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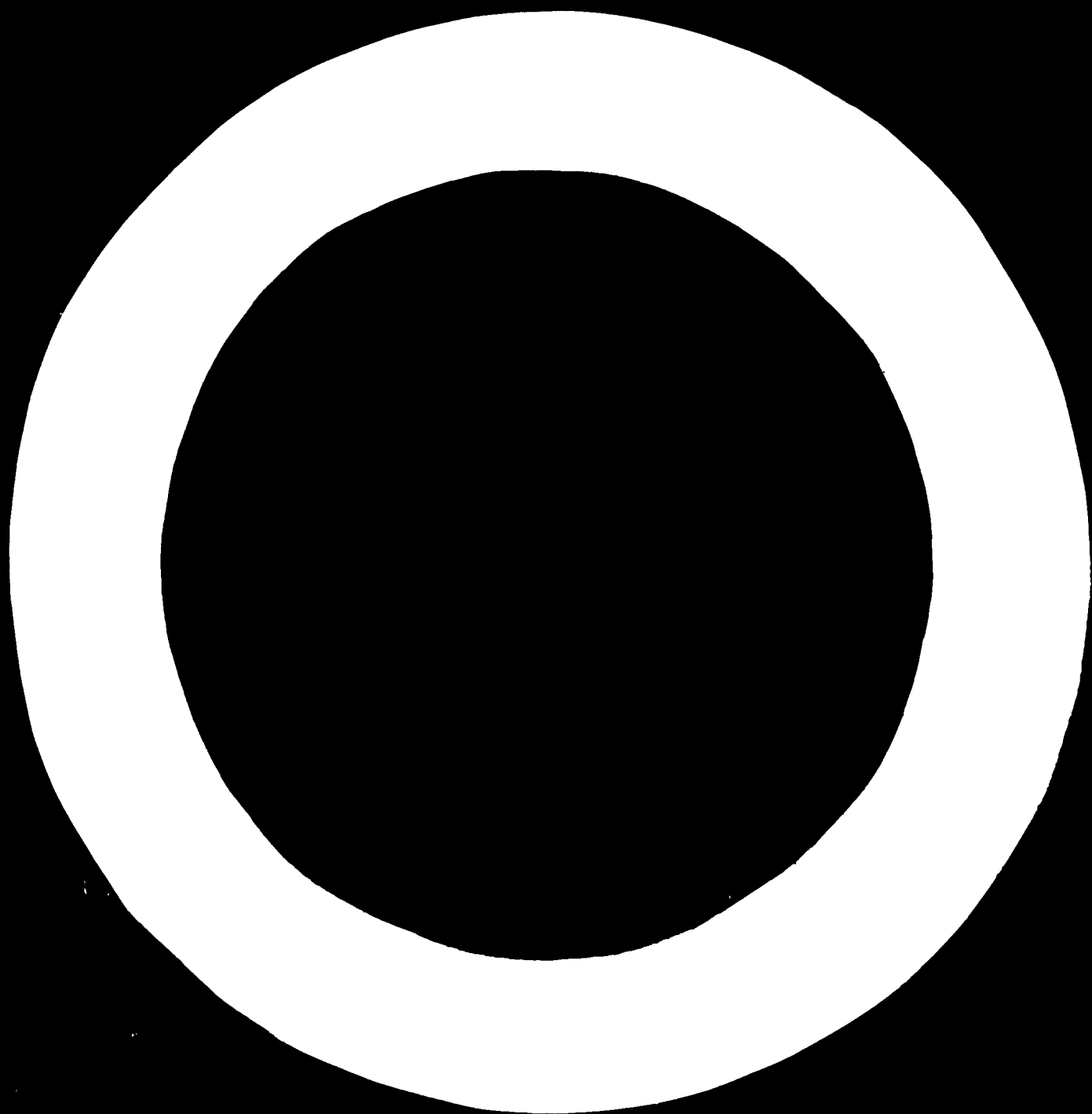
CONSTRUCTION PLANNING  
AND ADMINISTRATION IN THE HOUSING INDUSTRY<sup>1/</sup>

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## CONSTRUCTION PLANNING AND ADMINISTRATION IN THE HOUSING INDUSTRY

### WHAT IS I N D U S T R Y ?

I am sorry, but I think I have to start with some common remarks so that we are sure we are of the same opinion when speaking about housing industry. Interpretation of words, and communication are not the smallest problems in this world.

