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CHAPTER 5

THE INFLUENCE OF INCOME LEVELS, SPATIAL, AND INSTITUTIONAL FACTORS ON TECHNOLOGY CHOICE

In the last chapter we established that the use of indigenous technologies relative to their import-intensive alternative, can be more equitable and efficient while also strengthening participation and the building up of local institutions. Why then are import-intensive technologies still being promoted?

In Chapter 3 we discussed part of the answer in terms of Pakistan's national development objectives and policies. We also alluded to other reasons which we shall now examine.

Although the economic justification of greater efficiency is the most common, perhaps the most legitimising, it might not be the only reason for choices made, nor the most important. Other factors such as prestige enhancement, preferences learned from professional training, building codes, and so forth may also influence choices.

This chapter suggests that the importance of economic and other factors can vary with the income level of the decision

maker and with the spatial and institutional environment within which technology choices are made. The import-intensive technologies conform more to characteristics of the upper-income, the large cities, and the conventional construction agencies such as the Public Works Departments (PWD) and the construction departments of other ministries. The indigenous technologies, on the other hand, conform more to characteristics of the lowincome, the small town and rural areas, and the local government institutions such as the local councils and Local Government and Rural Development (LGRD) departments.[1] The technology characterisitics desirable to one set of incomes, spatial, and institutional evironments may be irrelevant, or even undesirable, to the other.

It is thus perfectly logical and rational that if the first set of income groups and environments dominate - as indeed they often do - so do the import-intensive technologies. But

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1. Construction rather than the materials production technologies are considered here. In principle, the same situation applies to the latter. To do justice to the production technologies, an analysis of relevant institutions equal to that done of the construction agencies is needed; this is beyond the scope of the present study.

We consider small towns of populations of 25,000 or less to be in the rural sector (cf.Chapter 1). Thus from hereon, when we speak of rural areas, we include these towns.

Non-governmental organisations and other community development groups are even more receptive than local governments. We speak of the latter since our concern is to institutionalise the development of indigenous technologies through the public institutions.

the result is the technology needs of the lower-income groups, city or rural, remain unmet. The urban poor have a choice between inadequate housing using discarded scraps or a very slow incremental construction process, the latter a reflection of the gap between their earnings and the rising costs of expensive importintensive technologies. The rural poor face a similar prospect given the steady erosion of their existing sources of adequate housing: the builders trained in indigenous technologies and the indigenous materials production industries.

A reversal of this trend requires a shift in decision makers or at least in the spatial and institutional environment within which critical technology choices are made. The comparative advantage indigenous technologies have in rural areas must be exploited to develop and establish these technologies in materials industries and construction methods. Once established, the same technologies with the requisite modifications could be introduced into low-income urban construction.[2]

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2. Although this approach has not been consciously articulated and attempted, the experience in several countries have been suggestive. Technologies of lower standards than officially acceptable have had to prove themselves first in smaller settlements before they could be introduced into the larger cities. Low-cost water supply techniques in, Brazil for example, had to prove themselves first in Brazil's small towns before they could be acceptable in the nation's capital where they are now being introduced. (Gakenheimer, R and Brando, C, 1985)

The institutional channels for such a program need to be the local government organisations - the local councils and the LGRDs.

This chapter examines how technology choice is guided by the interaction among characteristics of the alternative technologies and those of income groups and of spatialinstitutional environments. We begin with discussing the effect of income levels and the spatial environmentand following in the next section with the effect of the institutional environment.[3]

1. Income Levels, the Spatial Environment, and Technology Choice: Comparing Upper- and Lower-Income Needs, the Cities with the Small Towns and Rural Areas

Several factors relating technology characteristics to those of income and space influence technology choice.

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3. Other approaches to analysing technology choice stress socio-cultural or political factors in addition to institutional and economic ones. Architecture and anthropology emphasise socio-cultural factors because products of construction technologies - shelter and infrastructure - tangibly express and shape living patterns of society. Political scientists argue politics shape policy decisions. Any of these factors can and often do override purely economic ones. We believe that sociocultural factors vary with income and spatial environments. And from the plannners' and policy analysts' perspectives, it is adequate to discuss political influences when these bear directly on choice.

1.1 Construction-Maintenance Ratio and Timing

Besides cost-effectiveness over the building's life span, the timing of construction tasks over that period is an important criteria of technology choice. We earlier implied (see Chapter 4) that the timing characteristics of indigenous construction were often preferable to those of importintensive construction. This view is, however, very income and space-sensitive.

Construction using import-intensive technology is marked by a major proportion of total money, time, and effort invested in initial construction and a much smaller proportion at infrequent intervals throughout the building's life-span. Construction using indigenous technologies has a relatively smaller proportion of total investment in initial construction with the rest spread over the building's life-span, either in maintenance or incremental improvements (see Fig. comparing these patterns).

