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Background paper

BUILDING MATERIALS IN CENTRAL AMERICA**

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* This meeting was organized by UNIDO together with the Permanent Secretariat of the General Treaty on Central American Economic Integration (SIECA).

** The views expressed in this paper are those of the author and do not necessarily reflect the views of the Secretariat of UNIDO. Mention of firm names and commercial products does not imply the endorsement of the United Nations Industrial Development Organization (UNIDO). This document is a translation of an unedited original.

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1. INTRODUCTION

1.1. Macro-economic aspects

The importance of the building materials industry from the point of view of its contribution to the economic and social development of the Central American region, can be evaluated from different angles. From the standpoint of production, it gives rise to extensive activity covering both construction as well as industrial services such as commerce, shipment, finance, etc. Furthermore, it represents an investment contributing largely to the formation of fixed regional capital.1/ The industrial production of building materials relating to wood, chemical products, non-metallic and metal industries, represents 30 per cent of the industrial added value of the countries of the region. The building material and construction industries, taken as a whole, consist of enterprises with low capital investments. This contributes to generation of employment due to the existence of large numbers of small firms most of them from the formal and informal sectors which are able to provide jobs to numbers ranging from between one to 20 persons. Furthermore, because of its multiplying effect, construction of housing and regional infrastructure takes on a strategic role in the national and regional economies as a whole, especially those of the latter, due to lack of housing in the region. The problem is aggravated by the high population growth rate and natural phenomena affecting most of the countries of the region. There is an urgent necessity to increase the production of materials, mainly with local inputs, which can reduce dependence of foreign aid, as well as reduce costs and permit more self-focused development in the region.

The importance of the building activity in the industrial, commercial, transport and service sectors is extensive; it has been pointed out that at present it represents 30 per cent of the industrial sector and that during marketing it generates as much again in the commercial and service activities, but in the transportation its importance is even greater on account of the weight and volume of the construction materials.

The dependency on imported raw materials in Central America is obvious in the case of glassware, polyvinylchloride, iron and steel, electrical conduction material and special installations and finished products; another group of products, despite the use of the region's own raw materials, contains an appreciable percentage of components imported by way of the fuels and energy employed, plus the capital goods; this is the case with cement, bricks, concrete slabs, clay and wood products.

1.2. Market structure

The structure of the market for the building materials industry is taken to mean the set of elements in the organization of it that explain the behaviour of the enterprises in adapting to the market through price fixing,

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1/ Under current Central American conditions of low investment and replacement of equipment this is estimated as an average of 45 per cent of the gross formation of fixed capital.

sales and the use of technological resources. There are alsc barriers to entering the market, which include the control of higher technologies via patents or licences, and to access to certain production features and financial resources.

The above shows that one cannot understand the development of technology in the building sector without understanding the behaviour of firms and the structure of the market (as long as these analytical categories are adapted to the characteristics of the sector), if we want to gain an overall idea of it and not to overlook the basic differences between the various types of construction.

It is also important to distinguish between the various markets into which the building industry divides up in the Central American region:

- The road market divided into highways and urban paved streets.
- The electrical infrastructure, which includes all the facilities making up the process of generating and distributing power, i.e. power stations, hydroelectric power installations and, finally, urban and rural electrification grids.
- The various physical infrastructure, which includes bridges, irrigation systems, sanitary construction and other structures.
- The building market, which includes habitations, whether the commercial, hospital or the educational type.

2. CHARACTERISTICS OF THE INDUSTRY

2.1. Cement industry

The cement industry in Central America is one of the most important for building materials, since cement is an item which appears in a number of products forming part of the building industry; in this study, therefore, great importance was given to visiting at least one enterprise of this type in each of the countries.

These enterprises may be a dynamic element or one that impedes the development of the building industry; an inflexible supply of cement, furthermore, produces inflationary effects.

The industry is concerned with the production of portland cement and in certain cases fine cement, mainly used for infrastructural building, highways, docks, dams, structures for the industrial, commercial and service sectors and housing projects for the public and private sectors.

The demand for cement is a function of the dynamics of the economy in each of the Central American countries; hence over the years 1981-1985 there was a drop in production, although within this context the government projects were important factors for increasing this demand. In Costa Rica, where the Government has put into effect extensive housing projects over the last few years, growth in demand has been of great importance for stepping up production; growth over the years 1964-1978 was 10 per cent, while between 1964 and 1987 it was only six per cent, in view of the reduction in demand over that period, which forced a decrease in production over the years 1980-1985. The other Central American countries experienced a similar situation, i.e. a decrease in production over the same period with slight

differences in the length of the cycle. In El Salvador and Nicaragua the situation was slightly different for certain reasons, but at the same time the earthquake in El Salvador in October 1986 encouraged a faster growth in demand.

Since the earthquake in El Salvador, the demand has grown by approximately 30 per cent, while Nicaragua has remained stable. However, over the years 1980-1986 it increased to 10.7 per cent; nevertheless, considering that Nicaragua is the country with the lowest production and installed capacity, we realize that it is facing problems and urgently needs to improve its installed capacity.

These enterprises are characteristic in that they are not big ones, but among them there are some quite large-size ones. From the administrative standpoint some are more efficient than others; for example, one Costa Rica firm is well organized and the administrative process is more streamlined: there are control computers, main and personal computers for the most important executives where various production and administrative data are processed going even as far as the explosion of materials. On the other hand, others are less administratively efficient and do not even have computerized accounting.

The major problems in the cement industry are:

- The prices of cement are controlled by the Government;

- It is difficult to obtain foreign currency for buying the necessary imports, such as refractories and equipment, or for payment of interest and capital from abroad and, in the case of Honduras, on payment for the purchase of paper bags.

2.2. Sand and gravel industry

The industry produces sand and gravel for mixing with cement and water to obtain the concrete which is used for building the national infrastructure, for example highways, dams, ports, and buildings for industry and dwellings; for this reason these materials are important in the buildings industry.

The larger firms process clean washed sand and gravel selected in different sizes.

The demand for these products, just as for cement, is associated with the building cycle of the countries, hence during the period 1980-1985 they suffered the effects of economic recession, decreased their production and entered a critical situation.

In this branch of industry there are both formal and informal sector firms, the former with a certain level of acceptable technology and administration, since although the utilization of programming, direction and control is not the most efficient, there is, nevertheless, division of labour, and accounting with costing systems, while in the formal sector there is none. The enterprises of the formal sector are relatively few in number, while in the informal sector there exists in all the countries a large number of production units.

2.3. Lime industry

Lime is a very important product for the construction of family dwellings; it is used as a binding agent for mortar, bricks and blocks as well as for white-washing walls. It is produced either by formal enterprises, at a certain level of mechanization, which produce hydrated lime with excellent properties, or by the informal enterprises that exist in large numbers in each of the countries and which produce quicklime that is less pure than the hydrated type, with the calcium oxide remaining and the carbon dioxide removed. This product reacts with water. The demand for these products is extensive since they are associated, as pointed out, with housing projects of the government and the private sector. The hydrated lime companies are large, with high levels of mechanization, although they are now operating equipment without modern technology; they have a traditional administrative structure, without high levels of administrative technology.

2.4. Clay products industry

These plants produce tubular brick, solid brick (called "tayuga" and "rafón" and red in colour) and clay tiles; there is a high demand for this product and the brick is used for making external and internal walls, landings etc.; even in Tegucigalpa and Comayahuela it is preferred by the formal sector in lieu of cement slabs and tiles; it is used for roofs in the informal sector and as ornamentation for the roofs of houses built by the formal sector.

Although this type of plant is different from the lime type, it has similar features with regard to the administrative organization; those making tubular brick are to some extent mechanized and have traditional administrations, while the solid brick is produced by the informal sector.

2.5. Cement derivative industry

This industry produces a range of cement derivatives such as blocks for walls, paving stones and in some cases concrete, which follows the same construction trend. The manpower used for the production process is not skilled. A characteristic of this industry is also that it follows the same construction trend, and is, therefore, associated with the government dwelling projects. The crisis of 1980-1986 affected the demand for this product and the enterprises suffered financially.

The slab is broadly used in all Central American countries, but in Tegucigalpa and Comayaguela it has not penetrated very far and the walls are mainly made of red brick.

The block (slab) design of the dwelling represents approximately 10 per cent of the total cost. The sizes most used are 15 x 20 x 40 cm and 20 x 20 x 40 cm. The administrative growth of most of the enterprises has not followed their physical growth, to the extent that their account books are still not kept by means of data processing systems.

The owner and a member of his family carry out the administrative duties. There are very few firms in Central America that are formed as limited companies.

2.6. Fibrocement sheeting

This industry has also become a very important one, but in a number of countries the product has come to replace the clay tile and the zinc sheet. Costa Rica is the only exception where it has not been developed so intensively for roofs, but there is greater penetration in the case of plain sheets for walls.

As its principal market, the industry has new housing construction and the maintenance of existing dwellings, for which it provides corrugated sheeting for the roof and flat sheeting for the walls (dry wall). It also makes cisterns, septic tanks, water reservoirs etc. These plants operate in all countries of Central America. The demand dynamics depend principally on the economic situation in each country, but also on the government's construction plans.

During the crisis of 1980-1985 the demand for sheeting for housing construction dropped heavily, having been affected by the building cycle. For this reason the enterprises entered a critical period because of their production dropping so low. All the firms are organized as limited companies, but they do not all have the same administrative efficiency. Some handle programming and control satisfactorily, while others do so only modestly. Some of them have computing equipment and use it for production and administration, including interactive processes.

2.7. Tile industry

This industry covers two areas - the sanitary equipment industry and the glazed tile industry.

The sanitary equipment industry is marked by high investments, which reach $2,500 per worker which, combined with the use of 100 per cent skilled manpower, leads to the highest level of payment to the workers. On the other hand, the glazed tile industry is more modest in every respect.

The demand for tiled products is associated with the housing projects of both the government and private initiative; this has meant that over the period 1980-1985 they were mainly implemented through the replacement of imports rather more than by an increase in the internal demand, which underwent an obvious decline.

The administration of the sanitary equipment plants is modern; management of production, personnel, finance and sales are well established; the plants are managed by 30 persons in medium-level positions and professional experts or executive levels. Controls and information processing are carried out with a computer. The enterprise owners report that there is smuggling in sanitary equipment made outside the Central American area, which has an effect on internal demand.

2.8. Iron industry

Among reinforcing materials, iron rods, iron girders, galvanized sheeting, tie wire and nails, occupy an important place in the building industry.

The demand for these products during the period 1980-1985 dropped considerably and the firms were able to keep going and step up production through the replacement of imports.

These firms have a relatively modern administrative system and have their own main managerial posts; nevertheless, they are still open to improvement if the functions of planning and control can be introduced on a more technical basis. Use of the computer is mainly restricted to the administration and is very limited in the production process.

2.9. Aluminium industry

The principal characteristic of this industry is the fact that it is a transformation industry with little added value, reduced manpower and intermediate technology.

The demand for the product between 1980 and 1985 dropped considerably, resulting in decreased production, and there was only a small amount of activity with the replacement of imports.

The administration is simple and requires two executives and three workers occupying middle-level jobs. The controls and book-keeping are carried out in a traditional manner without using processor units. On account of the obsolescence of the equipment the Guatemala enterprise has problems with quality, a situation which was brought to light by the building firms.

2.10. Wood industry

Sawn wood is a basic building product and is used for the construction of sheet and tile roofs, wall linings, grills for terrace foundation, floors and concrete columns and as raw material for making doors and windows. Plywood is also made as a derivative of log timber. Honduras and Guatemala are the principal producers of sawn wood. For the most part production is dominated by family type organizations. Characteristic is the use of machinery that has been operated for more than 30 years to a large extent by non-skilled workers.

Furthermore, there are firms concerned with the production of plywood that are limited companies with up-to-date organization. In the sawn wood plants the administration is traditional and usually of the family type, they have neither managerial hierarchy, nor an administrative process; the accounting is simple and no cost account books are kept. From the administrative point of view the plywood companies lack efficient administration; they have managerial posts, but there is little planning or control. In Honduras computerized equipment will soon be introduced to improve the administrative and production systems.

The main problem is the supply of wood, which is affected by the institutional controls and requirements. Furthermore, there is unfair competition from woodcutters who work illegally.

The plywood is in competition with the new technologies for making cardboard, which is mainly imported from Asia.

2.11. Particle boarding

The main feature is the use of certain types of wood in their natural form which at best can be used as fuel; through this process they are converted into boarding for multipe use in house construction, partitions, general furniture etc. The administrative system is traditional and not aided by modern information processing systems.

2.12. Thermoplastic industry

This industry has an advanced technology; over the last few years thermoplastics have emerged as a product to replace galvanized piping, copper and iron piping, etc. to protect electrical installations, and also as a replacement for galvanized, concrete and other types of piping used in plumbing, sewage and rain drainage systems. The industry produces the entire range of equipment that these installations need. The demand for such products is constantly increasing on account of the replacement of other materials and the use of them is now widespread. Despite the fact that building dropped considerably between 1980 and 1985, the industry has maintained good production levels.