What is i n d u s t r y ?

I think that, today, industry is the attractive vision of many of the leaders of the developing countries, and they may be right if they are looking forward to an evolution like the one Europe went through in the 19th and 20th centuries. Industry is the basis of modern welfare, whether we like it or not.

Industry means m a s s p r o d u c t i o n. To be able to mass produce a product, you must possess a factory or production equipment which can be more or less mechanized, seen in relation to, amongst others, the ratio between costs of mechanisation and of manual labour. The factory and the production equipment must be financed and the investments amortized. The first copy of an industrially produced article will be very expensive, extremely

expensive, but the unit price of the following articles will be less than the unit price of the traditionally produced items. Industrial production will be feasible only in case the size of the production is so big that you pass the break-even point.

Industry also means a d e c r e a s i n g number of manhours spent in the production of a unit. Due to the repetition in production, the workers will get trained in the operations and use less and less manhours.

Just to relate this remark, which is an experience from all industries, to our theme of the seminar, I can produce the following figures from my own country and from our own firm. The figures indicate the number of manhours to produce a complete flat of about 80 sq.m., all operations included:

1946	1800 hrs.
1957	1500 hrs.
1962	1100 hrs.
1964	740 hrs.
1971	570 hrs.

In my company, ten years ago, we introduced a building type, a model of dwellings which has been used during all these years, and still 10 years after the beginning, we use less manhours per unit than the year before. The training is the key word.

This seems self-explanatory, but it must be kept in mind. This again means that, if you are in the phase of a running production of a standardized product and then introduce a new product in exchange of the previous product, then you will lose some production volume - - or use more manhours per unit - until you have again obtained the same level of training in production of the new product.

I shall revert to this later.

Industry also means production of articles which are designed before they are offered to the market.

No industrial production will start, no tooling-up of a production line or a factory will be done, unless the person in charge has researched the market and come to the conclusion that, if he offers his product at a certain price, there will be a reasonable chance that he can sell such a number of his article that he can thereby pass the break-even point, make a reasonable profit and even spend money to invest in the development of the next product he will offer the market, and its tooling-up.

Industry means market research. An industrial producer develops and designs his product before the first copy of it has been sold.

Industry means investment.

Industry means planning, planning, planning.

Do not forget that industry also means the planning in time of new products. If the production of a certain article continues year after year, and if there is a free liberal competition within the area, competitors will take up the idea and probably underbid you or offer better products at the same price. It is to be hoped that this happens only after you have passed the break-even point so that you have a possibility to lower your price. Life is so that you will not, year after year, be permitted to take advantage of the profit you planned to gain. In contradiction to what was written in the first pages, the accumulated profit of a given product will, after a certain lifetime of the product, not increase, but, rather fade out or decline. It is necessary to have developed a new product to throw into the market at the right moment.

Everything which has been written here and also in the following pages relates to common industries and also to housing industry.

WHAT IS NECESSARY IF YOU WANT TO INDUSTRIALIZE ?

To be able to industrialize, you need:

a technique, a know-how on production, and some raw materials,

a market for the product,

the necessary administration,

the necessary labour force,

financial means,

and last, but not least - planning and management.

This is also valid for housing industry. Of course, houses can be built by amateurs or by local craftsmen. But this limits the productivity, the volume of houses which can be built by the given resources. Craftsmen's work can be rationalized - - a little - - but never be industrialized.

WHAT ARE THE RESULTS OF INDUSTRY ?

Products get relatively cheaper.

If you calculate how many hours an "average worker" has to work to be able to pay for a bicycle, a typewriter, or a refrigerator and compare how many hours the same worker had to work some 40 - 50 years ago to be able to buy the same goods, you will realize that the products have become cheaper, and this is not due to the fact that the workers in the former colonies have obtained a better social status in society today. The same thing can be found in the "old world".

Products are available.