For the urban, upper-income resident whose opportunity cost of labour or leisure time is high, it is not worthwhile setting aside either labour or supervision time for frequent construction. For the low-income, urban formal sector worker, job timings may make frequent construction tasks difficult to do. The lowest income groups in the urban informal sector may likewise find the tasks inconvenient

because their periods of unemployment may be unpredictable, may be spent in seeking work, or may have to be left free to work at a short notice.

Unlike their rural counterparts, urban informal sector workers cannot rely as easily on the women to do construction and maintenance tasks. Religous and cultural constraints on women in Pakistan's urban areas, except in the lowest income groups, are much stronger than they are in the rural areas, where women do most of the housing maintenance.

Thus in a city setting, and definitely for the upper-income groups, the construction and maintenance characterisitics of indigenous technologies are undesirable.

In contrast, small town and rural residents can fully exploit the opportunities for reducing costs offered by the construction timing characteristics of indigenous technologies. Agricultural cycles highly influence the labour market in these areas; hence, annual and predictable periods of low employment and low wages arise.

Sahiwal has two such periods in the year: after the rice harvest and sowing, from February to April; and after the wheat harvest, from August to October. Upper- and lowerincome groups, farm and nonfarm workers use these

periods to do construction and maintenance tasks relatively inexpensively. The farm worker, otherwise unemployed, invests his time in improving his house. The non-farm worker and upper-income can hire construction labour at lower rates.*

Similar cost-saving opportunities are available to the rural community- and government-funded construction adopting these technologies. If indigenous technologies were widely adopted in government construction, and if construction and maintenance were timed for the low employment periods, significant cost savings for the government and improvement income distribution to the poor would result. If the investment were large, a public construction activity

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4. Note that in our economic and income distribution cost comparisons we have been conservative in not assuming this very real possibility of coinciding construction and maintenance with periods when the opportunity cost of labour could be close to zero. We have instead assumed construction could occur any time during the year, and thus only slightly lowered the shadow price and we have not shadow priced maintenance costs. If we were to shadow price maintenance as well and assume that both these activities were to occur in such periods, indigenous technologies would appear even more preferable than current calculations show for both cost and income distribution reasons.

dovetailed with low employment periods would reduce joblessness when it was most acute.[5]

This favourable match between the labour needs of indigenous technologies and the seasonal variations in employment is not present in cities.

1.2 Proportion of Possible Self-Help Inputs

Indigenous technologies are preferable to import-intensive ones, partly because the former have a much higher proportion of inputs - local materials, unskilled labour - supplied through self-help or community participation.

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5. Labour-intensive construction projects have been used occasionally to ease periods of high unemployment in other countries. Here we propose the annual, predictable maintenance tasks of rural construction using indigenous technologies to coincide with the equally predictable and annual periods of low employment to thus serve all three objectives of cost-reduction, employment, and income distribution.

Construction tasks spread out as maintenance or planned incremental improvements over several years and timed for agricultural troughs can limit inflationary effects and make construction management more efficient. Construction during periods of low employment will not bid up wages. Relatively small-scale, regular, and repeated construction tasks can more easily be planned for and managed in an efficient manner. Local materials producers can rely on a predictable demand for their products, be encouraged to invest in expanding production and also have time to expand production to meet this demand (other institutional implications are discussed in the next section). I am thankful to Michael Jacobs, with whom some of these ideas were raised.

In Sahiwal and in rural areas, in general, this factor gives indigenous technologies a decided advantage over importintensive ones. Self-help possibilities can drastically reduce the effective cost of the rural inhabitant's house. The proportion of potentially "free" inputs are high: materials - such as reeds, sand, and timber - obtained without payment or by barter; and the workers' own otherwise unemployed time to make materials or to construct. Moreover, maintenance, which permits full use of the annual low employment periods, has an even higher proportion of these inputs compared to construction.

The construction costs of community services can be likewise greatly reduced through community contributions. This feature can thus be important for community organisations and government agencies responsible for such projects.

Self-help and community participation in construction is also a city phenomenon, but the possibilities are much less than in rural areas. It is harder to get "free goods" by gathering. And, as noted, given the potential for year-round employment, it may be more economical for the house builder to purchase materials and hire labour than to use his own time. Individuals would be similarly more reluctant to contribute their labour in a community project. Hence selfhelp and community participation possibilities are less in the city, although the technology has a high proportion

of unskilled labour and local materials. And, as we shall see, the type of materials considered "local" may differ in the urban and rural areas.