Administration is organized in a modern manner and the accounting, administrative and production records are computerized. A special product management level has been established in order to spread the use of this material for agricultural irrigation projects. On account of the simplicity of the installation, the informal sector has adopted this technique and is using it in the maintenance service provided for formal housing.

2.13. Other products

Among the other products investigated is ironwork. However, the firms are not technologically developed and produce few items at a high cost; they cannot compete with the imported product and the profit shown by the imported product is much higher than that produced locally. The demand for the product has been increasing and production by the area has been stepped up by replacement of imports. Nevertheless, there are opportunities for greater development. The administration is very simple and the producers themselves market the product including retailing.

The electrical conductor industry, on the other hand, is made up of firms that have been relatively recently created; the product is used for electrical installations in dwellings, hydro-electric complexes, street lighting etc.

Although the component is not important in dwellings, from the point of view of developing public services, lighting is necessary in new projects.

The demand for this product has increased mainly through the replacement of imports and to a lesser extent by housing projects. From the administrative standpoint the firms are modern and so is their technology. It was not possible to obtain more information on the administrative and production operations.

3. ECONOMIC AND FINANCIAL ASPECTS

3.1. Cement Industry

3.1.1. Cost structure

In the production cost of cement, energy and electricy represent more than 50 per cent of the variable cost; the "bunker" represents more than 50 per cent of the total consumption of power.

The "bunker" is a totally imported input, while electricity in our environment is an input that also partially contains an imported component.

Even though the firms work with different costs in percentage terms, the ranges over which they move are not very different; they are in percent:

Fuel .....20-25 per cent
Electricity .....10-12 per cent
Direct manpower .....10-12 per cent
Manufacturing costs .....5-10 per cent
Administration ..... 5-10 per cent
Profit before tax .....10-20 per cent

Apart from the "bunker"*, refractory brick is also imported for maintaining furnaces, and also large quantities of spare parts for maintaining equipment.

The drop in the parity of the dollar relative to European currencies had made imported inputs more expensive, especially refractory brick which is imported from Europe.

3.1.2. Price trends

The prices to the distributor, when the product is sold at the plant, are as follows:

Distributor prices in bags of 42.5 k
(in national currency and dollars)

	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica
Portland cement	4.60	10.00	7.59*	40.00**	189.95
Bulk		9.22			168.25
Public		12.50			198.10
Type					
Exchange	2.70	5.40	2.80		76.10
Dollar price for distributor					
Portland cement	1.70	2.71	1.85		2.49

*This is the price in San Pedro Sula; at the Tegucigalpa plant it is 7.68 lempiras.
**The Cordoba conversion has no comparative significance.

Both Honduras and Costa Rica have exported small amounts of cement at $45 per ton to the Caribbean, but this price is not very attractive since the domestic price is 30 per cent higher in Honduras and 15 per cent in Costa Rica.

The greatest complaint by the cement manufacturers is that the prices are fixed by the governments of each country.

The trend in cement prices for this reason is fixed for a certain time, and it remains in force until the government and enterprise fix another one. The price of cement in Guatemala has varied from 2.05 quetzals in 1979 to 6.50 quetzals in 1988, i.e. an increase of 317 per cent. It takes the following form:

*Type of fuel used for the furnace.

Guatemala: price of product and base index 1979

Year	price	index	year	price	index
1979	2.05	1.0000	1984	4.66	2.2732
1980	3.05	1.4878	1985	4.75	2.3171
1981	4.20	2.0488	1986	5.43	2.6585
1982	4.35	4.1220	1987	6.00	2.9268
1983	4.35	2.1220	1988	6.50	3.1707

Source: Construction Industry Chamber

In El Salvador the prices were fixed in March 1986, an occasion when there was a drop of 11.1 per cent, with a decrease from 9 to 10 colones per sack of 42.5 k. Costa Rica maintained prices for 36 months until 1 April 1988, as can be seen on the first table, an occasion when there was a 12 per cent drop, while the consumer prices changed in relation to the demand and supply, with speculators taking advantage of the greater demand; for this reason, the price changes on the market despite the fact that the intermediaries obtain the product at the same price; these changes over the last six months are as follows:

	Colones per sack	Index
December 1987	161.70	1.0000
January 1988	174.95	1.0807
February 1988	175.53	1.0896
March 1988	175.53	1.0896
April 1988	197.12	1.2236
May 1988	198.10	1.2297

Source: Construction Industry Chamber

3.1.3. Scale and production

The installed capacity for cement in Central America in tons of production per day and the percentage utilization are as follows:

	Capacity	Utilization
Guatemala	2,400 ton.	95 per cent
El Salvador	2,037 ton.	95 per cent
Honduras	1,535 ton.	100 per cent
Nicaragua	795 ton.	100 per cent
Costa Rica	2,740 ton.	58 per cent

During 1988 Honduras will expand the installed capacity of the company Cementos Hondureños S.A (CEHSA) by approximately 1,400 tons per day, which means that while Guatemala, El Salvador and Nicaragua may have problems in face of a virtual increase in demand, Honduras will have problems through a surplus; one of its plants will have to work at lower capacity with serious financial implications.

Guatemala has the capacity to produce 2,600 tons of clinker, hence by means of small short-term investments it will expand its production by 200 tons per day and in the meantime has also long-term projects for stepping up its installed capacity.

In El Salvador the company Cementos Salvadoreños is overcoming several bottlenecks in order to step up production in the short term since the long-term projects are not being implemented on account of political uncertainty.

For the moment Nicaragua is more interested in making the relevant studies for setting up a pozzolanic cement factory, which will step up the production of Portland cement.

Production is a function of the quantity required and the installed capacity, hence Nicaragua cannot in the short term step up production in the material sense and the situation is similar in Guatemala and El Salvador. In the case of Nicaragua chances of expansion are very limited. In El Salvador, because of political problems, the enterprises are only interested in overcoming the bottlenecks and do not envisage new products for expanding their installed capacity.

Central America: Production of cement in tons per day

	Guatemala	El Salvador	Honduras	Nicaragua	Costa Rica
1980	1572	1377	841	477	1476
1981	1582	1260	852	489	1901
1982	1444	1174	760	485	1162
1983		1212	1330	730	1070
1984	1246		1464	776	1279
1985	1584		952	682	1303
1986		955e		778	
1987		1223e	1460e	790e	1500e
1988	2400e	1340e	1530e	790e	1590e

Source: SIECA Bulletin No. 21 for Nicaragua 1986 - Special Directorates I, II and III of the RMC. For the countries, data is based on information given by the manufacturing enterprises.

In Honduras increase in production has been slow since the Industria Hondureña de Cemento S.A. was set up six years ago.

Because of political problems, the cement industry in El Salvador has not been stable; however, since the earthquake in October 1986 production has increased by approximately 30 per cent.

The Nicaraguan information is the most complete and shows us some uncertainty in production, since it was low in the years 1982 and 1985, but from 1987 onwards it has reached 100 per cent of the installed capacity.

Costa Rica underwent an increase in production of 10 per cent over the years 1964-1978, while between 1964 and 1987 it was only 5 per cent. This shows that the period 1981-1985 was a recession in the building sector, a common feature to most of the Central American countries.

3.1.4. Ownership and financial situation

Most of the Central American cement companies have national private capital, but there are also others in which the government sector is a shareholder in the enterprise as is the case with Nicaragua and Honduras, where the cement companies belong mainly to their respective Governments; in El Salvador there is a firm belonging to the Government which has been transferred owing to financial problems.

Most of the firms do not have financial problems, hence their funds are sufficient to manage their affairs on a steady basis. Furthermore, they have financial support from banks and in El Salvador and Costa Rica there is the stock exchange, which provides rapid financing at a lower rate than the bank for the purpose of working capital or for small-scale investments.

For new projects the enterprises have the backing of international institutions and in some cases a banking pool for dealing with financial operations involving large amounts. It has not been possible to obtain a breakdown of the liabilities of the firms.

The position of the Nicaraguan cement company, on the other hand, involves problems of liquidity and there is inadequate upkeep of the fixed capital, although it recently obtained $3 million for the purchase of spare parts for the next five years. There is, however, a need for supporting equipment, such as tractors and trucks.

The cement companies use capital in the intensive form despite the fact that they also provide jobs for a large number of workers; the new production projects involve multimillion finances which cannot be contributed by national enterprises or banks, hence recourse has to be taken to international banking cartels.

There is concentration of production, and one or two companies control the market of each of the countries in the area.

3.1.5. Marketing

All the companies sell their products from the plant, that is to say that their own intermediaries or builders purchase the product and transport it themselves. Payment is in cash when making the purchase.

When there are two firms as in the case of El Salvador, Honduras and Costa Rica, the market is divided geographically so as to avoid competition to minimize transport costs.

Some enterprises sell their product in bulk form more cheaply than when packaged, while in Nicaragua, through lack of paper bags it is only sold in bulk form; but there are handling losses in such cases. In Nicaragua there was no free market for building materials, but in June it was reported that it had been freed, but that prior to purchase it was necessary to fulfil certain requirements, which made it more difficult to make purchases.

3.2. Sand and gravel industry

3.2.1. Cost structure

The large sand and gravel plants have a high percentage of imported components, which does not affect the raw materials, but rather the operation of the plant; hence their consumption of fuel is high, but they also need maintenance with a supply of spare parts and tranport costs. The raw material costs are low and of domestic origin.

The following is a list of costs:

Raw materials	12-17 per cent
Transport costs	5-12 per cent
Manpower	10-15 per cent
Maintenance	10-15 per cent
Fuel	2- 5 per cent
Electricity	5- 8 per cent
Manufacturing costs	7-12 per cent
Administration	8-12 per cent
Margin before tax	20-30 per cent

3.2.2. Price trends

In Guatemala the prices of sand and gravel per cubic metre in June 1988 were the following:

	Producer	Public
Sand	5.000	18.000
Gravel	12.000	38.000

Prices are stable but are lower during the rainy season than in the dry period.

In July these prices dropped by 8 per cent through speculation and the exchange rate and there was an increase in the price of petrol.

The price trends over the last few years can be seen from the following figures:

	Index Sand	Index Gravel
1979	1.0000	1.0000
1980	1.2083	1.0455
1981	1.4167	1.2727
1982	1.3750	1.2727
1983	1.3750	1.2727
1984	1.338	1.1955
1985	1.3637	1.1836
1986	1.3667	1.8727
1987	2.1400	2.0427
1988	3.0000	3.1818

Source: Construction Industry Chamber

3.2.3. Scale and production

It is hard to establish what the installed capacity is at the Central American level and for each country since we are dealing with a highly dispersed industry; there are no studies on this particular problem.

The visits made to various Central American countries, however, show that the installed capacity of the sand and gravel industry is more than enough; when the demand of the construction industry dropped over the period 1980-1985 these plants cut down their production and passed through a financially bad time; however, they are now producing at a higher level.

3.2.4. Ownership and financial situation

Most of the firms are small and of the family type; some of them are informal; a few are organized as limited companies and there is no intensive capital; there are many large firms. The most common feature is that they do not have any financial problems, but only the biggest ones can use bank credit and it is difficult to obtain capital for expansion.

3.2.5. Marketing

Products are sold directly from the factory, but there is product marketing through small intermediaries and informal enterprises. Transport is provided by the intermediaries and builders.

3.3. Lime industry

3.3.1. Cost structure

The larger slaked lime industries use only domestic raw materials, but they make large investments in equipment, which affects their operating costs with repercussions for foreign currency.

In the case of this product it is important to point out that the plants have a higher profit margin through the freedom in fixing prices than similar cement plants. The cost estimates are as follows:

National inputs	6-12 per cent
Fuel	18-25 per cent
Electricity	15-20 per cent
Manpower	6-10 per cent
Manufacturing costs	10-15 per cent
Administration	5- 8 per cent
Margin before tax	20-25 per cent

3.3.2. Price trends

The price of a quintal of slaked lime in Guatemala in June 1988 was 9 quetzals, having been 11.24 quetzals in 1987. The price trends over the last 10 years can be seen from the following table:

Slaked lime

	Index	Year	Index
1979	1.0000	1984	2.0500
1980	1.6000	1985	2.2100
1981	1.8750	1986	2.7300
1982	1.8750	1987	5.6200
1983	1.8750	1988	4.5000

Source: Guatemalan Construction Chamber.

3.3.3. Scale and Production

Lime underwent a drop in demand over the period 1980-1985; the producing companies have old equipment which is why they have problems in increasing production. There is no flexible supply, which encourages hoarding and an increased price on the market, which at certain times is even higher than the price of cement.

The large enterprises have a capacity for producing more than 40,000 tons a year.

3.3.4. Ownership and financial situation

The large enterprises are limited companies with domestic capital, but most of the firms are the family type. The financial situation of the enterprises is stable, but there is a low return on investment.

3.3.5. Marketing

Marketing is conducted in the same way as for sand and gravel; the product is sold at the manufacturing unit, but it is also marketed by firms in the formal and informal sector. Transport is provided by intermediaries and consumers. Payment is in cash.