Industry is interested in production only of goods which can be sold. If an industry market researcher finds a need, suiting his production capability (and production price), the product will be present on the market.

But industrial products are not individual. If the market researchers find that the market needs a special bunch of goods, they produce it, probably in different colours and in some different sizes --- but the flexibility --- the different sizes -- is preplanned. Bicycles are made 20", 22" and 24" high - and this variation is available at the market - but if you want a 23" bicycle, or even a 22" bicycle with 12" more distance between the axles, you will be in trouble.

Industrialization results in urbanization. You need workers, electricity, roads for transportation of raw materials and finished products, all of these things belonging to urban districts.

Also for housing industry it is of interest to produce in the neighbourhood of the market -- the townships.

#### WHAT IS HOUSING INDUSTRY?

I think that when speaking of building industry, two different industries are often mixed - the building industry and the building material industry.

The building material industry is producing everything you want in case you are going to build - it might be sanitary porcelain, clay bricks or corrugated asbestos. Definitely many products of this kind can be produced in the developing countries, and in increasing quantities. I am no expert in this business. When I speak about building industry (housing industry) I am touching the production of dwellings or parts of houses, house components.

If you are interested in improving and increasing the traditional housing, you must reinforce your building material industry --- and also increase the training and teaching of craftsmen.

But I am afraid - and this is the experience from Europe - that with an increasing demand of social welfare, people will want dwelling volumes in an increasing speed. You will have to increase the capacity of your housing production. And even if you reinforce the building material industry and educate more craftsmen, they cannot follow the rapidly increasing demands.

Wages are increasing. Products which are based upon manual production will be more and more expensive. The customers do also earn more money today, but they are pressed from all sides to buy more and more goods which are produced industrially and, therefore, relatively cheap. An increasing part of the world is using an increasing part of their income to buy industrially produced consumers goods, and fewer can spend a reasonable part of their income to pay for an increasing demand of bigger or better housing, as long as the latter is being produced manually by craftsmen.

Housing industry is an activity where buildings (or housing components) are mass produced according to drawings and designs which are preplanned, based upon market surveys, and developed before they are offered on the market.

Such an industrial production comprises practically only the capacity limitation which is based upon the financial means. Labour force is necessary only in minor quantities and the workers need not be craftsmen, but just plain labour force.

The mass produced houses can satisfy an increasing fraction of the urban need for low cost houses, while craftsmen in the future will be used for repair and for the construction of those few houses, the promoters of which can afford an individual production.

Mass produced houses can today be produced much quicker, of better quality and by application of much less manhours than before.

We are in a wicked circle.

If there is a market to satisfy, then an industrial production can satisfy the market, but nobody would like to order the first copy of the production before he has seen it, and nobody would like to invest in the production facilities unless he knows that he will be able to sell a sufficient number of the article.

#### TECHNIQUES, KNOW-HOW

How is the construction procedure today in the developed countries? Here I can speak mostly about the Western European experiences. They will be partly valid also in Eastern Europe.

Craftsmen's production is still in operation, and no doubt it will be so for centuries.

Not only for repair, as just mentioned, but also for all the individual production -- all structures and houses to be built in one copy only.

As soon as you are producing dwellings which are repeated, industry takes an ever increasing fraction of the volume. I can quote a top employee of the Danish Ministry of Housing who recently said: "In Denmark it is today nearly impossible to find a multi-storey low-cost house which is not more or less industrially produced".

The promoters for this industrial mass produced low-cost housing in Europe are of all kinds. Private capitalistic promoters buy houses and sell or rent them, municipal or state authorities build houses for the lower or middle income groups, and you will also find some non-profit social institutions, the aim of which is to build such houses; I can recommend a study of such institutions; they work more or less with state sponsored money.

Who is going to design?

Today this is also an item which is being very much discussed.

The traditional way was that the promoter went to an architect and told him what he wanted to be built. Then the architect made the design, probably in cooperation with other consultants (engineers, specialists). Further, the project was sent out for bids, most often separate bids for each trade, craftsmen were contracted and the architect managed the construction and erection - controlled and supervised and made the different trades cooperate technically and timewise.