1.3 Availability of Materials

Proximity of materials, such as agricultural waste in place of coal in kilns, gives the indigenous technology an advantage over its import-intensive counterpart in Sahiwal. In cities, the advantage of materials proximity lies with the import-intensive technology. Here the materials for import-intensive production and construction are more readily available, a major reason why these methods are more common in cities.

Take Karachi where most construction occurs. It is a port of entry for imported materials. Most of the cement from the plants located in the province of Sind are sent here directly. And the new National Steel Mill lies only 40 kilometers away.

Even when import-intensive materials are produced in the rural areas, these are distributed through the major cities. Thus steel bars and girders are cheaper in Lahore, their major distribution centre, than in Sahiwal, which is closer to the steel rerolling mills producing them.

On the other hand, the production and distribution system of the indigenous materials industry is very undeveloped and receives no government assistance. Therefore such materials as sun- and agri-waste bricks, and timber can only compete with their import-intensive substitutes when proximity of resources and market are overwhelmingly in their favour. Even in Sahiwal, some agri-waste kilns had to initially rely on the trucks returning empty from deliveries to the coal-fired kilns to deliver agriwaste to them.

1.4 Multiple Functions of Buildings: Prestige Enhancement, Investment, and Establishing Tenure

A construction project has purposes other than its immediate function as service or shelter. It may be an investment, a means of acquiring status, or simply a means of establishing tenurial rights. These functions are most obvious in building construction, especially housing, and can greatly influence technology choice. These functions gain importance as settlement size and income levels increase. Finally, these functions are also better served by adopting import-intensive technologies rather than indigenous ones, at least given the current level of technical development of the latter.[6]

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6. To say, for example, that timber per se is non-durable or cannot symbolise "upward mobility" is to ignore its level of development and use in many western countries today.

1.4.1 Prestige Enhancement

Construction as a projection of prestige and progress for the individual house owner, the community, the patronpolitician, or the government department responsible for the project, applies to both cities and rural areas. What may differ is the particular symbol associated with attaining prestige. This symbol develops through the demonstration effect of "trend setters" in the community - the rich, the powerful, the respected, the peer group known to have done well, and the government.

The overwhelming impact of this demonstration effect in Pakistan's cities is to encourage the use of importintensive technologies. This effect extends to rural districts like Sahiwal, although it is much weaker.

In Sahiwal the use of import-intensive technologies to project prestige is most common in the buildings of those who have close contact with the cities (and have few resource constraints): some landed rich who live in Lahore, local residents working in the Middle East, and the government.

Yet the influence of the traditional grand houses of the rural elite and the earlier government buildings that adopt more indigenous inputs still offer alternative symbols for

construction that locals can take pride in (and copy more low-cost, technically adequate shelter solutions). As one town councillor of Malka Hans (population of 15,000) put it:

> "We have fine examples of our traditional houses right here [in Malka Haus]. They show that even a *kucha* [sun-brick, timber roofed] building, if well constructed and maintained, will remain forever." (Ali, 1983).

New houses in another settlement (Chak Bedi, population 12,000) adopted the timber and tile roofing system and the facade of local government buildings constructed in the early sixties. The same roofing systems were also adopted in communityfunded buildings such as local mosques.

1.4.2 Housing as Investment

Housing as an investment to generate income either through rental, part commercial use, or resale, is a common phenomenon in large cities. Because buildings using importintensive technologies tend to be more comfortable, more prestigious, and have a greater monetary value, it is generally believed that these technologies will be preferred wherever obtaining incomes is a major motivation for construction.

No studies have been done to either prove or disprove this last assumption. In any case, we can expect location and the market served by the the landlord, shopkeeper, and house

owner to also influence his technology decisions. Thus, in the low-income areas of Karachi and Lahore, renters and shopkeepers are housed in buildings using technologies ranging from the most indigenous to the most importintensive.

As for resale value, the only systematic study done in Pakistan found that this was not an important factor. In a survey of new housing construction in 19 cities, including Karachi and Lahore, only 7 percent of the new house owners cited resale possibilities as a motive for constructing their houses (United Consultants, 1975: 27). Most of these owners were from the highest income brackets. This finding is consistent with my own more limited survey of new house builders in Sahiwal.

One can nonetheless expect some pressure to adopt importintensive technologies because of concern for returns on investment to be stronger in Karachi, Lahore, and Sahiwal city than they would be in small towns and villages.

1.4.3 Establishing Tenure

Many studies have documented the importance to urban migrants of establishing their right to be there. In the Pakistan study mentioned above, forty five percent of the

new house owners gave establishing security of tenure as their primary reason for housing construction.[7]

It may be reasonably assumed that those concerned with establishing tenure would prefer durable import-intensive technologies. Such technologies comply with building codes and act as some deterrent to demolition by the government. In low-income settlements of Pakistan's major cities, shanty housing concealed and protected by fired brick walls on the property's boundaries, a common phenomenon, suggests such a relationship between establishing tenurial rights and technology choice.