3.4. Clay products industry

3.4.1. Cost structure

The larger clay plant has high maintenance costs incurred through the use of mechanized equipment, while the informal sector has no costs at all.

The cost structure for the large firm is as follows:

Raw materials	15-20 per cent
Maintenance of machinery	7-10 per cent
Fuel and electricity.....	20-30 per cent
Manpower	10-15 per cent
Administrative costs	10-12 per cent
Margin before tax	20-25 per cent

The informal company uses firewood, hence there is no consumption of imported fuel or electricity, but rational use is made of plant fuel.

3.4.2. Price trends

The price trends over the last 10 years can be seen from the following:

Year	Tubular	Perforated
1980	1.0000	1.0000
1981	1.1652	1.0462
1982	1.1652	0.9938
1983	1.1652	0.9938
1984	1.2321	1.1248
1985	1.2714	1.2527
1986	1.7563	1.7045
1987	2.2066	2.1464

Source: Guatemalan Construction Chamber

3.4.3. Scale and production

In the area of production materials a few firms co-exist with a large installed capacity and a high number of small firms with smaller capacity. It is very difficult to establish the installed capacity at Central American level, since there are no studies on the subject.

The larger firms which produce clay products have a capacity above 50 million bricks per year; at the present time they are producing less than 50 per cent of their capacity. There are 10 or 12 enterprises of this type in Central America. The informal companies have enough capacity to produce three million bricks per year, but they are also producing below the installed capacity.

3.4.4. Ownership and financial situation

The larger firms are limited companies with domestic capital, but most of them are family enterprises; there are also units in the informal sector.

3.4.5. Marketing

Marketing is done in the same way as for sand and gravel; sales are made from the enterprise, but there is also marketing by companies belonging to the formal and informal sector. Transport is carried out by intermediaries and consumers. Payment is in cash.

3.5. Cement derivative industry

3.5.1. Cost structure

Cement derivatives cover a large number of products and the situation is very similar in respect of cost; as a result we will only take as an example the percentage breakdown of the cost of cement blocks (slabs):

Raw materials	40-50 per cent
Manpower	15-20 per cent
Electricity	1- 3 per cent
Administrative costs	10-15 per cent
Manufacturing costs	9-10 per cent
Margin before tax	10-15 per cent

In Nicaragua manpower costs reach as much as 63 per cent, while t' is no margin.

3.5.2. Price trends

Block prices in June 1988 were as follows:

Central America: price of block 20 x 20 x 40 per thousand

	Guatemala	El Salvador	Honduras
National currency	570.00	1,700.00	1,230.00
Rate of exchange	2.70	5.40	2.80
Dollars	211.11	314.81	439.28

The prices have increased over the last 10 years by an average of 269 per cent on account of inflation; the trends have been as follows:

Guatemala, blocks; price index per thousand

Year	Price index	Year	Price index
1979	1.0000	1984	1.3425
1980	1.0521	1985	1.5600
1981	1.3596	1986	1.6625
1982	1.5417	1987	2.0746
1983	1.2763	1988	2.3750

Source: Construction Chambers

3.5.3. Scale and production

In one of the most numerous industries to be found in Central American countries large, medium-size and small firms co-exist together with the informal sector; to evaluate the capacity and production is very difficult, but in almost all these countries the installed national capacity is under-utilized; i.e. a firm visited in Guatemala with a production capacity of 54,000 blocks per day, only operates at 33 per cent.

In Honduras there is only one shift and the plant therefore does not operate at full capacity; production over the last 10 years has dropped by 15 per cent.

Nicaragua has the capacity to produce three or four million large blocks and 10 to 11 million standard blocks a year. Here they are turning out at almost 100 per cent with one shift only.

Production depends upon the machinery available. A machine can produce approximately 2,000-2,250 units in an eight-hour shift. Production of blocks in Nicaragua is as follows:

Year	Units	Year	Units
1980	3.430,405	1984	13.276,500
1981	4.377,600	1985	13.525,870
1982	4.119,170	1986	14.855,810
1983	3.877,100		

Source: Special Directorates I, II and III of the RMC

3.5.4. Ownership and financial situation

The larger firms are limited companies with domestic capital, but most of them are family concerns; there are also units in the informal sector.

3.5.5. Marketing

This is undertaken directly by the manufacturer at his facilities, but sometimes there are distributing firms of the same group. The informal sector markets the product at its own product units, but there are also informal sector distributors. Transportation is carried out by the producer firms, intermediaries and builders.

3.6. Asbestos sheeting and fibrocement industry

3.6.1. Cost structure

The costing data is the most difficult information to obtain from a firm, but according to the information supplied by the executives of the firms visited in Guatemala, El Salvador, Nicaragua and Costa Rica, the raw materials keep within certain ranges, namely:

Domestic raw materials	30-34 per cent
Imported raw materials	4 -5 per cent
Fuel and power	4 -5 per cent
Direct manpower	8-12 per cent
Maintenance and depreciation	8-12 per cent
Administration	10-12 per cent
Margin before tax	5-20 per cent

In Nicaragua the cost of labour is higher, while there is no marketing margin.

3.6.2. Price trends

El Salvador shows the following prices per M^2V*

	Grooved sheeting		Rural sheeting		Plain sheeting	
	$	colon	$	colon	$	colon
1982-83	4.16	10.39	4.11	10.27	3.74	9.35
83-84	4.64	11.60	5.21	13.03	4.23	10.59
84-85	4.13	11.12	4.87	13.11	4.03	10.84
85-86	3.04	15.21	3.34	16.71	1.81	9.06
86-87	3.84	19.18	4.23	21.14	2.12	10.61
87-88	5.22	26.11	4.80	23.99	2.86	14.32
June 88	5.54	27.71	5.09	25.46	3.04	15.20

Source: Eureka Company

The price of fluted sheeting increased by 82 per cent between 1985 and 1988, plain sheeting by 68 per cent and rural sheeting by only 52 per cent. In Costa Rica a M^2V of sheeting for walls varies between 182 and 208 colones (2.39-2.73 dollars), while sheeting for ceilings varies between 220 and 225 colones (2.89-2.96 dollars).

The Engineering and Architecture Department of the National Institute for Housing and Urban Construction (INVU) reports that in April 1985 the price per plate was 54 colones and that from January 1986 there was a price increase; however, the highest increases are observed in January and April of 1988, when the price reached 80 colones, equivalent to a rise of 48 per cent. The dollar prices are slightly lower than in El Salvador.

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*A strip of 1 m^2 by 5 mm thick.

3.6.3. Scale and production

The installed capacity of each of the Central American countries is as follows:

	Installed capacity in M^2V
Guatemala	-
El Salvador	7.3 million
Nicaragua	2.8 million
Costa Rica	4.1 million

In El Salvador there are three plants, two of which are owned by the firm Eureka; the plant known as the Boulevard is concerned with the production of asbestos sheeting, and has a capacity for 3.0 million M^2V (a strip 1 M^2 by 5 mm thick); this plant produces at 100 per cent. The other plant, known as Ilopango, produces fibrocement or the "new technology" as it is called; its capacity is 3.5 million M^2V and it is now producing 1.8 M^2, i.e. working at 54.1 per cent.

There is also the plant Duralita de Centroamerica, which has a capacity of 9 million kilograms per year; this plant operates at 100 per cent of its capacity and, according to the firm's executive, it covers 20-30 per cent of the domestic market.

In Nicaragua there is only one firm with a capacity of 2.8 M^2V, which is working at 100 per cent.

The Costa Rican enterprise has a capacity of 4.1 M^2V and is working at 50 per cent. It has two production machines, but only one is in operation; the other has been shut down until there is an increase in demand. The production data is as follows:

Central America: Production in millions of M^2V

	Guatemala	El Salvador*	Nicaragua	Costa Rica
1983		1.5	2.0	1.2
1984		1.5	2.0	1.7
1985			2.3	1.9
1986		1.6	2.5	1.7
1987			2.6	2.4
1988		2.0		

*millions of m^2 roofed with asbestos cement

Source: Nicaragua: Special Directorates I, II and III of RMC

In El Salvador production reached maximum development in 1979, when it produced 2,000 m^2 of roofing; from that date the demand and the supply dropped sharply, and in 1983 was only 79.9 per cent of the 1979 production. The world economic recession and the country's political crisis were the causes of this.

Over the last few years in El Salvador the firm Eureka has introduced rural sheeting of lower quality, size and price, which according to the available information is also partly subsidized by other lines. It has been readily accepted by the informal sector on account of the ease of transportation and use in the house, in addition to its low price.

In Costa Rica production was also critical in the period 1980-1984, but in the last few years there has been a recovery mainly due to the Government's housing projects. The firm gave up the manufacture of asbestos cement sheeting. Inputs of raw material imported from abroad consist of asbestos and pulp, according to the type of sheeting, but cardboard from Guatemala is also imported as an alternative for the mixture.

Cement is the most important product.

3.6.4. Ownership and financial situation

Generally speaking, the firms enjoy a good financial position, but the Costa Rican position could be much better if the plants worked at higher capacity and not only 50 per cent.

Some firms such as Ricalit in Costa Rica, Eureka in El Salvador and Duralita in Guatemala are mainly foreign-capital enterprises, more specifically Eternit of Switzerland, while others such as Duralita de Centroamericana in El Salvador have domestic capital. Nicalit in Nicaragua is State-owned. They are companies which use intensive capital on account of the size of their needs.

3.6.5. Marketing

Between 40 and 50 per cent of the marketing is done by small-scale distributors, and the rest is sold directly at the plant to the building firms and the Government. The margins that the intermediaries show are between 20 and 30 per cent, depending on the product and the volume of purchase. In El Salvador rural sheeting has a higher margin to make its sale worthwhile, since the purchase volumes are lower. Transport is carried out by private firms or by intermediaries of the plant or builders.

3.7. Tile industry

3.7.1. Cost structure

The cost structure for enterprises concerned with the production of sanitary tiles is as follows:

Domestic raw materials	10-15 per cent
Fuel and electricity	15-20 per cent
Imported inputs	2- 5 per cent
Manpower	15-20 per cent
Manufacturing costs	10-13 per cent
Administration	9-13 per cent
Margin before tax	25-35 per cent

3.7.2. Price trends

The trend in weighted sale prices of sanitary equipment is as follows:

Year	Guatemala Weighted Quetzels	Costa Rica Economic washroom Colones	Centaur White
1979	52.86		
1980	72.35		
1981	85.99		
1982	73.09		
1983	86.36		
1984	87.94		
1985	225.1	2,290	6,670
1986	233.4	2,420	6,970
1987	221.3	2,250	6,555
1988	239.0	2,740	8,240

Source: Guatemala: Guatemala Construction Chamber; Costa Rica: National Housing and Urban Development Institute

3.7.3. Scale and production

The tile industry is one which has developed over the last few years; the installed capacity for this type of industry ranges from eight to 10,000 sanitary units per year, i.e. wash basins, lavatory bowls, bidets, etc. The plants are producing at between 90 and 95 per cent. The capacity of the plant visited in Guatemala is being utilized at 95 per cent.

Production has been increasing over the years by taking advantage of the decline in imports.

3.7.4. Ownership and financial situation

These firms have large inventories, capital intensity and solvency; their commercial activity is of Central American magnitude. They are organized as limited companies and approximately 50 per cent of the social capital belongs to transnational concerns. The capital in circulation varies between 15 and 20 million quetzals.

3.7.5. Marketing

This is done through 120 distributors in Central America in the following form:

Country	Distributors
Guatemala	30
El Salvador	30
Honduras	20
Costa Rica	40

The coverage of the market in Guatemala is 70-80 per cent, the rest is covered by imports. 40 per cent of the sales are for Guatemala and 60 per cent are exported to Central America. With a 40 per cent expansion of the installed capacity of the plant export will begin exporting to the United States.

3.8. Iron and iron derivatives industry

3.8.1. Cost structure

The cost of iron derivatives is affected predominantly by the imported raw materials; the breakdown is estimated as follows:

Imported raw material	15-20 per cent
Domestic raw material	15-20 per cent
Direct manpower	5- 9 per cent
Fuel and power	5-10 per cent
Administration	8-12 per cent
Margin before tax	20-30 per cent

The "bunker" is an important item in the direct cost; 17 per cent of the direct cost is used for melting the scrap, while the rolling uses 7 per cent.

The billet is the raw material imported to make the rolled metal, the prices of which have risen steeply in the last year; the cost in January 1988 was $210 per ton, while in May it reached $275.

3.8.2. Price trends

The prices of iron in June 1988 were as follows:

	Guatemala		El Salvador	
	Quetzals	Dollars	Colones	Dollars
Iron	62.50	23.15	112.00	20.75
Wire	79.75	29.55	124.00	22.96

The difference betweeen the price in Guatemala and in El Salvador is the distributor's intermediary price margin; in El Salvador the price is for sale from the plant, while for Guatemala it is the price of the distributor who has a margin of 12 per cent in iron and 30 per cent in wire.