These principles have been used for centuries. They have been varied. We all know that main contractors could simplify the erection procedure. Some of these drawbacks are that the architect is acting only as a consultant. He is not responsible for the price, and as a matter of fact often interested in as big production price as possible - his salary being a percentage of the production price. Further, the architect would very often introduce new designs every time he got a new job - and some promoters would also like their products to be different from others. Although the

requirements would very often be similar from house to house -- being so and so many flats of a given mix of different sizes and number of rooms -- the architect tries to solve the same problems in a different way every time, every time making new "monuments". If the same architect had been working for an industrial housing producer he would have been allocated a budget and time for development of a certain type of house fulfilling the given requirements. Then he is designing a housing model which should be used in thousands. Now he can work to elaborate the right model.

Even if you are working with a general contractor who is also responsible for the design, and who then has to consult architects and engineers himself -- probably his own employees -- then this will not be industry. The general contractor is appointed for one object only, and normally he will have only a very short time to prepare the design.

But the industrial housing producer. How does he do at present in Europe?

He visits prospective clients, he studies their wishes, their requirements for the houses they will build in the future. He combines the requirements from different market areas, he engages market research specialists to do this. He engages architects and engineers to design the right model which will cover the demands of that fraction of the market he finds feasible. He produces designs -- probably a scale model -- a mock-up --. He engages a sales department who contacts the client, the demands of whom he knows he has taken into consideration. He offers them at a reasonable price because he knows he will find sufficient clients. He invests in a factory. His production engineers

cooperate with the architects and thereby they secure that the product they design is also feasible to the production.

If the right product is offered and at the right price, why should the clients not buy?

You may say that what has been described above is a system and that a person who is responsible for the use of public finance cannot be dependant on one system only.

Well, if you are going to buy an automobile today, you do not go to an automobile architect and ask him to design a car specially made for you - - and if you did it there would be no tenders after the design, no tenders, where the architect calls for bids - one for the body of the car, one for tyres, one for the electrical system. You look at the cars which are available, compare and evaluate their qualities and prices to your requirements and resources, and you make your choice.

Two variants of housing industry are today predominant in Europe.

One tendency is to produce houses, housing models, as just described, another to produce housing components. Let us look a little at the producers around the component industry also.

It is possible today, in very rationalized factories to produce high quality standardized wall components and floor components. Many modern architects and engineers have been working on the development of such components which could be used for multiple purposes.

Such components are made in standard sizes. In some countries in Europe you will find that a planning module grid of 30 or 60 cm (1' or 2') is being introduced. In my country all flats for renting must - if their plans are passing the Ministry of Housing to obtain state sponsored financial means - be designed in relation to a module grid of 60 cm. In countries where the modular idea is accepted there will hence be a market trend for floor slabs of width 60, 120, 180, 240 cm and lengths also varying in steps of 60 cm; similarly there is a tendency to produce walls the widths of which are varying in steps of 60 cm. In my country we also have a standard height of a storey. Hence it will be possible for component producers to invest in rationalized equipment producing these s t a n d a r d components.

The architects, knowing that there will not be enough money unless they have modularized, start their design by making a 60 cm module grid, and if they use their grid the right way, they can adapt their design and the functional requirements so that a large part of floors and walls can be produced in the rationalized production equipment.

If the standard housing components are applied, we again have the system where an architect makes the design in accordance with his personal style, only limited to the requirement of a module grid.

When such components are applied, you still need the production of exterior walls, etc., which are not standardized, and here the architect has the possibility of giving the building his personal touch.

I should like to repeat:

In industrialized housing you can either develop models which are totally prefabricated under industrial circumstances or you can develop industrial components but still have to put these together in houses under a management working the traditional way.

Naturally such industries can be developed only in areas where the infra structure is prepared for it. You must have roads for transport of raw materials and components, electricity and water supply to the factories, etc.

The technique of producing with components, which has been described shortly and which will be demonstrated at the Seminar can be exported to developing countries. At the Seminar some "systems" will be demonstrated and anyhow from my own company a film about the introduction of our system in Malaysia will be shown.