As mentioned in Chapter 3, the relaxation of standards will at least reduce the imperative to adopt import-intensive technologies (cf.p.), but the time lag between policy and practice may be great. Meanwhile land rights remain a problem.

These factors are, however, of little concern in rural areas. In Sahiwal, tenant farmers with no land rights have lived on their landowners' farms for generations and do not perceive a threat of eviction, nor conceive of resisting it. In small towns that are expanding, farm land that can be

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7. The second most frequently cited reason, rent savings, was mentioned by only 9 percent of the owners (United Consultants, 1975:27).

converted to housing plots is still in adequate supply and relatively affordable to new house builders. Moreover, spatial and institutional distance also greatly weaken the threat of building codes. Residents can therefore make technology choices less impelled by pressures to adopt importintensive alternatives.

Finally, the needs of greater physical security from fire and theft are clearly better served by import-intensive technologies. Equally clear, however, is that these concerns are greater in the more densely populated, ~~less~~ more closely knit large cities than in small towns and rural areas.

This is not to say, however, that indigenous technologies have no place in the urban areas. All the factors mentioned that make indigenous technologies more problematic in the urban environment apply less, if at all, to the urban poor. The recent urban migrant, one still struggling for economic security, may indeed have more time to spare for constructing his shelter, may be yet unconcerned with urban social mores restraining women from maintenance work, and may place less importance on prestige, tenure, and durable housing than his more established counterpart (Turner, 1976:). As earlier noted, such persons make up a large and growing proportion of the urban population (25 to 33 percent of the expansion in Pakistan's urban areas is in squatter settlements, World Bank, 1984:124).

For the urban poor, indigenous technologies similar,if not identical, to those in the rural areas could be suitable. Yet, the forces for the development of indigenous technologies are too weak in urban areas. The urban poor, who would benefit most, have little influence - politically, socially and economically. They are also subject to pressures against the emergence of indigenous technologies.

Attempts to introduce indigenous technologies, construction methods and industries within Pakistan's cities have therefore been unsuccessful. The technologies used in model houses of government low-income housing projects have rarely been utilised by the residents (e.g., Lines Area Housing Project, see Afshar, 1982:). For the same reasons, attempts to introduce indigenous technologies in large cities of other countries have also seldom been successful. Soil-cement-block-making plants failed to catch on in Dakar, Ghana, because of the heavy maintenance required and the low status accorded the material (Skinner, 1983: 147; also Martin,).

Although the urban low-income cannot be expected to create an adequate initial demand for indigenous technologies, they can be the market on which these technologies expand, once

these have been established in the rural areas and modified to suit the urban context.

programs to develop indigenous technologies should take root in the small towns and rural areas where conditions are more conducive. The basis of these technologies - materials industries such as agri-waste kilns, timber, and the like - are all in the rural areas. These industries and their immediate potential market - the middle- and low-income rural groups - are relatively free of the social and economic pressures that make the emergence of such industries in cities so difficult.

But neither low-income demand, nor a potentially conducive rural environment is adequate for the development of indigenous technologies if the institutional channels of technology decisions and public construction expenditures resist the adoption of these technologies. These institutional issues are discussed in the next section.

2. Institutional Factors and Technology Choice: Conventional Construction Agencies Compared to Local Government Institutions

This section examines how institutions influence technology choice. We discuss the characteristics of indigenous and import-intensive technologies in relation to those of the alternative institutions involved in construction - the conventional construction agencies, such as the PWD and the

construction departments of other line agencies, on one side, and the local government institutions - the local councils and the LGRD, on the other.

The analysis suggests that the characteristics of the conventional construction agencies give them a natural preference for import-intensive technologies over indigenous ones, The local government institutions, in contrast, should be more sympathetic to the adoption of the latter technologies.

2.1 Potential for Cost Reduction

The primary advantage indigenous technologies offer over import-intensive ones is the opportunity to reduce costs. Yet this advantage is unimportant to the conventional construction agencies. These agencies have no incentive to cut costs. If anything, their incentive may be to increase costs. Why is this so?

The power of an agency is closely related to its budget; the budget, to the costs of the projects implemented. To cut costs is to risk reducing one's budget and hence weaken the agency relative to others.

