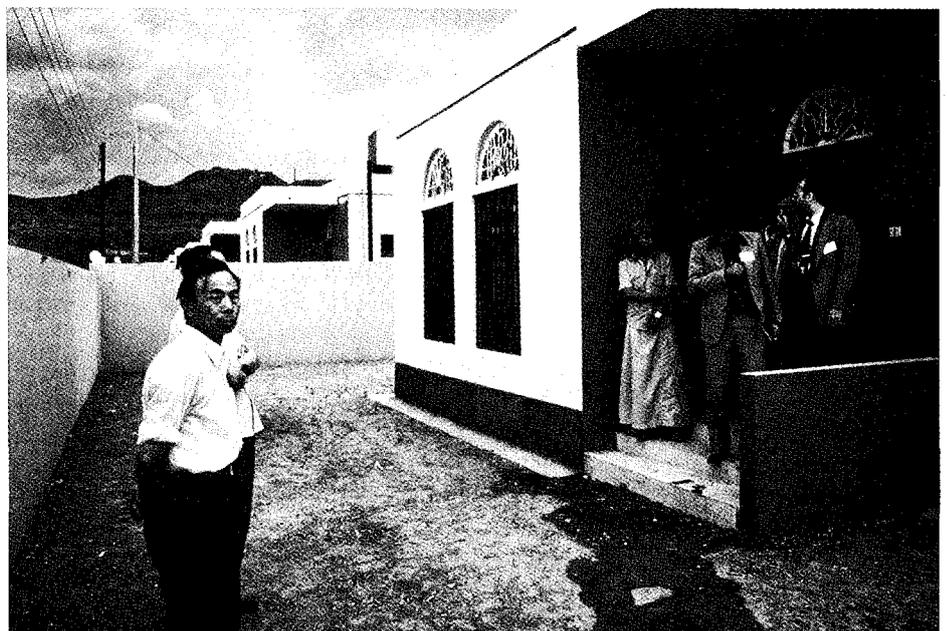
A new low-rise housing development in Sana'a.

Photo: S. Özkan.

Site Plan for the Sana'a Project

Ten sites in Sana'a were identified by the government ((that is, by the Ministry of Finance or the Ministry of Municipalities and Housing) as potential development locations. These were reduced to four likely possibilities by the comparative application of the basic criteria of 1) cost of acquisition, 2) proximity to sources of employment, and 3) off-site infrastructure (e.g., roads, water and electricity).

Of the four priority sites, one was rejected due to soil structure (solid rock). Of the three remaining sites, the government selected one without further examination due to its apparent ease of acquisition. While this site was initially thought to comprise an area of one hundred hectares, preliminary acquisition steps made it appear that the site would be limited to ten hectares. Both the World Bank team and the consultants urged the government to increase the size of the site to at least forty-five hectares.



The housing was designed and built by the Chinese as walled compounds.

Photo: W.L. Porter.

Subsequent investigation by the consultants has revealed that a proposed major urban road (the northeast boulevard) would, if approved, bisect the chosen site. The topography of this site is such that its bisection by the road would make the area unsuitable for a sites-and-services development. Consequently, the consultants have recommended strongly that the site immediately to the south of the proposed road be considered as an alternative. The alternative is one of the three sites initially identified as being most desirable for development.

Once the site was selected, the acquisition procedure was complicated and extended, which illustrates the need for a land registry system as well as legislation concerning expropriation. The current acquisition procedure apparently is as follows: officials of the Land Registry Department and Ministry of Finance, accompanied by special counsellors who are knowledgeable about traditional ownership in the area to be inspected, make a visual inspection of the site and establish approximate site boundaries based upon natural features. The site is subsequently demarcated by a physical boundary (a trench dug around the perimeter of the site). The boundary demarcation precipitates the presence of the heretofore unidentified private owners at the Ministry of Finance. A process of negotiation between private claimants and the Ministry of Finance presumably terminates in the compensation of valid claimants at the estimated market value of the land.

Development of the Sana'a site plan took place over a period of one year with four major revisions before a plan emerged that met both the criteria of the World Bank and the planning features required by the Ministry of Municipalities and Housing.

The World Bank criteria required:

- three sizes of housing plots — 72, 80, and 96 sq. m. each;
- strict association between the sizes of plots and the level of access, such that the smallest plots would be served by pedestrian walkways, the intermediate plots by

service roads, and the largest plots by primary roads;

- the total surface area of saleable housing plots comprising 60 — 65 percent of the total site area;
- roads, pedestrian ways and parking areas restricted to 25 percent of the total site area;
- community space limited to 10 percent and open space to 5 percent.

The objectives of the Bank were to achieve affordable costs. The objective of the client was to achieve the highest standard of quality.