The price trends in Guatemala are as follows:

	Index Flat iron	Index Corrugated iron	Index Wire
1979	1.0000	1.0000	1.0000
1980	0.9700	1.1329	1.1667
1981	0.9828	1.1348	1.2227
1982	0.9600	1.0714	1.2350
1983	1.1012	1.2714	1.2897
1984	1.1320	1.2571	1.3200
1985	1.7000	1.9976	2.8070
1986	2.8000	2.9376	2.9650
1987	2.6236	2.3962	2.6400
1988	3.0816	2.9762	2.6583

Source: Guatemala: Guatemalan Construction Chamber

3.8.3. Scale and production

Guatemala's installed capacity is 365,000 tons per year and the country is producing 219,000 tons per year, i.e. at a rate of 60 per cent.

El Salvador has a capacity of 300,000 tons per year; one of the firms visited was working at 66 per cent of its installed capacity, but at the time the plant with higher capacity was underutilized. In general the installed capacity in Central America is underexploited but it does have the capacity to supply the market for the next five years.

3.8.4. Ownership and financial situation

These are limited companies which use capital in the intensive form, with domestic capital predominating.

3.8.5. Marketing

The firms have regular wholesale distributors of the same group, who sell to semi-wholesale and retail distributors. The wholesale firms have their own transportation, as do the semi-wholesalers.

The firms sell for cash and on rare occasions advance credit. The smallest firms sell directly from the plant.

3.9. Aluminium industry

3.9.1. Cost structure

The costs of the aluminium industry are influenced to a major extent by the consumption of imported raw material, known as "Tocho" (billets or cylinders of aluminium), and second place is taken by the consumption of energy.

Percentage breakdown of the cost is as follows:

Raw Material	45-55 per cent
Manpower	3- 8 per cent
Fuel and electricity	5-10 per cent
Indirect manufacturing costs	5-10 per cent
Margin before tax	30-40 per cent

3.9.2. Price trends

A kilo of profiled aluminium in Guatemala cost 1.86 quetzals in June 1988, whereas in 1982 the price was 0.64 quetzals, which represents an increase of 189 per cent.

The price trends are as follows:

Guatemala: Profiled aluminium price index

Year	1982	1983	1984	1985	1986	1987	1988
Index	1.00	1.25	2.66	3.15	3.51	3.66	4.89

3.9.3. Scale and production

The aluminium plants in Guatemala have installed capacities for the production of more than 6,000 kilos each, but through a reduction in the building rate over the years 1980-1985 production was substantially reduced; however, in the last few years there has been a clear recovery and the plants are now working at 40 per cent of their capacity.

The plant set up in Guatemala has a capacity of approximately 6,040 k and turns out between 2,400 and 2,700 k of profiles per year, in a nine-hour work day.

The process is carried out by heating and extruding aluminium billets through an extrusion furnace which has at its outlet a matrix shaped in the profile that it is desired to produce. It is then drawn by hand and cut into strips of the desired size.

3.9.4. Ownership and financial situation

The firms are organized as limited companies with Salvadorian domestic capital, both in Guatemala and in El Salvador.

The aluminium plants are in a satisfactory state since they work with resources provided by their clients, without incurrent financial expenditure, and are also very cost-effective.

3.9.5. Marketing

This is done directly at the plant installations. Clients put in orders and collect the material. The sales policy is payment in advance and delivery within 30 days.

3.10. Wood Industry

3.10.1. Cost structure

Wood in the form of logs is the principal component of the raw material costs; the breakdown of the costs is as follows:

Raw materials	45-50 per cent
Manpower	5- 8 per cent
Electricity	2- 4 per cent
Administrative costs	2- 3 per cent
Indirect manufacturing costs	10-15 per cent
Margin before tax	25-35 per cent

Cost of plywood

Inputs	60-62 per cent
Added value	35-40 per cent

Raw materials	40-45 per cent
Manufacturing costs	5-10 per cent
Depreciation	1- 2 per cent
Manpower	25-30 per cent
Financial outlay	2- 3 per cent
Administrative costs	8-10 per cent
Margin before tax	5-10 per cent

The domestic inputs are: silver fir, ocarpa, resin, sand, arina, etc.
The imported inputs are: sand paper and glue.

3.10.2. Price trends

The price of wood per foot in Guatemala in June 1988 was 80 centaros, and the price trends are as follows:

Guatemala: Price index for sawn wood

Year	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988
Price	1.00	1.14	1.29	1.43	1.71	2.29	2.86	3.57	4.57	5.71

Source: Construction Industry Chamber

For the purpose of the study only the price of pine wood is considered.

Prices of plywood:

In June 1988 the prices were as follows:

	Lempiras	Dollars
Domestic price per sheet	17.22	6.15
Export price per sheet	-	4.20

3.10.3 Scale and production

The installed capacity in Guatemala ranges from 450 to 500 million board feet and for the Honduran enterprises from 500 to 600 million board feet with a working capacity of 30 to 60 per cent.

One plant investigated in Guatemala has a capacity for 16,000 feet per day and it works at a capacity of 30-50 per cent. Sawn wood production is low on account of the difficulties in obtaining operational licences from the Government authorities in charge of forestry, such as INAFOR in Guatemala and COHDEFOR in Honduras.

The enterprises buy some of the wood that they process, while the rest is obtained from forests in their possession.

The Honduran corporation for forest development COHDEFOR controls wood production and supplies statistics relating to it. Production is as follows:

Production in millions of board feet:

Year	Honduras		
1978	261	1983	192
1979	240	1984	175
1980	231	1985	177
1981	230	1986	167
1982	201	1987	199

Source: COHDEFOR

Installed capacity for the production of plywood is 720,000 sheets per year, but the industry only works at 33 per cent.

Plywood production in Honduras is as follows:

	Sheets	m^3
1986		
Coloured wood	202,765	3,591.6
Plywood	177,958	4,200.2
1987		
Plywood	232.747	
1988 up to May		
Plywood	126,660	

The production was 30 per cent higher than in 1987.

3.10.4. Ownership and financial situation

Approximately 85 per cent of the sawmills are privately owned.

The manufacture of plywood in Honduras is covered by 74 per cent private capital of domestic origin and 26 per cent Government capital, with COHDEFOR exercising control over the latter.

The financial situation of this industry is good, since the enterprises for the most part have been in existence for more than 30 years, own their forests and work with an attractive margin of profit.

The plywood industry in Honduras has bank credit under contract at 11 and 12 per cent. There are difficulties in obtaining resources for expansion of output and for working capital.

The wooden particle block plant in Guatemala is the only one of its kind in Central America and is organized as a limited company with domestic capital. Its economic situation is good in view of the fact that the product has been better accepted recently through a change in administration.

3.10.5. Marketing

This is done directly at the sawmill. Some of the mills have a distribution point if they are located in a place where there is no commerce. The sales policy is in all cases cash and fixed prices. Honduras exports wood inside and outside the area; in 1986 it exported 94.2 million board feet, 70 per cent of which went to the Caribbean and the United States, 10 per cent to the rest of America and 20 per cent to Europe.

Agglomerate industry

The producers of agglomerates have wholesale and retail distributors, in the latter case they are ironmongers etc.

The prices are for sale from the factory. As competition there are pressed cardboard sheets (mazonite) which are imported from Asia.

3.11. Agglomerated board industry

3.11.1. Cost structure

The information provided by the only firm producing this product was incomplete; nevertheless, the costs have been estimated in the following form:

Percentage breakdown of cost

Raw materials	45-50 per cent
Electricity	1- 4 per cent
Manpower and manufacturing costs	20-25 per cent
Margin before tax	25-30 per cent

3.11.2. Price trends

The trends of the prices of particle boarding over the last three years, per type of board produced, are as follows:

Board thickness (inches)	1988	1987	1986
1/4	13.60	12.15	12.15
3/8	19.20	17.15	17.15
1/2	24.20	21.60	21.60
5/8	29.20	24.00	24.00
3/4	34.00	30.00	30.00
1	44.80	40.00	40.00
1 1/2	65.40	60.00	60.00

3.11.3. Scale and production

The installed capacity for Guatemala is 24 cubic metres of raw material, sufficient for supplying the domestic market.

3.11.4. Marketing

This is done through a network of 90 wholesalers throughout the Republic from the same plant. The firm proposes the sale prices for the public and fixes a margin of profit of roughly 20 per cent for the wholesalers.

Fifty-five per cent of the sales are cash and the rest is credit.

3.12. Thermoplastics industry

3.12.1. Cost structure

In the PVC component the raw material represents 100 per cent of the costs while the other variable costs are not so important, except for the manpower. The raw material comes from outside the country and the imported component has a determining effect.

Estimation of the cost structure is as follows:

Imported raw materials	38-43 per cent
Manpower	12-16 per cent
Electricity	4- 6 per cent
Manufacturing costs	5-10 per cent
Administration	6-10 per cent
Margin before tax	25-30 per cent

3.12.2. Price trends

The price of PVC per kilogram in Guatemala was as follows:

1985	1986	1987	1988
0.75	1.05	1.57	1.88

3.13. Other products

3.13.1. Cost structure

Other products were investigated but in less detail, not only because they represent a smaller percentage in the cost of a dwelling, but also because the plants were not very co-operative; consequently only the information considered of any importance will be mentioned i.e. lathes (screws) and ironwork.

The cost of nuts, bolts and ironware are considerably affected by the imported raw material. The estimated cost structure for nuts, bolts and ironware is as follows:

Raw material	30-35 per cent
Direct manpower	8-20 per cent
Maintenance	8-10 per cent
Energy	5- 8 per cent
Spares	10-15 per cent
Administration	8-12 per cent
Margin before tax	30-40 per cent

3.13.2. Price trends

Electric cables show the following price trends:

Year	12 cables	cable
1979	1.0000	-
1980	0.9545	-
1981	1.0000	1.0000
1982	0.7727	0.8151
1983	0.7727	0.9273
1984	0.8181	0.9152
1985	2.2273	2.1848
1986	1.9091	3.5485
1987	1.4545	1.5879

Source: Guatemalan Construction Chamber

4. TRADE

Foreign trade, more specifically imports from abroad, shows strategic outlets for the development of the construction materials industry by means of a policy by which imports are replaced.

In view of the abundance of information that exists on the subject only those products have been selected whose importance makes them suitable for replacement by domestic or regional products.

The total import of construction materials in terms of wood and wood products, non-ferrous metals and their derivatives, and ferrous products and their derivatives in 1980 attained 304.2 million, but because of the economic crisis in the Central American countries the figures dropped to 192.6 million in 1984, despite the price increases; in 1985 recovery began and totalled 369,575 tons, with a value of 203.6 million Central American pesos, corresponding to the import of 299,465 tons from outside, at a value of 171.5 million pesos.

Imports from abroad in 1985 were: Costa Rica - 50.5 million, Guatemala - 36.2 million, Honduras - 31.5 million, El Salvador - 28.4 million, and Nicaragua - 24.9 million.

4.1. Asbestos cement and fibrocement sheeting

Fibrocement is a type of sheeting used for roofs (corrugated) or for dry walls (plain) and is imported from outside the area since there is practically no interregional trade.

The imports from the rest of the world attained 4,544 k in 1981 with a value of 1.1 million Central American pesos; later on they decreased to 62 thousand pesos, in 1983.

In the following years a recovery started, and 3,055 k were imported in 1984, at a value of two million pesos, the only importing country being Nicaragua.

As a whole this product is well covered by domestic production and there is an installed capacity for supply without any problem in the coming years.

4.2. Tiles and porcelain

Despite the fact that in Central America there are several firms producing tiles and porcelain, there are still large volumes of imports from outside the area. Intraregional trade dropped to its lowest level in 1981, when two million pesos worth was marketed; subsequently with slight ups and downs the industry recovered in 1985 with the marketing of 3.1 million pesos worth.

The principal importers of this product in 1985 were El Salvador, which imported 1.6 million and Honduras with 1.1 million, while the producers themselves were Costa Rica and Guatemala.

Imports from the rest of the world reached a high point in 1980 when the area gained an income of 1.5 million dollars, and dropped by 27 per cent when 1.1 million was marketed in 1985. The principal importing countries in 1985 were Guatemala, El Salvador and Honduras, with values ranging from 300 to 400,000 pesos.

Under this heading there is need for more financial, technical and integrational effort at the level of the enterprises in order to step up production, improve the quality of the product and expand the quantity of output.

4.3. Glazed tiles and mosaics

These products are being produced in different countries of the area and there is trade within as well as outside Central America. The imports within Central America reached a high point in 1978, when 3,065 k were sold, at a

value of 1.9 million Central American pesos, whi.e in 1981 imports reached their lowest point with 1,000 k worth and 262,000 Central American pesos; the recovery in the following years was momentary, since after reaching 1,492 k, at a value of 1.2 million pesos, imports dropped to 1,309 k, with 962,000 Central American pesos in 1985.

The above shows that the trade is complementary and involves low-cost products, since the mean price per kilogram fell last year in a very clear-cut fashion. The importing countries are Guatemala, El Salvador and Honduras, and the exporters are El Salvador and Honduras. Up to 1980 Nicaragua was the greatest importer in trade within Central America.