The bias towards increasing costs is reinforced by the budget procedures in Pakistan. Even if budgets were assured, there is no incentive to reduce project costs so that more

projects could be implemented. More projects mean more work (unless the staff increases). Yet staff increases are very difficult, if not impossible, to justify; increasing capital budgets is much easier than increasing current budgets, which fund personnel salaries. The pressure to expend capital outlays without the commensurate staff increases therefore promotes projects using import-intensive technologies.[a]

Moreover, corruption increases with the project's size. The occasions for earning "illicit income" and its amount relate directly to the project's physical and financial scale - another factor against cost reductions and for cost increases through higher standards.

Not least, projects of a large-scale and high standards are key elements of prestige for construction departments. Both elements are compromised by cost reductions and by lower standards concomitant with using indigenous technologies.

On the other hand, local government institutions would be more receptive to cost-cutting measures for construction projects. Much of the power and prestige of the local councils, relative to government agencies and to their own

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1. A World Bank review of planning in developing countries, also notes that a dual budget outlay (current and capital) "contributes to a needless emphasis on brick-and-mortar projects, and conversely, to the neglect of maintenance outlays (Agarwala, 1984:25). Similar observations are made by Korten (1980) in analysing disbursement procedures of donor agencies.

communities, hinge on the number of projects they have control over. And their argument for getting more control from the government, is that they can implement these projects more cost-effectively than other agencies.[9]

In Sahiwal councillors, LGRD staff, and community members formed project committees to manage and supervise construction. The committees claim to have reduced construction costs by cutting out contractors' profit margins and inefficiencies. Consequently, an increasing number of construction projects are being handed over to these committees. Similar savings through project committees have been documented elsewhere.[10]

As an elected representative of numerous settlements, a councillor's popularity depends on providing something to as many of the settlements as possible. There is thus an incentive to decrease project costs so that more projects can be implemented. Spreading a construction budget among several low-cost schools in several villages may gain a councillor more favour among constituents than using it all

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2. Councillor , Chairman Union Council Pukka Sudhaar, interview with the author, Sahiwal, Pakistan, 14 December 1982.

10. In Mansehra district (in the North-West Frontier Province) project committees have been 20 to 30 percent more cost-effective compared to government agencies in a wide range of activities including school construction. Based on this experience, the Mansehra District council has handed over the entire package of Sixth Plan projects to the project committees (Mauras, 1982:17 and Lashker, 1983:34).

in a single high standard school in one village, which may simply bring charges of favouritism.

2.2 Construction-Maintenance Characteristics

A basic difference we earlier noted between indigenous and import-intensive technologies is in the ratio and timing of their construction and maintenance requirements. In addition, the type of maintenance also differs. Construction projects using indigenous technologies require effort and expenditure on construction and maintenance spread out in annual but small, predictable amounts over the projects' life span. With import-intensive projects, most efforts and expenditures are concentrated up-front in initial construction with occasional but nonetheless substantial, less predictable amounts for maintenance concentrated at certain points of the projects' life (compare Fig. and Fig.). Such maintenance is also technically more complex.

These differences make the import-intensive technologies the natural choice of construction agencies who have large capital budgets for construction but no maintenance budgets. Project maintainance is ad-hoc. The responsible agency funds maintenance when severe disrepair in enough projects prompts it, and the scale of damage makes maintenance costs high enough to qualify as a capital budget outlay.

The funds required for annual maintenance in indigenous technologies, on the other hand, are too small to qualify for a capital budget. Further, maintenance in projects using these technologies cannot be postponed till maintenance needs are severe enough to warrant a larger budget because by then the project would be irrevocably damaged.

Even if funding were available, construction agencies are not sufficiently decentralised below the district to adequately monitor, implement, and inspect the maintenance of projects using indigenous technologies. The frequent maintenance of these projects, although technically simple, is administrative and personnel intensive, and can thus pose problems if the implementing body is distant from the project.

Choosing import-intensive technologies does not circumvent problems of recurring maintenance.

Given the different ages of the projects spread throughout the district, maintenance, although infrequent for each project, is a recurring problem when the district's projects are considered altogether. This factor, besides those of budgets and spatial distance, prompts agencies to pass responsibility for maintenance of some projects on to the community served by it. But no provisions are made to assist the community. Maintenance in importintensive technologies

can be complex and expensive, given the technical and managerial skills, and the type of materials available to the community. Often poor maintenance, or none at all, is done. Under these conditions, the choice of importintensive technologies exacerbates, rather than solves, the maintenance problem.

Therefore, regardless of who is responsible, the lack of maintenance remains a major problem of facilities constructed in import-intensive technologies.

Since the establishment of the local councils, construction and maintenance tasks are being increasingly delegated to the local councils. Some technical and financial assistance is provided through the LGRD. The councils are also expected to work with their constituencies in doing these tasks and to reduce costs through community contributions. Under this institutional structure, the adoption of indigenous technologies makes sense.