The site that was finally selected was a fortunate choice. Consisting of a long platform sloping towards the Sana'a valley, substantial economies were obtained in the drainage and sewerage network. This resulted in cost savings that enabled the construction of an additional one hundred demonstration houses within the total project budget.

All housing plots are oriented either south or northwest, so that houses may be heated by direct solar radiation. Solar energy is the principal source of heating in Sana'a, where daily temperatures can vary as much as 20° celsius between noon and midnight.

The 26 hectare site incorporates the principal elements of a self-contained neighbourhood, including a central mosque, central market, social service facilities, two school sites, and areas for small local businesses on plots bordering primary roads. The site may be expanded in the future by extension of modular neighbourhood units, modified as necessary by the configuration of the site boundaries.

The level of infrastructure provided for, within the limits of affordability, includes:

- water service to every plot;
- sewerage connexions to every plot;
- electrical connexions to each house with an average connected load of 1.6 kwh;
- macadamised primary roads; and
- secondary roads of compacted gravel.

The project includes 120 demonstration houses. The objective of these houses is to demonstrate the application of the lowest

cost local construction techniques available in the capital. The houses are to be capable of expansion in several stages, replicating an established and widespread practice.

It may have been more economical to build the houses on a group basis, rather than as individual units. But the project is designed to accommodate construction by individual owners, each building at a rate determined by the owner's personal financial capabilities. The most predictable form of expansion is addition to core units, one room at a time.

Frequently, during the course of project design, Yemeni planners raised this question: Why not build apartments and economise on the construction costs? The reason is that this form of construction requires relatively large-scale capitalisation, beyond the range of financial resources available and exceeding the affordability for the target group.

The project design was based upon the following criteria:

- orientation for solar heating;
- the provision of an expandable core consisting of two rooms and a sanitary block;
- the potential for expansion, one room at a time, with vertical expansion of an additional two storeys;
- the employment of the lowest cost construction methods and materials having the desired structural properties;
- space organisation suited to the established living pattern in Yemen; and
- incorporation of traditional, arched windows with the capability of incorporation of *gamarias* according to individual priorities.

The analysis of costs, construction techniques in practice, and the availability of materials resulted in the choice of:

- stone foundations;
- high density, split-face concrete block walls;
- small span reinforced concrete slab floors;
- precast concrete window arches;
- traditional mud roofs on completed parts of houses; and

- precast concrete interior stairways made of standardised parts applicable to any house design using traditional masonry construction techniques.

The role of the consultants terminated with the completion of detailed design for the site plan, including demonstration houses and infrastructure works.

Technology Transfer: Myths and Realities

Contracts for feasibility studies and engineering services between expatriate engineering firms and governments of developing countries frequently provide for the training of local counterparts by the consultants during the performance of the contracted services. This provision, made in the interest of technology transfer, is in fact a contradiction between performance and education. Since consultants are obliged to perform specific tasks within a limited period of time and according to a definite schedule, they apply all of their effort and resources to performance. The broader goals and slower pace of the educational process are incompatible with those of the efficient performance of engineering and planning contracts.

Furthermore, the local personnel designated to work with expatriate firms are usually government employees, and this relationship places them in the contradictory roles of student and teacher at the same time; supposedly learning from the consultant while being obliged to advise government officials on the evaluation of the consultant's performance.

The question of technology transfer is more complicated than the question of training of counterparts because of the fundamental conflict between traditional and technological societies. Technology has no national, cultural, or religious tradition. It is a form of non-political totalitarianism that operates according to unwritten, implicit impulses. Technological societies have abandoned religion, ethics, tradition and cultural continuity for the pursuit

of development. The religion of technological societies are anachronisms having a purely ritualistic and non-functional role. The technological society has a non-sectarian social ethic, a mass phenomenon that continually changes character without reference to established institutions.

Traditional societies, in particular Islamic societies, in contrast to technological societies, tend to practise traditional religion and strive to integrate a fundamentally religious ethic into the political, technical and administrative processes of development. In short, technology is a challenge to the Islamic world, a challenge that presents a conflict of value systems in every exchange.

At the conclusion of a research paper on land tenure and land legislation in Yemen, the institutional expert for the Sana'a project made this astonishing observation: "In the Yemen Arab Republic many of the values widely held are deeply rooted in religious origins. These values have been maintained and sustained through effective religious education and legal precedent. The economic content of Islamic social policy is clearly defined. It stresses:

- maximum of production and efficiency;
- wide distribution of wealth;
- earning of additional income only through work; and
- security for the underprivileged.

"The westernisation process, at least with regard to technology, may well have an impact on traditional values, but any recommendations regarding land tenure, mortgage credit and municipal administration and finance must be consistent with the values held by the people."