Imports from outside the area reached a high point in 1979, when 3,602 k were imported at a value of 2.1 million Central American pesos. In 1982 they reached the lowest point when only 285 k were imported at a value of 231,000 Central American pesos, but in the following years there was a slight recovery and a figure of 1,707 k was reached at a value of 1.2 million in 1985. In order of importance the greatest importers are Honduras, with 501,000 pesos, Costa Rica with 399,000 pesos, and Guatemala with 258,000 Central American pesos.

This industry will have to seek better integration of the enterprises so as to cover this gap in imports which still exists by increasing installed capacity and introducing certain innovations in the product.

4.4. Iron products

Construction materials derived from iron are the most important items of import from outside the area. The products listed below show the value of the imports for the years 1982-1985:

batch		1982	1983	1984	1985
681040001	Profiles	740	15,073	1,661	345
681040002	Girders	10,070	7,943	8,926	9,162
681040009	Other	4,088	2,791	2,119	3,482
681050001	Plain sheeting	51,715	51,860	53,134	63,488
6810702	Galvanized	8,445	8,919	6,171	5,676
6811300	Piping and G	8,599	9,353	8,489	7,063
681130009	Other	19,685	18,550	7,491	7,493
6811400	Cast piping	207	1,557	3,201	2,151
6811599	Iron parts	2,261	2,275	3,717	1,005
	Total	105,810	118,321	94,909	99,865

Details of batch:

68104001- angles, profiles, strips or sections which are shapen and perforated (e.g. "DEXION" metal, except for building construction).

68104002- bars, beams, sections, angles and profiles up to 7.62 cm (3 inches) on the larger side; plates up to 17.78 cm.

68104009- other.

68105001- "universals", plating and sheeting, smooth.

6810702 - galavanized plating and sheeting.

6811300 - iron or steel piping, tubing and accessories (except cast iron), lines or not, including grooves and channels.

681130009- other.

6811400 - cast iron piping, tubing and accessories.

6811599 - cast iron or steel parts and forged iron or steel parts.

The above statistics on imports of some of the principal products derived from iron make it clear that it is a very important item as a building material and that via this building component large sums of foreign currency flow abroad. It is recognized that these are difficulties with regard to development from various standpoints - technical, financial, marketing, but it is a strategic outlet which should concern governments, international organizations and private initiative so that in future they can stimulate development of this industry or change the construction standards so as to diminish consumption. The volumes and values attained in trade within Central America are considerable and the supplies that come from domestic production are also considerable, but there is still a strategic outlet and it would be of advantage to develop it.

4.5. Plate glass

Another important item is plate glass used for construction. This is, however, not produced in Central America despite the fact that plants have been set up in Guatemala and El Salvador, but for technical and financial reasons never started production.

The behaviour of the imports over the last 10 years, as estimated during the mid-eighties by the Secretariat for Economic Integration, indicates a crisis in the construction branch, since imports from outside areas attained 13,569 metric tons, at a value of 6 million Central American pesos in 1980, but then dropped to 8,913 metric tons, at a value of 4.2 million pesos in 1984. In 1985 a recovery began in the import of glass, reaching 10,321 metric tons at a value of 4.5 million pesos.

The main importing countries in 1985 were Nicaragua, with 1.9 million, and El Salvador, with 1.2 million, these being the countries that began the recovery, after which Guatemala, Honduras and Nicaragua continued the downtrend. The author does not consider that the imports within Central America should be re-exported, since there is no domestic production and the amounts are insignificant.

5. TECHNICAL ASPECTS OF PRODUCTION

5.1. Cement industry

5.1.1. Technical aspects

In Central America use is made of both wet and dry technologies, the most advanced among them predominating in Guatemala and Costa Rica, where the entire production process is dry. Nicaragua produces solely by the wet system. Honduras and El Salvador have combined systems. The wet technology uses up more fuel. For example in El Salvador the consumption of fuel oil per 42.5 k bag of cement produced is 1.64 gallons by the wet technology and 0.99 by the dry one. The technology used stems mainly from Europe or North America.

5.1.2. Origin and type of inputs

Cement inputs are of domestic origin, namely from the calcareous stone, iron oxide and gypsum quarries. El Salvador has to import iron oxide and gypsum from Guatemala but the amount of these products contained in the cement does not create serious problems for the industry, despite the high cost of transportation and the distances covered.

The principal domestic consumption is therefore calcareous stone, which is an input that has to be located at the plant itself. Nicaragua has not studied the raw material quarries to any extent, hence a geological study will be made, with the technical assistance of UNIDO and financing from the Soviet Union, in order to quantify the quarries and promote some of the construction material plants.

5.1.3. Employment and characteristics of manpower

In 1988 there were eight industrial cement plants operating in the Central American area; they employed more than 3,600 persons, with an average of 450, the numbers ranging from 300 to 850 persons. Between approximately 80 and 85 per cent are workers, 15 to 20 per cent are administrative staff, and only 2 per cent are technical personnel.

5.2. Sand and gravel industry

5.2.1. Technical aspects

Simple technology is used based on mechanization of the process running from the mining operation to the loading of trucks using excavators, which then transfer the sand to the feed silo that feeds the conveyor system by gravity; the latter separates the sand and gravel during the process by vibration and washing. They are then stored separately by means of a frontal loader.

The origin of these materials is North America, but they are now imported to some extent from Mexico and are produced regionally.

5.2.2. Origin and type of inputs

The input is 100 per cent domestic and consists of river sand. To obtain it is no problem since it is extracted from fresh water river beds.

5.2.3. Occupation and qualification of manpower

In this industry there are few plants which employ more than 40 workers and they are the most mechanized enterprises; there are also some with between 20 and 40 workers and most of them in the informal sector have less than 20.

In the formal sector between 85 and 90 per cent of the personnel employed are labourers, while 5-8 per cent are administrative employees and less than 1 per cent technical staff.

5.3. Lime industry

5.3.1. Technical aspects

The larger plants use some of the technologies and infrastructure from the cement manufacturing process. They are Danish in origin and more than 50 years old, with the consequent poor production efficiency and high cost.

5.3.2. Origin and type of inputs

Inputs are 100 per cent domestic, consisting of easily obtained calcareous materials.

5.3.3. Employment and characteristics of manpower

In the formal sector the lime industry employs 120-250 persons per production unit, approximately 79 per cent of whom are workers, 20 per cent administrative employees and 1 per cent technical staff.

The informal sector employs less than 20 persons, all at worker level in each production unit.

5.4. Clay industry

5.4.1. Technical aspects

Intermediate technologies of European and North American origin are used; the plants are marketed by the versatility of the equipment which makes it possible to manufacture as many as 30 different products by simply changing the matrix and adjusting the cutting unit.

5.4.2. Origin and type of inputs

The principal input is clay with different physical properties; it is domestic in origin.

5.4.3. Employment and characteristics of manpower

Only the enterprises with a high degree of mechanization have more than 100 workers; a high percentage of these are unskilled labourers, less than 10 per cent are administrative employees and there are very few technical staff.

In the informal sector, which applies to most of the plants, virtually all workers are unskilled.

5.5. Cement derivative industry

5.5.1. Technical aspects

The machinery used is simple and is made in the Central American countries themselves or imported from Mexico.

It was introduced into Central America about 50 years ago from North America. So far the machinery has not been substantially altered except for the moulds and materials needed for new designs.

There are at least two technical operation levels, the most developed one with the greatest investment is used with silos to store the materials, high-capacity mixers and automatically fed presses which handle the final material and products by mechanical means. They are capital-intensive. At another level the press is operated manually or sometimes hydraulically, and the handling of the materials is also manual. The manpower used is intensive and there is little capital per worker.

Most of the firms work with less than 10 persons; only a few have more than 20.

5.5.2. Origin and type of inputs

The inputs are domestic and of the mineral type, such as cement, pumice stone, sand and gravel. The supply of these raw materials is no problem. All the countries have sufficient amounts.

5.5.3. Employment and characteristics of manpower

The most mechanized enterprises, which are few in Central America, employ more than 40 workers, of whom 85 per cent are labourers, 14 per cent administrative staff and 1 per cent technical personnel. Because of the degree of mechanization they have relatively few employees. In the informal sector the production units have less than 10 unskilled workers.

5.6. Asbestos cement and fibrocement sheeting industry

5.6.1. Technical aspects

The technology employed is mainly of European origin; the principal firm supplying the technology and know-how is the Swiss Eternit. This company has also taken part, together with domestic firms, in the search for new products.

Most of the equipment is Swiss, but adapted in the United States for Central American production conditions. Some minor equipment is of Central American origin, such as motors, moulds etc.

5.6.2. Origin and type of inputs

The asbestos and paper pulp is imported from outside the area, the former for the manufacture of asbestos sheeting and the latter for fibrocement sheeting; paper (cardboard) and cement wastes are used as the domestic or Central American raw material.

El Salvador has to import the cardboard to be mixed with the paper pulp from Guatemala since there is no complete supply of this raw material within the country.

5.6.3. Employment and characteristics of manpower

These enterprises employ between 300 and 400 persons, 80 per cent of whom are workers, 15 per cent administrative staff and 5 per cent technical personnel.

5.7. Tile industry

5.7.1. Technical aspects

The industry works with the American Standard technology, for which it pays fees; however, the enterprises have developed their own technology for certain processes and products.

5.7.2. Origin and type of inputs

Sanitary equipment utilizes 75 per cent of the domestic raw materials and 25 per cent from outside the area; more specifically, it is imported from the United States; the imports are kaolin and enamels which are not produced in the area.

5.7.3. Employment and characteristics of manpower

The sanitary equipment plants employ a large number of workers, between 200 and 300 per firm, 85 per cent of whom are workers who must have some kind of training; this ranges from three to 12 months. 12 per cent are administrative personnel and 3 per cent technical staff. For glazed tiles and ceramic floors the firms employ between 40 and 150 workers, 80 per cent of whom are labourers, 11 per cent administrative staff and 1 per cent technical staff.

5.8. Iron industry

5.8.1. Technical aspects

A medium technology has been developed and improved through the use of new techniques and production controls; the process involves melting iron in the form of ingots and foundry returns, which is then made up in the hot state according to the product to be manufactured; its origin is European.

5.8.2. Origin and type of inputs

This industry imports 50 per cent of its raw material needs from outside the area - slabs (iron rods) for furnace melting. Use is also made of foundry returns as a Central American input, but El Salvador imports almost all this raw material from Guatemala to cover its production needs.

5.8.3. Employment and characteristics of manpower

These plants have a large number of workers; the smaller firms employ approximately 600 persons, while the larger ones have 1,500; 70 per cent are workers, 20 per cent administrative employees and 10 per cent technical staff.

5.9. Aluminium industry

5.9.1. Technical aspects

The technology is North American in origin and 38 years old. The process takes place by heating and extruding aluminium billets through an extrusion furnace which has at its outlet a matrix of the profile it is desired to shape; it is drawn by hand and cut into strips which are then passed through a drawing bench and subsequently a hardening furnace.

5.9.2. Origin and type of inputs

The only input is aluminium in cyclindrical or block form, which is imported from outside the area and represents a high loss of foreign currency.

5.9.3. Employment and characteristics of manpower

These plants employ between 25 and 75 workers, of whom 81 per cent are labourers, 8 per cent administrative staff and 11 per cent technical personnel.

5.10. Wood industry

5.10.1. Technical aspects

Use is mainly made of European technology, which is for the most part more than 30 years old. Multiple-band, circular belt and manual sawmills are in operation.

In Guatemala there are more than 100 sawmills and in Honduras 126, of which only 109 were working in 1986.

The manufacture of plyboard is based on international technical assistance, such as the Executive Service. ICAITI* has given Costa Rica technical assistance for the installation of a solar energy drier and for use of timber wastes in heaters.

5.10.2. Origin and type of inputs

The only input is wood in the form of logs of any of the existing varieties; Guatemala and Honduras have a supply of domestic timber without any problems while Nicaragua and Costa Rica do have a problem of supply.

El Salvador has to import timber, but mainly after some kind of transformation, from Honduras and Guatemala. To make plywood use is made in Honduras of silver fir, "ocarpa", resin, sand and "arina".

5.10.3. Employment and characteristic of manpower

For physical handling of the product the enterprises employ between 30 and 150 persons, 92 per cent of whom are workers, seven per cent administrative employees and one per cent technical staff.

5.11. Particle board industry

5.11.1. Technical aspects

Intermediate technology of Norwegian origin and German commercial development that uses simple mechanical equipment for the processing of the principal input wood - which is converted into chips which are then dried, homogenized and mixed with synthetic, anti-thermal and water-repellent elements; in this way they form a mattress which is subjected to high pressure in a high-temperature press; this polymerizes the synthetic material and the chips, thereby creating the boarding.

5.11.2. Origin and type of inputs

Wood of domestic origin in the proportion of 85-90 per cent and synthetic resins from Germany or Italy.

5.11.3. Employment and characteristics of manpower

Between 75 and 125 persons are employed, of whom 80 per cent are workers, 15 per cent administrative staff and five per cent technical personnel.

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*Instituta Centroamericano de Investigación y Technologia Industrial.