Housing models and housing components must be designed in accordance with local functional requirements and local raw materials.

The local conditions f.inst. the climate - will influence the design of the components. In colder climates the thermal insulation is important, in warmer climates the time lag factor might be deciding. In seismic zones concrete components must be reinforced, in non-seismic zones, plain concrete walls are sufficient. Different types of components - could anyhow be produced as results of the same production way.



Today the most common building material for mass produced houses are bricks, timber, metal, plastic and concrete.

For bricks a lot of skilled labour is necessary and even if you rationalize there is a limit of how many bricks a bricklayer can place per day.

Timber is a fine building material, but according to my experience it is in mass production mostly applicable to joinery, furniture and equipment.

Plastic is under development. Today it is mostly found in science fiction. However, today the production of f.inst. totally completed bathrooms with all equipment is a reality. I don't think that such specialities which are rather costly, but manhour saving will be actual the earliest years in developing countries.

Concrete is a cheap and durable material, not being affected by insects, fire or fungus. In countries where methods saving skilled labour are introduced, concrete is used as the basic material for the house components and housing industries.

Standard concrete components can be used for a multiple of purposes. Schools, medical centres, one-storey houses, multi-storey houses, military barracks. However, you should not imagine that the standard component will be produced and stacked, waiting for sale in a stockyard. Experience shows that these are produced only when they have been ordered. You must also consider that if you imagine a multi-purpose standard component you also need a multitude of architects or consultants to design how this should be combined into the buildings.

If you consider the applications of housing models you need one good architect or consultant to develop the model, and then just a few technicians to adapt it to the different sites.

If the production of a running model should be really economical the sales of this should be planned in advance.

### A MARKET FOR THE PRODUCT?

Is there a market for the housing industry - ?

A market for housing models or for housing components ?

To estimate the answer you must know a lot about your country, statistics, policy.

Do you really need housing?

Your first reply will be, that you need a lot of houses. But it will be one of the unpleasant tasks of your politicians to decide which one of the housing needs should be satisfied. You cannot afford to build all the houses you want, and houses with such a quality as you want.

What about the distribution of state finance resources? Infra structure means expenses also. For industrial housing you must accept that no real industrialization will take place without some big investments, so big that it is unlikely that anybody will start it unless the state is somehow involved, either as co-investors or by granting a certain sales value. I shall revert to this.

A market research study is necessary.

And I propose you start by gathering statistics and ask the politicians what the goal should be -- and whether there are the necessary financial resources to cover the requirements.

Industrialized housing should start in the urbanization centres -- where the volume of the erection of new houses is most concentrated.

Is it intended to urbanize? Where? What will the key industries be?

This will be a difficult political task, and it will not, taking the speed of the development in the developing countries into consideration, be easy to extrapolate as it can be done in the "old world".

You have to consider - and decide - w h a t should be built.

How big should dwellings be? How many family members per dwelling? How much living space for each person?

Will you provide housing for the growing population of workers at your key industry? Should they have family dwellings or just hostel-type houses for the male workers who have left their families behind them in the countryside?

Don't imagine you can solve the urbanization problems as well as the farm housing needs by the same activity.

Make a plan for what you need, and what you can afford. It may be difficult to make all ends meet.

Thus having made a study of the need and the resources you must develop some dwelling types which will satisfy your purposes and your purses.

Surely you will find, you cannot afford what you want. You must cut down. You cannot afford luxury.

One of the ways to cut down is to develop a housing model and produce it in factories. Repeat it, repeat, repeat.

You don't need to be afraid of uniformity. "The right model" does not necessarily mean that all dwellings and housing blocks must be alike. A good model must be made so that it can be used for long blocks, short blocks, tall blocks, low blocks and in the blocks there must be a preplanned possibility of mixing the sizes of dwellings which are needed. A good model will often be produced in a given production rate -- so and so many sq.m. per day or per shift. Within such a production unit a preplanned mixing of 1 - 2 - 3 - 4-room dwellings can easily be arranged, as it will be demonstrated at the Seminar.

But when a model has once been finally developed it is complicated to change it.

Very often we have been asked what is the minimum market you should look for in case you consider to start a housing factory?