A more decentralised monitoring and management system is possible through the project committees. A much larger proportion of required skills and materials in indigenous technologies, relative to import-intensive ones, can be contributed by the community; this is more true of the maintenance than of the construction stage. Thus the construction and maintenance characteristics of indigenous

technologies dovetail with the local councils' takeover of construction projects using these technologies.

2.3 Employment, Income Distribution and Community Participation

Employment, income distribution, and community participation effects are not the primary arguments for indigenous technologies, but these considerations strengthen the case for such technologies. For the conventional construction agencies, however, these effects are irrelevant: the agencies' objectives are to construct facilities that are structurally sound, acceptably cost-efficient, and provide service and shelter.

Indeed, labour-intensive construction and certainly community participation are considered likely to complicate or delay project construction. Hence, from the perspective of conventional construction agencies, a major set of arguments for indigenous technologies, at best, carry no weight and often dissuade those contemplating their use.

In contrast, the local councils and LGRD departments are mandated to promote employment, income distribution, and community participation. For the elected councillors, these objectives have pragmatic value. Achieving them enhances the councillors' popularity and, thus, their chances of reelection. Community participation and, hence, contributions help cover part of project construction and

maintenance costs. For the LGRD personnel, who are trained to act as intermediaries between the people and the government, community participation in projects is an end in itself. Thus, from the perspective of the local government structure, the employment, income distribution, and community participation effects of import-intensive technologies are powerful arguments for adopting them.

2.4 Training and Personnel Bias

In the conventional construction agencies, engineers make the major policy, adminstrative, and technical decisions affecting construction. Trained professionals in Pakistan, like other developing countries, are generally from the big cities. With their urban origins, most engineers are likely to be unfamiliar with indigenous technologies practiced largely in the smaller settlements. Their subsequent training, focused almost exclusively on import-intensive technologies, weakens any familiarity they might have had.

Let us take two examples. A standard civil engineering text (Khanna, 1982) of the Engineering University in Lahore gives 210 pages to reinforced concrete construction and only 23 pages to timber. Agriwaste bricks are not mentioned at all .[11] Similarly, a recently graduated engineer, a PWD employee

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11. This text nonetheless gave more information on timber and other local material than any other I could find. It is widely used in India and Pakistan.

in his hometown of Sahiwal city, told me that no one in his district uses "*ghilafi*"[12] construction anymore, a practice I subsequently found to be still widespread, even in that city.

The engineers in the conventional construction agencies are thus trained to work mainly with importintensive technologies and often firmly believe in their superiority over any indigenous alternative. The selective engineering criteria they are trained to apply in making technology choices further reinforces this view.

Engineers of the local councils and the LGRD departments have the same professional backgrounds. They, however, do not dominate the local government institutions.

The management and field personnel of the LGRD are largely graduates of the agricultural schools. Many are veteran development workers of rural development programs in previous administrations (e.g. Village AID, Basic Democracies). All undergo pre-and in-service training on rural development and local administration in the provincial local government training institutes. Their training

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12. "*Ghilafi*" are walls faced with one layer of fired brick with the rest in sun-brick. It is an effective and economic solution to both weather proofing (therefore maintenance) and "appearance" concerns. The author has seen it still widely practiced in South Asia, the Middle East and China.

therefore makes it easier for them to examine technology choices within broader developmental criteria.

The administrative presence of LGRD at the district and union council levels permits closer contact with local conditions.[13] Most important, councillors, as residents of the district's small towns and villages, are keenly aware of these conditions.

Contrasted to the views of the engineer from the PWD in Sahiwal city, are those of a town councillor from Pukka Sadhar, Sahiwal:

> "We know that we can use two-foot wide *kutcha* (sunbrick) walls and cement plaster them. They will last at least twenty years providing that the plaster is keyed into the mud-wall. Such a wall will be much cheaper and cooler. Similarly, *kikar* (accacia) as long as it is at least ten years old can last as a beam for at least twenty years. But we cannot use such a roof or such walls. Specifications for all technical work are given by the government so local councillors can make no changes."[14]

2.5 Modernity and Prestige

The stronger image of modernity and progress projected by import-intensive construction projects (relative to indigenous ones) gives prestige to all those associated with

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13. The District and Union Council secretaries are both LGRD personnel.

14. See note 2 above.

its implementation. This also has its institutional implications.

The prestige factor makes import-intensive technologies equally appealing to members of both the construction agencies and the local government institutions. Councillors are, however, not as quick to dismiss their indigenous technologies as the engineers of the construction agencies (or those of the LGRD, for that matter) are prone to do. Indeed, some councillors regard these technologies highly as evident, for instance, from the previously cited qoute.