5.12. Others

5.12.1. Technical aspects of PVC

PVC uses an advanced technology in the thermoplastic group, for which process the moulding of polyvinylchloride is carried out by the extrusion technique. It is one of the technologies that is constantly renewed and comes ever nearer to the generation of superplastics. The origin of it is mainly Austrian and North American.

5.12.2. Origin and type of inputs

The inputs are 100 per cent imported from outside the Central American area and are made up of polyvinylchloride and resins.

5.12.3. Employment and characteristics of manpower

Between 150 and 225 persons are employed, 81.5 per cent being workers, 11.5 per cent administrative employees and seven per cent technical staff.

6. ANALYSIS OF SOCIAL ORGANIZATION

6.1. Introduction

Because of inflation and the crisis affecting the countries of the Third World, the real housing market has declined, while the potential market has expanded, hence the solution for expanding the real market has undergone an obvious decline at different levels. It is, however, more obvious at the lowest income level where improvements for the population are often few when they exchange a slum for a legalized dwelling, with the advantage that they are the owners of the property. There has therefore been a change in mentality as regards the application of improvements which in the long run make the housing situation better. The solution to the housing problem presents different problems at governmental level, even when it is a question of minimal solutions. The problems involve:

- A financial effort involving the national budget;
- A drain on foreign currency because of the imported construction component;
- The risk distributed among the projects available, despite their social content, does not lead to a better risk distribution.

With regard to the efforts made by a government to carry out social work in face of so many priority needs in economic development, any contribution that may be made in this sense shifts the attention from others. Furthermore, the financial requirements for trying to solve the housing problems are unquantifiable and as a result unplannable.

Various studies made in Central America have reached the conclusion that the housing projects have a high imported component, for example, the Costa Rican Construction Chamber found in a study made to this end that 20.5 per cent of a popular solution is converted into loss of foreign currency. It should be mentioned that during the present study it was found that cement, despite the fact that the basic (mineral) raw materials were of domestic origin, has a foreign currency content of over 50 per cent of the variable cost, principally on account of the fuel and electricity consumption; other products, such as PVC, contain 100 per cent imported raw material.

Lastly, despite the fact that the projects have a social content, the risk created by these efforts is always transferred in the long run as a high percentage to the formal sector of the economy through the action of construction and purchasing materials from the formal sector, and the value added generated is largely translated as profit and to a lesser extent as wages and salaries.

6.2. Importance of the informal sector

In the countries of the Central American area housing construction at the level of the higher-income groups and the Governments' housing projects are covered by the formal or modern sector of the economy.

A high percentage of building materials production and the value of the buildings relate to this sector; nevertheless, the informal sector engages in a great deal of activity in producton, transport, marketing and construction.

In the production of materials there are specifically traditional fields, such as sand and gravel production and clay products: adobe, compact brick roofing, "fachaletas", lattices and ornamentation; cement derivatives: piping, columns, wash-basins, blocks, sumps, floors, ornamental fountains, decorative trellices, drainage tanks etc.; wood products: windows, doors, partitions, closets and so forth; stone products: lime, decorative stone, etc.; ironwork: light structures, doors, windows, balaconies and railings, and lastly, a line in tinware: ducts, chimneys, ventilators, gutters, etc.

In marketing there is a large amount of business handled by the informal building sector, supplied to 100 per cent; in this respect one should consider that the informal sector is also responsible for maintenance, repair and small additions to houses that have been built by the formal sector, though it also assists, under verbal subcontracts, with larger buildings such as in the case of master builders who contract for work to be done by their own workers, who do not normally enjoy the social services established by the national legislation.

The master builders contact their workers for the job and pay them a little more than the formal building concerns, but do not pay social security or other contributions.

With regard to the housing construction, the informal sector in certain countries manages to build as much as 85 per cent of the dwellings in the urban area and roughly 100 per cent in the rural area, using not only new products, but also waste products from demolished buildings, wood obtained from packing material used by import marketers, waste sheeting, wood, cardboard and so on, all of it bought through the informal sector. They cover the low-income market, though also certain higher-income brackets; as regards maintenance services and new dwellings there are even engineers and architects in the informal sector for building larger dwellings, using the technology they learned at the university.

In the formal building sector there are private housing projects, larger buildings and commercial centres, and at State level there are popular housing projects. This sector, however, is reluctant to enter the field of smaller housing except in the case of ambitious projects, which at times the Governments are not in a position to implement financially.

Origin of the informal organizations

As far as traditional products are concerned, such as the manufacture of clay products, these organizations have always existed, while for new products, such as window glass with iron or aluminium frames, manufacture of mirrors, fibreglassware, etc., the new owners have been conducting high-level business. With little capital, which is sometimes from the familiy, with credit, or merchandise on consignment, they undertake their business, making use of the garage of their houses and employ their wife and children for the work.

In most of the countries these organizations are not controlled by the Government, they do not pay taxes, they do not give receipts or invoices for sales, nor do they ask for invoices for their purchases; this gives rise to tax evasion by the firms in the formal sector.

The only country in which informal business is controlled to a large extent is Nicaragua, where they even demand a small tax; it is also in Nicaragua where this sector has developed most rapidly over the last few years in view of the limited supplies from the State enterprises.

Employment

Judging by the number of dwellings provided by the informal sector, the number of persons involved is high; one master builder in Guatemala may have more than eight construction projects that may not be considered so informal, and he provides employment for about 40 workers; on the San Miguelito market in San Salvador there are more than 100 persons working on marketing and their families also live on the spot. They are organized into a co-opereative which has still not been approved.

A characteristic of the employment in the informal sector is that roughly a third of the workers are under 18; because of the legal restrictions on working in the formal sector, they find a way of earning their living in the informal sector, since they are not registered with the social security and therefore have no legal limitations. In Guatemala most of the assistant bricklayers are poor people from the rural areas.

The construction projects also provide employment in situ for a large number of persons who work on food production and sales.

Technological aspects

In terms of production the informal sector uses very little technology; this gives rise to the poor quality of the finished product and lack of standardization (size), high prices and no guarantee of supply.

The sand produced contains plant residues; blocks manufactured with it easily break.

Furthermore, the sector accepts technological innovations such as the replacement by PVC of galvanized material. Innovations are also making inroads into the production of glassfibre for wash basins and such.

Types of service

In the commercial sector the prices are high but the user buys small quantities that cannot be made in the formal sector, although prices are better in the latter; the informal sector sells the exact quantity needed by the user.

Attention is given to Saturday and Sunday mornings as the workers also provide their service on non-working days to persons who use such days to have their houses repaired.

The worker uses his own tools and wastes a great deal of time in trying to deal with problems for which there are no proper answers. When there are no spare parts or when the replacement costs are too high, there are also risks when he tries to repair equipment which he is not acquainted with.

6.3. Relationship between the formal and informal sectors

There is little relationship between the formal and informal sectors; at the construction level the informal sector is subcontracted to carry out certain jobs: master builders for certain construction work, electrical and hydraulic installations, and carpentry work; when the carpenter's work is excessive, several informal enterprises are subcontracted to do the job.

It is only for very large projects that enterprises of the formal sectors are subcontracted, for example OEG or SIEMENS, for electrical installations. Marketing of products in the formal sector at a low percentage is through the informal sector, which acquires products through intermediaries who own lorries and who sell to each small businessman part of what is transported.

Between the informal lorry driver and the informal businessman there are verbal contracts for the supply of materials which are paid for when the sale is made. An example of this was seen at the San Miguelito market in San Salvador.

In summary, in terms of total production and services, the informal sector provides a small percentage of its products and services to the formal sector and a high percentage to the informal sector. In turn, the formal sector sells a high percentage of its products to the commerce and the construction industry, and a small percentage to the informal commerce.

6.4. Other observations

The process of solving the government housing problem is contained within an administrative and financial framework with serious contradictions; for the formal sector to take up the building of mini-dwellings is not a worthwhile business activity. The sole use of the formal sector, furthermore, involves large budgetary allocations that are not available and there is a major impact on the balance of payments, which also shows up as a drain on foreign currency; moreover, the supply of materials is not flexible in the production sector, thereby giving rise to scarcity, hoarding, high cost, etc. The informal sector, in addition, is not an important element in a housing programme, but in case of an economic crisis such as the one between the years 1980 and 1985, this sector was the only one that took part in the housing construction.

The very informal constructions are favoured because the users are not the owners of the land where the houses are built; the tenants are afraid that at some time they might be evicted from the land they occupy, which would compel them to dismantle the house; this promotes a housing shortage of a qualitative type as far as the size and grade of the materials used are concerned.

Experience gained in several countries has shown that to overcome the legal problem of tenancy the users suddenly alter the grade of their dwelling.

The informal sector may be given access to the construction of more formal dwellings, if it is provided with minor equipment, such as presses for making blocks. Technical information has to be provided for manufacturing the products so that later better grade materials can be demanded. The housing authorities can provide builders with plans and give training in construction.

By the use of mass media, popularization programmes can be drawn up and construction manuals made available, giving information on the traditional technologies that have been lost.

The old techniques of house building with adobe and wattle have been forgotten on account of the limited demand for this type of dwelling; this has come about through demonstration of standards imported from the developed countries and also through the devastating effects of the recent earthquakes in Nicaragua, Guatemala and El Salvador, since the dwelling has become a status symbol.

Furthermore, the universities have not bothered to teach technology suited to housing construction; the professionals who leave the universities only know about the Western technology and their ambition is to build bigger and more sophisticated buildings than is possible. All this means that the efforts made by UNIDO with regard to technology suitable for use with regional raw materials has not yet penetrated the region's environment.

7. LEGAL AND INSTITUTIONAL ASPECTS

In all the countries of Central America there is at present specific legislation which regulates the construction activity, and implicitly the materials used for it. The regulations are contained in laws, codes and provisions, which are verified by the municipalities or the government institutions responsible for their application.

There are also controls made by financial and safety authorities, which make use of research institutes and centres at universities in order to verify the standards laid down, such as the Institute for the Promotion of Insured Mortgages and the housing and construction banks. For the construction of a building there are building regulations and standards in each of the countries, but they are not applicable to all types of the construction, purpose, etc; the requirements run from the most elementary to the most detailed; in Honduras, for example, when dealing with housing construction worth less than 10,000 colones, it is only necessary to submit simple plans signed by a collegiate professional; this enables informal builders to comply with the requirements; it is also possible to get a housing institution to supply technically drafted plans to users to meet the requirements; this is done, for example, by the Costa Rican Institute of Housing and Urban Development. In Guatemala when there is a small change necessary, it is enough for the builder or owner to submit a request in writing. When the construction is a more important one, there is need to submit a series of plans to ensure that the structure is properly built. Where one-storey and adobe buildings are concerned, the requirements are fewer, but there are specific regulations for adobe buildings.

When it is a matter of dwelling houses with several floors, for commercial and industrial use, the requirements are more complete; these buildings must be safe against earthquake, fire and industrial accidents, hence full additional plans of the industrial facilities it it is intended to build, both inside and outside the building, are required and they must clearly show the manufacturing process.

The details for buildings are as follows:

7.1. Plan of layout

This should show the layout of the building within the grounds, with indication of patios, gardens, streets, avenues and parking lots.

7.2. Situation plan

This shows the approximate situation of the property within the block or site.

7.3. Architectural plans

This shows the distribution of environments, roof projections and overhang, axial measurements, wall thicknesses and strategic points for determining levels.

7.4. Structural plans

7.4.1. Cement structures and column plans

Location of footings (plinths), cement structures with identification of columns resting on them, together with the distance between columns, type of ironwork and other structural specifications. Typical sections of cement work, footings, floors and columns with specifications, minimum depths etc.

7.4.2. Tile and girder plans

These indicate the reinforcement, location of the iron, sizes and separation (one for each storey and if there are several identical storeys a typical sample is acceptable). Indications of floor beams with sections showing dimensions, grades, coverings and thicknesses of the tiling.

7.4.3. Structural details

By means of wall sections, with indication of heights of floors, columns, details of stairways etc.

7.5. Installation plans

7.5.1. Water installations

A complete network, starting from the counter, with indication of diameters, various accessories, control valves and sanitary equipment; hot water network, if applicable, installations foreseen; the type of quality of material to be used is indicated in all the above cases.

In no case it is permissible to use galvanized iron piping in buildings with one floor at ground level, nor at levels below this. In buildings with levels above ground this material may be used, but only for the higher levels and provided it is not in contact with the ground.

In cases where a building is fitted with a water supply other than the public utility, the following must be identified:

(a) All details of the installation, mentioning flow rates;

(b) Details of the systems protecting against crossed connections with the utility; and

(c) The system adopted for purification, treatment and/or pumping, with details of the installation, as required.

7.5.2. Drainage system

A complete network of the drains, with indication of diameters, slopes, direction of flow, meters, sumps and siphons; details of the latter equipment, rain pipes and their diamters, location of absorption wells and septic tank, when there is such; class and grade of materials to be used. All the provisions of the "Norms and Regulations for Drainage in Guatemala City" must be applied in the preparation of this section.

Earth connections must be described in detail with diagrams, showing the installations where they are to be connected so that they are not mixed up with the drinking water piping system.