The reply naturally cannot be given just in a short sentence. Also here you ask where the break-even point is to be found.

In a diagramme where the size of the market is the abscissa and the production price of the housing product is the ordinate, the price for traditionally produced houses will follow a straight line through the origo. The price for the first expensive industrially produced house will be marked on the axis of ordinata and the price of the following industrial houses will follow a straight line through this point. The break-even point is that size of the market where these two straight lines intersect. This abscissa which you are asking for is defined on the bases of the unit prices for the two different production methods and also based upon the initial costs.

It is rather difficult to define these two proportions exactly and, therefore, difficult to state the exact value of the break-even point.

As a rule of thumb we have found with the experience we have in my company that you must be sure that you within the natural market area of one factory should be able in 5 years to produce about 50,000 to 70,000 m<sup>2</sup> every year. The natural market area is also difficult to define. It depends on the roads and transport vehicles. We have found that most of your products should be sold within a distance of 70 - 100 km from your component factory. Naturally the factory should be placed as close as economically possible to the centre of the erection.

## ADMINISTRATION

What can be done from the governmental and probably local authorities to promote the industrialization of houses?

Be sure that the sites are open, that when houses are there, that it is then also possible to get there - - that roads, sewerage, water mains, electricity mains, etc., are there as soon as the houses are ready. - And do not forget that one of the advantages of industrialized housing is its rapid speed of erection. As soon as soil and sub-soil construction has been completed only a very short time will go before the houses are there, and if the local infra-structural programme has not been carried through to the necessary extent, the money for the houses is wasted as long as you cannot exploit them, due to lack of water or sewerage.

The necessary town planning must be done in time. It is up to the local politicians and their technical employees to decide in time which type of housing they would like to see in which parts of the towns. The town planning should not be made all too detailed, but more or less given as functional requirements. As an example I can refer to a building scheme I know, when the town planners had decided that on a certain site, houses should be 12.00 m. in width. As we had a product model which was 11.66 m. in width, it was difficult for us to get the necessary permits. I think that the idea of the town planners was that they did not want houses to be more than 12.00 m. in width, but they could also have indicated that they did not want more than so and so many sq.m. of houses. The idea behind the town planning and the political decisions should be clear. How the producers can fulfil the requirements ought to be their problem.

The building regulations and building legislation should be revised. Most of such papers are based upon old experiences and old craftsmen's traditions. They should be based upon functional requirements. In many

areas which within this century have been colonies the building regulations are still based upon the regulations of the former colonial powers. This might be or might have been a good idea, but it should not be forgotten that also in the "mother countries" development is continuing and that regulations have progressed from the stage they had arrived at, at the time the ties between the colony and the "mother country" were broken. Europe shows in these years a clear tendency to change their codes and norms so that they are more oriented towards functional requirements. There is also a tendency to make the regulations more international. Within the international organizations such as CIB (Conseil International du Batiment) and CEB (European Concrete Committee) the last 10 years have seen good progress in these respects and I think the developing countries should study these results carefully.

How will it be possible for a developing country to approve the introduction of an industrial building system? I think it will be a little complicated. Only few have the necessary technical competence to do it. Most system houses do not fulfil the present local norms because most norms are old fashioned. If you are going to accept a building system, you must know exactly which criterias you will apply for your decision (and the systems builder should know the criterias also).

For instance, you should not indicate which wall thickness you want, but indicate what your requirements are concerning strength, thermal insulation, thermal absorbtion, accoustic insulation, protection against fire, termites, etc.

I can recommend that you try to state the necessary technical/political decisions - - the functional requirements - - then contact some system builders and ask them to demonstrate how their systems comply with your requirements. Ask a few of those who comply with your requirements to cooperate with you. Make

them prepare estimates based upon the assumption that a fairly large amount of houses could be built in a suitable sequence of years. It could be necessary to engage a consulting engineer or an architect to prepare the tender material and study the bids - - but be sure you get a competent man to do it. It is not just to make the architect prepare drawings. I don't think an architect can prepare designs for houses which will suit all systems - - but he could probably present some requirements which are indispensable and some which are desirable.