Yet councillors as <u>politicians</u> may be swayed by the prestige factor if it affects their popularity among their constituents. Whether this factor will influence them towards indigenous or import-intensive technologies depends on what they value for their popularity. That is, whether they perceive their popularity as better enhanced by the modernising image of a few projects using importintensive technologies, or by the greater coverage from a larger number of more modest projects that also create more employment and incomes among their constituents.

In sum, while in the local government structure,the prestige factor may influence technology choice towards either alternative, in the conventional construction agencies, it

almost always reinforces preferences for import-intensive technologies.

2.6 Contracts and Materials Procurement

Materials production and supply, and construction of projects using import-intensive technologies are done by a group of entrepreneurs, merchants, transporters, and builder/contractors distinct from those who do the same activities for projects using indigenous technologies. The former group are based in the main towns, mostly in Sahiwal city, are relatively large, licensed establishments, and hire non-family employees. The latter are small, usually unlicensed, family enterprises distributed in the smaller settlements.[15]

The construction agencies, all based in Sahiwal city, have a long established network of official and unofficial contacts within the former group. All materials procurement and construction is done through this network. Only contractors with assets (bank balance, capital equipment, etc., not less than Rs 200,000) can be licensed to construct government projects (Ali,1982). These contractors, with their own set of contacts with merchants and transporters from the former

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15. Exceptions on both sides include the truckers for coal fired kilns who are based in the coal producing outside the district and the reed mat producers who are in Sahiwal and in the neighbouring district.

group, are unwilling to work with those that use indigenous technologies.

Most important, the cost-plus system encourages these contractors to bid for only the more expensive import-intensive projects.

Thus when engineers of construction agencies state, as they often do, that they cannot find contractors and materials suppliers for projects using indigenous technologies, they mean, they cannot find them among those they are officially allowed, used, and willing to work with.

The LGRD department also has its lists of official contractors and network of materials suppliers largely from the first group. But in addition, it draws on producers, suppliers, and builders, from the second, unlicensed group. This greater flexibility stems from two factors. First, the pressure from local councillors eager to use entrepreneurs from their constituents. Second, the smaller-scale and greater dispersal of the construction projects. Moreover, the project committees formed by the councillors and the LGRD replace the contractors and the pressures these contractors bring to use import-intensive technologies.

2.7 The Scale Effect

Large- and even some medium-scale construction, such as rural hospitals, often require import-intensive technologies, heavy machinery and equipment, contractors, and materials suppliers able to meet the technical and supply demands of such projects, and, of course, government engineers trained to deal with all of the above.

When the same institution is responsible for both large- and small-scale projects, as is the case with the construction agencies, the attitudes and practices associated with the former projects tend to dominate in those institutions and are also applied to the latter projects. This tendency contributes to the prevalence of import-intensive technologies in these institutions and to some of the situations described previously.

Cement mixers purchased for the lone district hospital contracted out by the local PWD are then available for use in subsequent buildings - big and small - thus reducing the labour content of construction and further prompting the use of cement. The same contractor is relied upon to construct several primary and secondary schools across the district. And he will, of course, only do so if these schools are constructed using cement and steel, for which he is equipped and which have higher profit margins - official and unofficial - than schools using the indigenous technologies.

Such a "scale effect" may be avoided in construction through the local councils and the LGRD simply because the majority of their projects are smallscale: feeder roads, village water-supply shemes, primary and secondary schools, basic health units, rural health centres and sanitation.

2.8 Corruption

Commissioning and obtaining building contracts and materials supplies, and opportunities for implementing substandard construction allows substantial scope for illicit income from payoffs. The widespread practice of making such income in the construction agencies is acknowledged at all levels, unofficialy and officially. At a National Consultative Assembly Meeting, the Minister for Water and Power admitted to "rank corruption" in his Ministry for which "thousands were sacked... even chief engineers or superintending engineers (Pakistan Times, 23 February 1983).

Less well acknowledged is the fact that such corruption encourages the use of import-intensive technologies rather than indigenous ones.

The opportunities to obtain illicit income and its amount increase with the per unit cost of a project, and with the scarcity and regulation of its inputs. All three

characteristics apply more to import-intensive technologies than to indigenous ones.

As a resident from Malka Hans town stated:

> "Anything that the government puts under its control, the prices go up. The government made local magistrates responsible for selling cement at Rs 65 (per 50-kilo bag). We ordinary people could only get it at Rs 100. Those who had 'approach' with the magistrate would get large quantities at Rs 65, they would pay the magistrate Rs 10 or Rs 15 (and still make a big profit). If I go to the magistrate for a few bags for my house, he looks at me, at my clothes, and says, 'Who are you? Get out!'"