These values were manifested throughout the studies of the Urban Development Project by the government officials responsible for its supervision and evaluation. They consistently fought for:

- low interest rates for homeowners;
- a higher level of infrastructure than the bare logic of cost recovery could justify;
- high quality construction;
- larger houses; and
- site planning conducive to establish living patterns.

The technologists prevailed on all counts except the site plan.

The Islamic values as applied to this project succumbed to the built-in criteria for a technological process. But the impetus for quality arising from the Islamic ethic may have pushed the project to the qualitative limit within the imposed technological restraints. The maximisation of qualitative achievement may be the most important role of Islamic values in development.

Technology Transfer in Urban Development

Contracts between consulting firms and governments of developing countries almost invariably specify the training of counterparts by the consultants. The counterparts are usually civil servants.

The conditions under which consultants perform their contracts are not conducive to counterpart training. Consultants are required to perform specific tasks within a schedule of deadlines for a fixed price. Their resources are divided between the field and headquarters, and they devote all of their efforts to performance. Training is incidental and the only educational experience of the counterpart is one of observation of operations in which he is not a functioning participant.

In short, counterpart training is an inadequate form of education. This situation is only a manifestation of a deeper problem, a symptom and not a cause. The question of technology transfer is related to the larger issue of modernism and tradition.

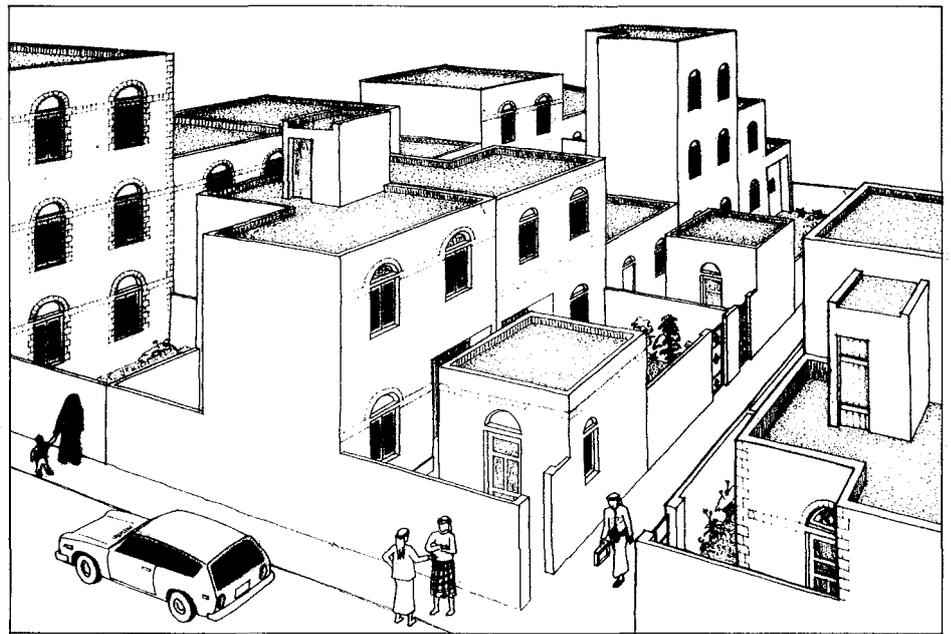
In Islamic countries the issue of modernism and tradition in urban development is joined in two phenomena: urbanisation and the introduction of modern technology. The polarity of modernism and tradition can be equated to that of Islam and technology. In the case of urban development in Islamic societies, modernism in the form of technology is being exported to and imported into traditional societies.

A similar situation occurred, in reverse, during the Gothic period in Europe, in the twelfth century. The established social order, dominated by ecclesiastical theology, philosophy, administration and finance came face to face with nascent rationalism (building technology is exemplified by architects). This phenomenon was examined in detail by Erwin Panofsky in *Gothic Architecture and Scholasticism* (New York: Vantage, 1964). He described the saga as a conflict of faith and reason, a concept that is equatable to modernism and tradition.

A similar situation is occurring today, whereby Islamic societies are adopting modern technology. Modern technology is a phenomenon of technological societies. If one can believe the French philosopher Jacques Ellul (whose *The Technological Society*, New York: Knopf, 1964, was commissioned by the Fund for the Republic, an American Foundation), technology itself is the new religion of the eastern and westernised worlds. Technological societies have effectively abandoned traditional religion and its corollary, social ethic, in the systematic pursuit of materialism. Technological societies operate on a non-religious, non-sectarian negative social ethic, which may be defined as a form of tension between predatory mechanisms of technology (exemplified by monetarism) and regulatory institutions (law, judiciary and police). The latent conflict between Islam and technology is the conflict of the value systems of technological and Islamic societies.