I can inform you that I have seen three different ways of introduction to industrial housing systems.

The **f i r s t** is not acceptable, but I have seen the tendency in many cases. There is a need for housing. Some promoter or authority has asked an architect to make a design, tenders are called for, and the prices are found to be too high. In despair the promoter contacts some system builder, and asks him to give a price for the same houses, but built according to his system. As the architect never thought of systems, when he designed it, it is evident that they are not very suitable for industrialization. The result will be houses which are also too expensive.

The **s e c o n d** I have seen just a few times. That is the way indicated above. The authority knows that it will build, and can afford to build so and so many houses in so and so many years. They go to a consultant and give him a good payment to find a building system according to which it will be possible to build houses corresponding to some functional requirements stated by the consultant and approved by the authorities.

The **t h i r d** is that the authority makes a survey of systems, finds one, which they find acceptable and then asks that system builder, and only him, to give a price for the houses, probably including the design. Politically it can be difficult to go into negotiations with one company only without asking for tenders, but if you can negotiate the houses at a price which you can agree upon with the political authorities this way can be applied. I can tell you that in my country most of the



low-cost multi-storey houses are controlled by the Ministry of Housing. It very often happens that the non-profit organization negotiate directly with only one producer.

The reason is, you will understand, that models are often developed by and owned by the producer, and hence no consultant can prescribe this model if he is calling for normal tenders.

In developing countries and, by all means, also countries in the "old world" systems are very often introduced by adopting well-known systems which have already been in operation in other countries. The transmission of know - how from such a system is then covered by a licence agreement.

#### LABOUR FORCE

It is possible and necessary to industrialize. Prices are going up for labour force, as well as for materials, but the wages for the labourers are increasing relatively in a more rapid speed than the prices for the materials.

Compare two products, the price of which today are both 100, but where one is composed of 50% material and 50% wages, while the other is composed of 50% material, 25% wages and 25% capital costs - - - the latter naturally being the industrially produced product, the former traditionally produced. Within some years the prices for wages have gone up 20%, materials only 10%. Thereby the price of the former product has increased to  $55 + 60 = 115$ , while the latter now costs  $55 + 30 + 25 = 110$ . The tendency is clear. Even if an industrially produced article today has the same sales price, it will in the future become cheaper than the traditional.

At the beginning of this paper, the training of the workers was mentioned, the influence of the repetition of the work.

It is our experience that you can easily train workers to do the job in component factories. You do not need any - or only very very little skilled labour in the production and erection of the structural components for the industrialised housing.

In some countries we have heard the argument that industrialized housing is not acceptable because you have a large number of unemployed workers and industrialization means less employment. Of course this looks like a problem. You should not introduce industrialization if you do not need more houses than you can produce today. In traditional housing you need skilled labour. If the capacity of the skilled labour force has been totally exploited and you in addition introduce industrialized housing, this means an increase in production.

Skilled labour force is a scarcity in many developing countries.

Besides our European experience, we have in our company started license factories in Turkey, in Malaysia and are starting another one in Central America during these weeks. It has not been difficult at all to train Turkish or Malaysian workers in the factories.

We have even had the pleasure to train their leaders in our own European factories.

L a b o u r o r g a n i z a t i o n s are sometimes supposed to be a problem when introducing industrialization. In our country, I must say, we have not had any difficulties in this respect.

#### FINANCIAL MEANS

What is the price? How much do you have to pay to go into industrial housing?

The reply of course depends on many factors unknown to me today.

We, in my company, never go into any industrial housing activities abroad without carefully studying the prices in the country in question. And prices are definitely not the same in the countries participating in this Seminar.

It will be wisest to make a feasibility study together with a specialist before going too far into details.

The following brief list of items which must be invested in, and for the greater part of it - apart from the costs of the land - imported, can be a guidance:

Component Factory

Site for the factory, incl. preparation

Factory building

Factory equipment (cranes, casting machines, curing chambers (if any), laboratory, etc.).

Production Equipment (moulds)

Transportation Equipment

Building Site Equipment

Erection equipment (cranes, special equipment)

Designs, etc.

Factory designs, designs of products.