Moreover, opportunities to do and conceal substandard construction are more in import-intensive technologies than in indigenous ones (e.g., weak cement and mortar mixes, fewer reinforcing bars in the r.c.c slab, etc.).

Thus corruption entrenched in the construction agencies also reinforces the use of import-intensive technologies and the specific contractors and materials suppliers who have established their positions through it.

New contractors, materials suppliers, and those promoting new technologies can only dislodge those so entrenched by making larger illicit payments than the latter do. And to pay more they have to anticipate making more profits than their competitors. Given these conditions, the less costly technologies with smaller profit margins and the smaller contractors, materials producers, and suppliers associated

with such technologies clearly have less chance of gaining acceptance.

The adoption of technological innovation likewise moves from the simpler to the complex and expensive technologies. In an interview with a producer of new pre-cast concrete components roofing system, the firm's representative reminded this author to add [to the product's cost] the not inconsequential percentage they spent on bribing government engineers to specify their product. Shortly after, a Sahiwal engineer informed this author that they were adopting the components in place of girder and tile roofs in some buildings because these were cheaper - a claim that even the firm's representative could not make.

That corruption with similar effects on technology choice will not take hold in local councils and LGRDs cannot be guaranteed. It is less likely, however, because the smallscale projects attract less graft. The councillors are elected representatives accountable both to their constituents and to the government. And finally, the division of responsibilities among the elected councillors, the LGRD staff, and community members of project committees encourages some double checking against the actions of each other. All these factors are absent in construction implemented thrugh the conventional construction agencies.

2.9 The Influence of Foreign Aid

Despite their professed support for lower construction standards and the use of local resources, aid agencies can also distort preferences in favour of higher standards and import-intensive technologies. Others have treated this subject exhaustively and well (see for example, Tendler, 1975; Korten, 1980; Rondinelli, 1982). Here let us briefly mention three ways in which this distortion can occur and suggest an alternative to the conventional aid agencies; an alternative not raised by others.

Aid agencies are susceptible to prestige projects in the same way as national governments are. After all prestige and gaining political capital is a major motivation of aid. And as discussed, projects using import-intensive technologies are more prestigious.

Second donor, because of bureaucratic pressures for immediate results, agencies have a preference for lending to projects that have a finite and preferably short completion time. Their aid is biased towards construction rather than towards ongoing maintenance; thus, into projects and technologies such as import-intensive ones that seem to minimise the latter.

Third and most important, foreign aid agencies, by their very nature, are set up to fund the foreign exchange component of projects. It is in the interest of the agency to encourage imports and many stipulate that these come from the country they represent. After all, enhancing their county's exports is one of the ways such agencies justify their aid and lending programs domestically.

To attract such aid, national governments are then prompted to design projects that have large import and therefore foreign exchange components.

Major structural changes in these agencies may be necessary if these and other biases are to be removed; changes which, given the nature of such agencies may be difficult to implement.

A more immediate alternative maybe the small group of nevertheless influential aid organisations that have Third World roots. Such organisations as the Aga Khan Foundation and the Bank of Credit and Commerce International are active in funding and supporting development projects in Third World countries. They are headquartered in western countries but have no interests, nor obligations to encourage purchases from those countries. Their extensive personal and business links within the Third World make it easier for

them to support the local currency components of projects and field local personnel as well.

These organisations, however, are responsible for only a small proportion of total aid. Their role is perhaps in setting examples of what can be done either in the projects they fund or in inducing some of the required structural changes in other agencies through the joint funding of projects.

3. Summary

In sum, what we consider as desirable characteristics of indigenous technologies may be either irrelevant or even undesirable within the large city context, to the upper-income, and to the conventional construction agencies. Given that these income groups, spatial and institutional environments dominate the construction market and technology choice, it is not surprising that these technologies are superceded by import-intensive ones.

In contrast, the low-income groups and local institutions in the small towns and rural areas offer a potentially more sympathetic base on which to develop indigenous technologies. The current government's emphasis on such

areas and institutions may be tapped to promote such technologies, As noted earlier, a substantial amount of total government expenditures and activities are in the construction, in these areas, and through these institutions.

Problems remain, however. First, few decisions over choice of technology are in the hands of these local institutions. Second, although the institutions are more receptive to indigenous technologies, they are by no means immune to the pressures to adopt import-intensive ones. Finally, although a substantial amount of total construction expenditures are disbursed through these institutions, they are still a small proportion of the national total. The emphasis thus has to be on delegating decisions downward; incentives to encourage the use of indigenous technologies; and demand creation in key ways so as to spread this choice in the private sector. Such factors will be discussed in the concluding chapter.