Islamic societies, in their present state, tend to practice a social ethic that is based on religious belief. A constructive union of Islam and technology is possible if technological resources can be made to conform to the Islamic social ethic.

Are the objective systems of technology susceptible to the incorporation of a social ethic other than that which has evolved with the technological society? After a brief examination of this question in relation to urbanism, architecture and the built



Drawing of a housing scheme for Yemen.

Source: BCEOM.

environment, the significant aspects of technology that are susceptible to domination by a new social ethic seen to be finance, design, and education.

Finance

Technological finance is purely functional, except in the case of defense; Islamic finance is socially oriented. In housing, technological finance means market interest rates; Islamic finance means low interest rates. The low interest rate is a form of distribution of wealth intended to provide better conditions for the homeowner.

In the case of the Sana'a urban development project, a loan to the government was made at the interest rate of 3/4 of 1 percent. The loaning institution imposed the rate of 12 percent interest on the project beneficiaries. The government, by the

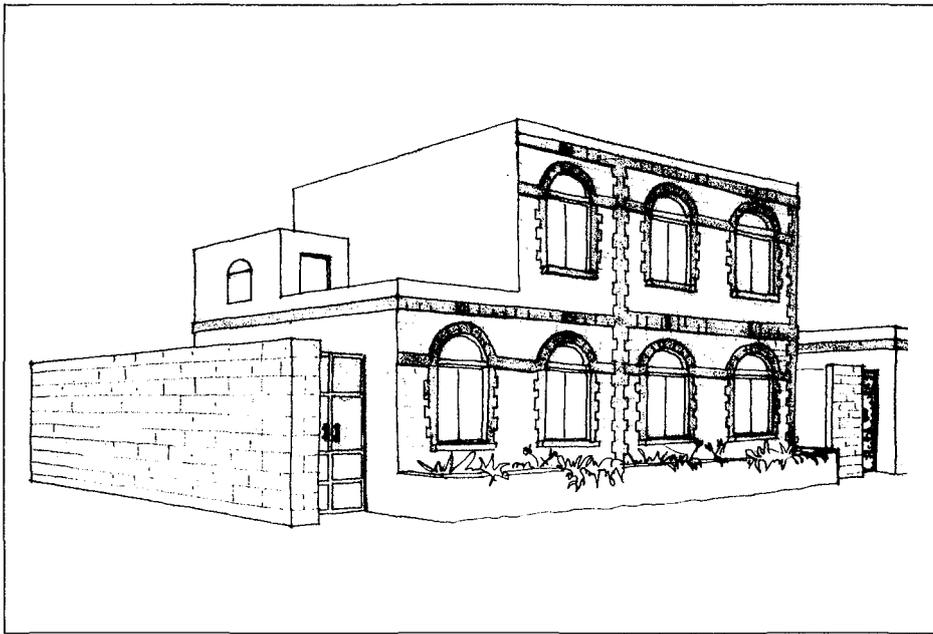
terms of the loan, was required to charge 12 percent interest on loans to future homeowners.

Design

Technological design is based on a process of quantification. Only the quantifiable enters into the production of object systems.

The architectural designer in the technological society manipulates the technical process to achieve a personal aesthetic expression. This quest is limited by the technical options within financial limitations.

The result is a profusion of styles that the technological society has produced. Neo-Gothic, Greek revival, Baroque revival, functionalism, pop art in architecture, and now post-modernism. This is a rampant form of the negative social ethic. The pre-



House design for Yemen based on a traditional style.

Source: BCEOM.

datory mechanism is the quest for self-expression. The regulatory mechanisms are building codes, performance standards, zoning codes and budgets.

Islamic values will materialize in a technological world to the extent that they can be quantified, provided that Islamic finance does not conform to its counterpart financial practices.

Education

In this context I mean specifically the education of the designer. Design is a process transforming abstractions into objective systems through intermediaries by quantification and description.

Theoretically, this concept of design would admit the incorporation of any quantifiable aspect of any society, but designers in the technological society are not educated in design. Architectural schools are limited to

the discovery and perfectionism of talented students.

The initiates are moulded to conform to an existing model. The existing model is a successful practitioner. A successful practitioner in education is a practising designer with a substantial lineal footage of print and substantial square metres of photography in publication.

Islamic societies, if they are to achieve Islamic values in design, have a major role to play in the education of designers.

*The planning studies represented in this paper were conducted by the Bureau Central d'Études pour les Équipements d'Outre-Mer (BCEOM). The commentary, starting with the heading "Technology Transfer: Myths and Realities", are the personal views of the author and not those of BCEOM.