7.5.3. Electrical wiring plans

A complete network, from the meter, with indication of the switchboard, automatic safety trips and number of circuits; diameter of ducts; number and grade of wire in each section; height of interrupters and mountings, voltage used, aerials, bells, telephones, furnaces, heaters and facilities envisaged.

In buildings of three or more floors, radio and television aerials should be in common use.

Earthings should be described in detail with diagrams, if they are connected to different parts of piping and other installations.

Special installations such as generators, transformers, and motors of any type, should be accompanied by specifications of the equipment they use.

All buildings or constructions which rise above the surrounding area should be accompanied by a plan showing the installation of lightning-conductors.

7.5.4. Mechanical or special installations

Lift installations should be accompanied by an individual plan showing all the necessary data, such as speed, permissible load, type of operation, energy output and alarm system, position of the machine room, with corresponding specifications. Hydraulic elevators should be accompanied by all the necessary specifications provided by the manufacturer.

Food and merchandise hoists and elevators should be accompanied by plans showing their specifications and characteristics.

Plans of escalators should be accompanied by all the necessary specifications, as provided by the manufacturer.

Refrigeration, heating and air-conditioning systems should be specified in plans showing accessories, grid design and generators, with the specifications of the manufacturer.

8. BASIS FOR AN ADDITIONAL PRODUCTION PROGRAMME

8.1. Planning for self-focused development

The construction materials sector is an industry that has so far not been given any special attention in institutional or governmental policies, even though old studies exist on the subject; there is no understanding of the full impact of the industry on the Gross Internal Product through being involved in the manufacturing, commercial, transport and service sectors.

The growth of the sector has been disorderly and disrupted; neither vertical development of the enterprises nor local development of the industrial plants has been promoted; the large plant, the formal family enterprise and the informal sector all exist together, but there is no sound connection between them.

As we know, the construction sector and construction materials industry have a boosting effect on the economy, but at the same time they exert a positive influence on trying to overcome housing problems which appear insoluble. A policy directed towards increasing the production of construction materials and construction itself many promote a greater growth rate for the Central American economies and for the formation of capital, as was seen in the introduction to this study.

Furthermore, during the present decade new technologies have been incorporated into the building industry which have reached Central America; at the same time, international organizations such as UNIDO have been making studies on the best technology for using local construction materials, but on account of the economic crisis over the period 1980-1985 the advent of such technologies was inopportune, and some enterprises even lost valuable resources through this introduction.

A criterion which is applied in this study is the search for the integrated development of the building industry by finding strategic windows for development, by resuming projects that failed in the last decade, and by studying suitable technology in the building industry and the impact of trade in construction materials for promoting a policy of import replacement.

Integrated self-focused development can be considered in three dimensions: regional, national and local; at regional level there is a proposal for large-scale projects needing a regional market and high investment to make them profitable. At national level attention is given to the remaining industries by examining the technological, financial, administrative and vertical integration problems, but one must keep in mind not only the existence of larger enterprises and the informal sector, but also the formal family concern, which is highly involved in the construction materials market and production unit that provides employment and subsistence for a large number of people. The larger enterprise must be planned with regional projections, while the formal family concern and the informal unit should be the bastions of production for the internal and local market; the first case applies to industries such as iron, plate glass, aluminium, fibrocement, chemical (PVC) and others, while the second case applies to cement derivatives, ceramics and tiles, clays and such like.

The investments that have to be made in enterprises of the regional type are ambitious and foreign funding is needed. The other industries can develop with governmental programmes in collaboration with international development institutions. The informal sector must collaborate with the government and the international organizations through special programmes in which financial

and technical assistance is given for marketing their products and for enabling them to participate in the government and formal sector construction materials market, for which a specific proposal is made in the last part of this chapter.

The information in this study shows that the building industry is highly dependent on imports from outside the area. Industries such as the cement industry work with fuel and, as a whole, all of them use the energy with a high content of "bunker" and oil; the equipment in the cement, gravel, clay and other industries needs high expenditure and maintenance and the machinery and equipment need multimillion investments for purchase and replacement; the transportation equipment for building products requires high investment, which needs to be obtained from banks.

Some industries such as iron, PVC, aluminium galvanized roofing, asbestos and fibrocement sheeting, nuts and bolts, ironware etc. import a high percentage of raw material for their production, in addition to which some of them use a great deal of fuel and energy. Imports of plate glass which is not produced in the area represent a loss of foreign currency for the Central American economies and this should be a matter of great concern to the international and governmental organizations; in the past a plate glass project was forgotten although it had been already set up in Guatemala. Other such incidents in Costa Rica and El Salvador could also be mentioned.

The high volume and weight of construction materials makes it difficult and costly to move them about, hence the scale of the enterprises should be national and local in most of the industries.

Forestry resources have not been adequately used. Central America has a great deal of forest area, but utilization of the wood has been irrational; this industry could serve as a basis for construction in general, but in practice the use of it is limited and no measures are adopted for reforestation that might make it possible later to have intensive but rational exploitation.

The old techniques for building houses with adobe and wattle have been forgotten; the present builders have lost the techniques and the structures regularly fail to come up to the technical specifications that used to exist. The effect of demonstration by the developed countries on the population of the Third World has been such that the type of dwelling has become a status symbol; this creates resistance against returning to the old building systems with adobe and wattle, which makes penetration of the appropriate technologies favoured by the international organizations difficult. The limited market also means that certain industries such as nuts and bolts, iron ware, nails etc. cannot develop in the environment under study. For this industry to develop a broad internal market is needed to enable use of highly efficient equipment. The margins for products produced in the area are low and do not reach 100 per cent when they are produced and sold directly to the consumer, whereas the products imported show margins of above 300 per cent.

It is also important to point out that there is misuse of the construction materials, whether imported or not, through lack of technical preparation, negligence or bad faith.

Wood goes to waste in different ports; in the forests trees are cut down or burnt; in the sawmills wood is wasted when worked or left out in bad weather and it is not preserved chemically during use in order to prolong its lifetime, it is also wasted when used as forms for casting, when use could be

made of iron, including for street pavements. There is chaos through lack of proper use of the names of woods; the use of the scientific name within Central America could solve problems in the supply of wood.

Iron is another example of bad usage; informal builders who have not studied at the university waste the iron by using more than is necessary. In the implementation of housing construction projects one has to air at having the "best bit and the best tucker" ("buenas botas y buen sombrero").

To use materials in a better way one should design houses of a modular type in integral form in order to avoid wasting material on roofs, walls and floors.

For example, when using a certain roofing material of a certain size, there is wastage on the floors, or vice versa. When designing the size of a window there is wastage of aluminium or iron profiles, according to the case, and glass is wasted when it is cut down to a certain size, without using 100 per cent of the sheet.

Housing planners should develop projects with better features and the builders should select better materials so that the life of a dwelling is longer and without need for repairs. For example, floor joints should be designed to accomodate expansion due to heat.

An exchange of technologies and experience is an important point for making the construction sector and the construction materials industry more dynamic, but in this case one has to solve technical and financial problems.

Among the technical aspects which give rise to error and misunderstanding is the use of the metric system; for example, work is still calculated in inches and centimetres as the dimensions for certain materials and use is also made of kilograms and pounds; to overcome this problem there is need to unify the entire metric system by adopting the decimal system alone. In the semantic sense there are also a variety of names for certain products; for example, compact brick or solid clay are called in Guatemala "tayugyo" and in Honduras "rafón brick"; in a semantic sense there is also need for unifaction of approach.

An exchange of trained professionals between different countries of the area could serve as a way of transferring experience and technology, but this involves financial problems; for this purpose the salaries of professionals should be paid by the governments of the countries to which they belong and subsistence and transport costs should be financed with specific funds.

Design innovations should be the concern of special teams at the housing institutes and special organizations, so that money and material can be saved by new designs; for example, water meters could be installed where the equipment is less subject to deterioriation.

Government housing projects should be developed on the basis of better use of the foreign currency and should promote the involvement of the small enterprise and the informal sector; when there is a governmental building policy, the inflexible supply of certain products should be replaced from the time of planning and be supported to this effect by substitute products but with a greater social content if these products stem from the smaller formal family enterprise or from the formal sector.

This study shows ar example of accumulation in which the construction materials industry takes part, but where in certain cases there is lack of consistency, especially if it concerns participation by the informal sector (see figure 1, p. 47).

8.2. Research and technological development activities

8.2.1. Ductilblocks construction process

8.2.1.1. Introduction

The Ductilblocks sytem is based on the principal of a mechanical system. Hence it enables production of highly varied housing structures.

The characteristics of the system are such as to make it preferable for self-building.

8.2.1.2. Origin and characteristics of the technology

The system has been patented in France and was invented by the Spanish research worker Lorenzo Fernandez.

The manufacturing dimensions of the Ductilblocks are those established by international standards for modular co-ordination dimensions, and the tolerances lie between the limits resulting from application of the relevant manufacturing dimension and the tolerances indicated below:

Thickness tolerance:	+/-0.5 mm:	v/lm/m
Height tolerance:	+/-0.5 mm:	v/lm/m
Length tolerance:	+/-1.00 mm:	

For making the blocks, use is made of vibrocompressors which may be domestic, regional or from outside the area.

The system uses very little iron, and no wood or binding mortar and is intended for antiseismic structures using mechanical anchorings; it may be used in any climate since it is heat-adapted by virtue of the air circulating through the walls.

By means of this complete system a building covering 50 m^2 can be put up in two days, i.e. using prefabricated roofing; under the conditions prevailing in San Salvador the construction of each dwelling takes a week.

8.2.1.3. Employment and characteristics of the manpower

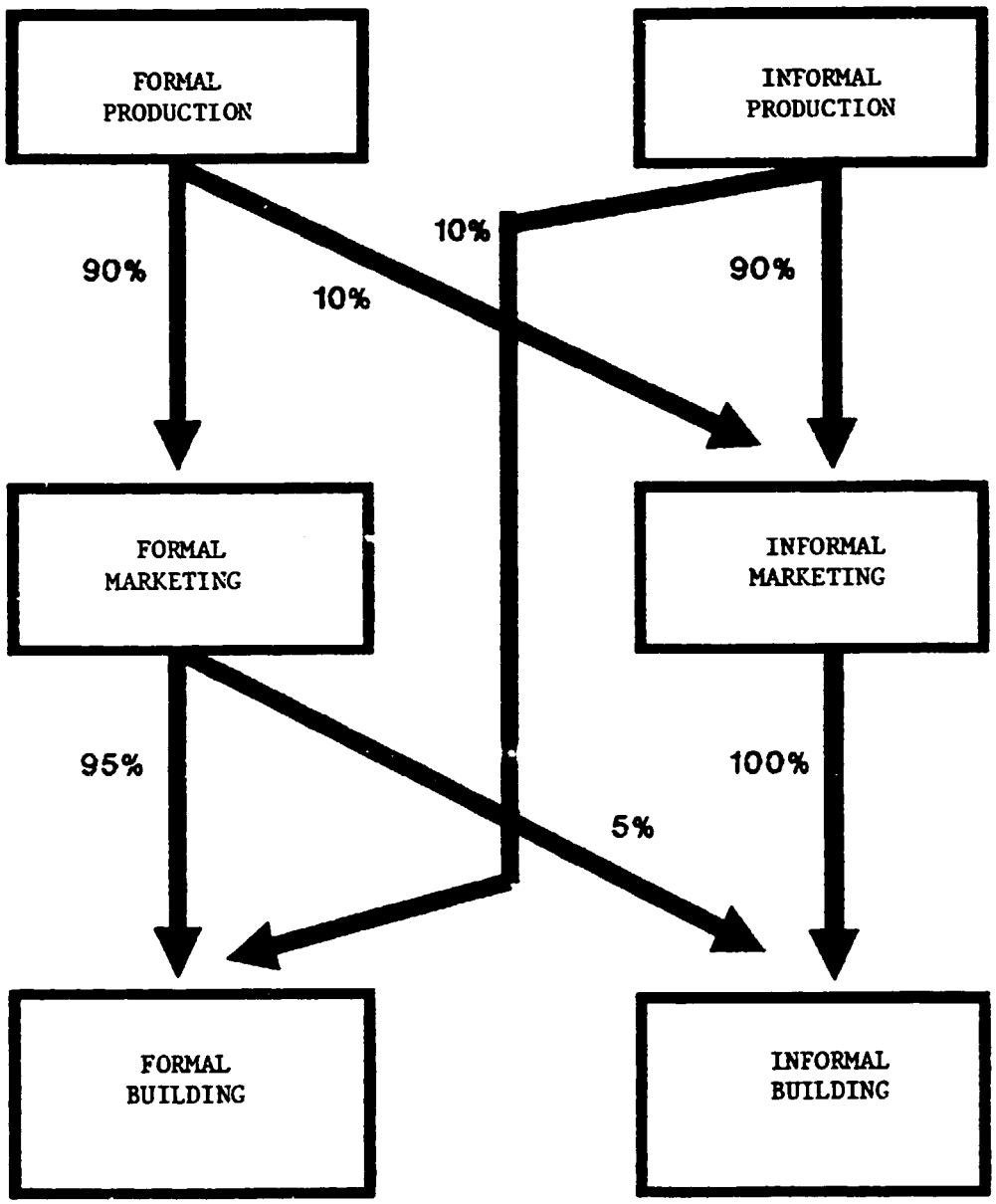
Construction of the blocks is relatively labour-intensive; manual equipment needs four people to handle it, while for larger equipment, despite the fact that more labour is used, the relative effect loses importance because of the equipment size.

Depending on the type of machinery, the system can be used with very little special skill in the case of manual equipment, and with specialized workers in the case of larger equipment. For the construction of the lower and upper floors of a house there is need for specialized bricklayers, whereas for the construction of walls there is need for workers without specialized skills. Hence the system is of advantage in self-construction.

Fig. 1

Building Materials Industry

Relationship between the formal
and informal sectors of the economy



Note: The percentages are approximate and show qualitative relationships.

8.2.1.4. Mechanisms and transfer

Since the system is a French patent belonging to the firm Ductilblocks International System, the relevant royalities have to be paid.

8.2.1.5. Feasibility of adoption by the region

Because of the destruction caused by the volcano Nevado del Ruiz in Colombia, the builders in this country have adopted this system and it is still functioning. Several thousand houses have been built since that time.

In El Salvador the construction of houses in very small quantities has also begun.

It is possible that it will meet with some resistance from the larger building firms, but given the characteristics of the system it could be adopted by the housing organizations in Central America.

Despite the fact that this system is already known internationally, UNIDO should study it so as to give it more encouragement.

8.2.2. Ladri-blocks "Nahuat"

8.2.2.1. Introduction

This is an economical, rapid and easily applied system which uses the earth on the spot and a stabilizing cement for making the brick.

8.2.2.2. Origins and characteristics of the technology

The Salvadorian engineer, Roberto Jiménez, was interviewed and said that it was a patent of his own invention.

It involves small hydraulic equipment which is being built by the firm ECONSA de C.V., Alameda Roosevelt 1802 in San Salvador, the manager of which is Mr. Jiménez.

It involves cement-earth bricks of the following size: Length 30 cm, width 15 cm and height 11 cm.

The bricks are put one on top of the other and bound with a liquid mortar which is poured into one of the cavities; little iron is used, but bamboo or barbed wire can be used instead.

Compression tests have been made at a pressure of over 50 k/cm^2.

A bricklayer can build twice as many square metres as with the traditional blocks.

In place of cement use is made of running lime or oil to stabilize the earth.

8.2.2.3. Employment and characteristic of the manpower

The construction of the blocks is labour-intensive, since the equipment is the small manual type that is made locally and can be carried to the construction site.

Bricklayers with little specialized training are used for the construction work.

8.2.2.4. Mechanisms and transfer of technology

Since it is a Salvadorian patent, there is no difficulty in transferring it; Mr. Jiménez, when selling the machinery gives handling instructions, procedures for making up the material, and provides a booklet for the self-construction of dwellings, with plans, measurements, and types of reinforcement and erection.

8.2.2.5. Feasibility of adoption by the region

Despite the fact that there are studies of the resistance to this technology, it has not been adopted in El Salvador; Mr. Jiménez has only built a few houses.

In other countries of the area difficulties in adopting the technique are greater, hence highly prestigious organizations such as UNIDO are needed to encourage the system.

8.2.3. Waterproof brick

8.2.3.1. Introduction

Earth is one of the raw materials that has been used since time immemorial for the construction of dwellings, but at the present time new technologies have been introduced to improve it by treatment of with CONSOLID 444 and CONCERVEX which produce high-grade impermeable bricks for housing construction.

The compressive strength of these bricks ranges from 40 to 100 kg/cm^2 and permits the construction of one- ore more storey buildings. The high density of the bricks imparts remarkable protection and insulation against temperature and noise, which makes them useable in any climate. Taking advantage of this material reduces the use of cement, steel and aggregates that are used for reinforced cement and slabbing.

The CLU 3000 adobe brick system helps solve the problem in countries of the Third World since the investments in the CONSOLID system with the CLU 3000 brick machine are limited, compared to investments in permanent plants which produce conventional bricks, with the advantage that the CLU 3000 brick machine is easily transportable.

The system makes it possible for local inexpert personnel to use the machine, thereby creating jobs.

This technique avoids deforestation, which is reflected in environmental problems, since the product does not require furnace treatment, while the conventional bricks are made in furnaces fired with wood in the rural area.

The use of CONSOLID 444 and CONSERVEX for treating earth used to build adobe houses does not necessarily depend on the CLU 3000 brick machine. The earth can be mixed with chemical products using manual shovels.

The system can be used for constructing highways, in which case it is simple to apply using only conventional machinery; furthermore, it is possible to have immediate compaction.

The CONSOLID and CONSERVEX systems help people to build their own houses.

8.2.3.2. Feasibility of adoption

A brick similar to the conventional kind but different in colour is produced; the important thing is that the engineers, architects and builders see the advantages of it over other products.

8.2.3.3. Mechanisms and transfer of technology

The system is a Swiss patent belonging to the firm CONSOLID A.G. and has been developed by Dr. G.A. Scherr, with representatives in Guatemala and other Central American countries.

8.2.3.4. Technology

The following changes are induced by mixing CONSOLID 444 with earth and fine aggregates:

- The fine particles agglomerate irreversibly, which increases the number of pores; this enables the system to show less resistance to compaction;

- The water repellent effect of the CONSOLID is to reduce a tendency to capillary absorption.

CONSOLID 444 is not a binder, but the water repellent effect produced considerably modifies the soil characteristics. For additional improvement in the load resistance, and without losing the water repellent effect, other stabilizers can be introduced by mixing, for example cement or slake lime, immediately after the application of CONSOLID 444. By mixing one or two per cent of these binders, relative to the weight of the soil, one obtains surprising effects. Empirical tests in the laboratory and in the field show economic advantages.

CONSERVEX supplements and considerably improves the advantage of soils produced with CONSOLID 444. While CONSOLID 444 works by facilitating compaction and reduces capillary uptake of water, CONSERVEX protects the soil through dispersion and finely divided distribution of particles of bitumen, by which it:

- Reduces penetration of surrous water (permeability);
- Improves the water repell effect of CONSOLID 444.

8.2.4. Manufacturing process for tablex panels and polyurethane for housing construction

8.2.4.1. Introduction

Panelling designed for housing construction in series employ tablex (agglomerate) boards, wooden frames and polyurethane fillings, with the incorporation of windows, electrical installations and plumbing. These have the advantage of facilitating installation and cutting down on manpower.

8.2.4.2. Origin and characteristics of the technology

The system was thought of in Guatemala 20 years ago. It is characterized by a simple technology which requires little investment in machinery, since disk saws, drills, boreholes and presses are used in the process to fit the panels together which are then filled with polyurethane. The final finish is

paint or synthetic covering. The technology has the advantage of facilitating the assembly; the material is incombustible, thermally and acoustically insulating and resistant to dust.

8.2.4.3. Employment and characteristics of the manpower

To make the panels the manpower does not have to have much training, since the process is one of cutting and assembly. A workshop of this type can employ less than 10 workers.

8.2.4.4. Mechanisms and transfer of technology

Since the system is not patented, its transfer in the region presents no problem.

8.2.4.5. Feasibility of adoption by the region

There are possibilities for the use of the system in rural areas since it is a dwelling easy to build, remove and improve; it can be adapted to the climatic conditions of the regions.

It can be combined with galvanized sheeting and fibrocement roofing.

8.2.5. Tiling made of sand and cement with maguey* fibre

8.2.5.1. Introduction

Sand and cement tiling can be used to make an economical roof, since the manufacturing cost is one-third of similar roofs made of sheeting. At the present time it is not being made, but there is a plant which could be put into operation if there were a demand.

8.2.5.2. Origin and characteristics of technology

This technology is simple and of English origin; it uses a simple machine to mix the sand, cement and maguey fibre, which is then pressed in another machine and then air-dried. The dry tiling has very good strength, impermeability and low cost.

It can be installed using nails or wire and can be combined with wood or bamboo roofing.

8.2.5.3. Employment and characteristics of manpower

In the case of a process for manufacturing cement derivatives there is no need for skilled labour and the amount of employment is a function of the plant capacity and demand for the product.

8.2.5.4. Mechanism and transfer

Since the system involves making a group of cement derivatives it can be incorporated into the manufacturing process without any problem of a technical nature. The transfer of technology may be made through government programmes or by the housing institutions.

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*Agava or sisal fibre.

8.2.5.5. Feasibility and adoption by the region

Since this material is another application of cement, is low in cost and has better characteristics than other materials, possibilities for adopting it in the region are extensive.

8.3. Development policies for the formal building sector

8.3.1. Regional enterprises

Because of its economic and social importance, as pointed out, the materials industry should be given governmental and institutional support.

The extent of this support in each of the plants should be different; the larger plant, with regional projections, needs greater resources for its plans for expansion or building new enterprises, but basically what is needed is a stable political climate; as is known, the capital is used mainly in those countries which provide it. In addition, there is need for profit margins similar to those found in this type of industries in other countries.

An adequate supply of electricity is an important factor for the industrial localization of this type of enterprise, but there should also be a supply of foreign currency for overcoming problems relating to the purchase of equipment, raw materials and know-how.

Among these enterprises can be mentioned cement plants, iron industry, chemicals and other firms with high technology.

Some enterprises need vertical development; plants such as those producing sanitary equipment have been replacing imports, but there are still large volumes that could be replaced by means of better vertical organization. This could be promoted by tax policies and limitation of imports so that the better-off classes can consume the Central American product.

The regional enterprises need a stable market structure common to Central America, especially as regards customs duty and frontier barriers.

It is also important for governments to provide assurances as regards exchange and foreign currency for regional transactions.

8.3.2. Formal family enterprises

The formal family enterprise makes a substantial contribution to the production of building materials; as has been seen, this type of firm is organized as a company and to a lesser extent as a body corporate; the fundamental needs of these enterprises are modernization in the area of administration, but also to some extent in the technical sense.

These firms are already with some limitations, open to credit, but there is lack of financial machinery suited to their size; the larger banks that possess resources for providing finances are not interested in this sector, since the financial expenditure involved in the control of the transactions does not leave satisfactory margins of profit for the financial institution.

Hence it would be worthwhile establishing certain banking mechanisms using special schemes or second-instance credits to ensure interest in providing funds for these industries; government banks and smaller banks should be dynamic elements in encouraging these firms.

The funds should then be geared to modernization in production and administration; at the production level there is need to advance credit for the purchase of machinery and equipment and, for purposes of administration, to purchase computerized equipment for streamlining accounts, inventories, invoicing, etc.

Official research and technological development institutes should advise these enterprises on the technical side - improvement of processes, plant distribution, quality control and so forth.

In administration they should advise on the use of computing equipment, accounting systems, clients, payrolls and purchases.

They could also participate jointly with the informal sector in a construction materials stock exchange that could be sponsored by international and governmental institutes.

8.4. Support programmes for the informal sector

Below we give a programme for the incorporation of the informal sector into the construction process in a more organized and active manner.

A programme for promoting the informal sector, as already said must be designed to solve several basic problems, namely:

(a) Encouraging administrative and technical improvement;
(b) Transformation into small formal enterprises;
(c) Availability of credit and basic financing;
(d) Assurance of a minimal captive market;
(e) Receptiveness to information available through popularization programmes.

The housing promotion institutions could take charge of programmes of this type of which they should have the collaboration of technical training institutes so as to minimize the cost of the infrastructure, and the religious, benefit, governmental, institutional and other organizations providing encouragement for the programme.

The institutions should study those parties interested in the programme, with a view to advancing credit, for an analysis of which one should know the experience they have gained in production and business administration.

Credit should be granted for the purchase of machinery and equipment for working capital; repayments and monthly interest should be deferred until the equipment is in operation.

Payments should be made gradually, in the following form:

First stage: purchase of machinery and equipment
Second stage: cost of installing machinery and equipment
Third stage: working capital.

The promoting institution should set up infrastructure for administrating the programme and following it up with credit users. Repayment of capital and interest should be agreed on between the bank and the beneficiary to whom the payment is made in the form of the supply of products, blocks, bricks, columns and so forth.

In order to incorporate the formal sector into the axis of accumulation of the formal sector it would be best to organize material sale depositaries through co-operative organizations selling the materials and housing co-operatives or religious organizations.

It would also be possible to work with the formal sector of the economy in a building materials stock exchange.

As soon as the beneficiary has been accepted for the programme he should receive training in the handling of equipment, mainly in the more efficient use of it and, in improvement of the product quality. It is of importance that the product should be able to serve for paying bank debts, which can only be achieved if the product is a high grade one.

The institution in charge of the product should have budgetary allocations for popularizing the programme, but mainly for circulating information on building technologies, manuals for the use of certain resources, and so on.

The building industry is a good example of an axis of accumulation, since all the industrial sectors, trade and services are inter-related and meet at one point - that of construction.

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