Licence agreements, know-how, experts.

Capital

Working Capital

The figures to be filled in could be varying very much, depending on many local factors and decisions.

Should the production be as much mechanized or as manual as possible? Should a large or a smaller factory be introduced? Is the available cement rapid or slow? Can we work in one shift or in two shifts? Must we have many or few social rooms?

As a guidance the following prices can be mentioned:

Component factory (land not incl.)	0,4 to 2,4	mill US\$
Transportation equipment	0,1 to 0,2	" "
Building site equipment	0,2 to 0,6	" "

It is impossible for me to give an indication of the size of the working capital. It is of course depending very much on the speed of payments, the distance in time between consumption of resources and payment.

Development programmes and international bi-lateral and multi-lateral assistances are interested in the erection and introduction of housing factories.

I am sure that some of the UNIDO officers present at the Seminar will be able to give information in this respect.

I know from my own country that our government has rendered state loans to many developing countries. Such state loans are often free of interest for a few years or more. Our Ministry of Foreign Affairs grants loans, or in a few cases even gives donations to cover feasibility studies and the import of production equipment to the developing country. In these cases the developing country has to cover local expenses. My country even covers expenses for experts to run-in the production.

In case your country will try to obtain state loans from Denmark, the procedure will be - after an informal "feeler" - to ask for a State Loan through your government and the local Danish diplomatic representation.

I do not know the procedures of how to get assistance through UNDP, UNIDO, etc.

#### PLANNING AND MANAGEMENT

These two words are key words.

When a housing factory or housing component factory starts, a large amount of money has been invested. It costs money not to exploit the invested means the best possible way.

You must engage a staff for the planning. Planning cannot be done with the left hand of a person who has something else to look after.

It is necessary to have a c o n t i n u o u s production. Earlier in this paper we mentioned the training of the workers. They get trained when repeating their operations. If there is a gap with no production - or even reduced production, the workers will get out of training, and when you start again you must invest in the loss of production in the running-in period.

And - naturally - in a period of no production you have no sales value and you obtain no contribution. To be sure, you will get a continuous production you must have a s a l e s plan.

We have often seen that it takes 2 years or more from the first sales contact until a contract of production of housing has been signed. Your sales must be far ahead of your production.

The most important plan is the p r o d u c t i o n plan. The objectives of production planning are to secure that the resources (manpower, machinery, raw materials) are exploited in the best possible way so that the costs are minimized. The right resources should be available at the right moment, and the final products from the component factory as well as the complete product - the houses - should be ready at the right moment, neither too late (penalties, no income of sale) nor too early (waste of interests of the consumed resources). The production planning must use an integrated way of thinking, looking not only for a rational production, but also for a production which follows the site erection. As a very illustrating example I can quote what happened to one of our licence factories. To produce as rationally as possible, nearly all interior walls and partitions were produced before the floor components were produced. Result: a very rational component production, but very badly planned because nobody could use the products until a reasonable quantity of the floors were also produced.

The delivery plan is an integrated part of the production planning. It should hereby be kept in mind that concrete components due to curing, should be stored a week or two so the production should be somewhat ahead of the delivery. As mentioned above, it should not be too much ahead. An integrated reason is that housing components are voluminous. A well proportioned concrete component factory will have room in the stockyard for only 3 to 5 weeks production. And when 2 out of these must be used for curing it is evident that production and delivery must be parallel.

If an effective production planning and a good management system have been introduced, it is possible to preplan for each day in the future months, when which machinery and concreting mould, when each worker, when each quantity of raw materials and each amount of money should be available in the most economical way.

The most simple way of production planning I can recommend you is a PERT plan or a Critical Path Method network.

If you obtain a large and expensive production, I can as a maximum recommend an integrated EDP of your production, purchase, economy, etc.

When a production plan has been carried through a purchase plan is the next step. If you can plan what you are going to produce every day in the coming half year it is also possible to plan when you need the raw materials. Your sub-suppliers of raw materials or sub-contractors will be happy if you can give them a forecast for their delivery to you, and you can get better prices from them if you can grant them long term contracts.

Having done all this you can also preplan the cash flow and make an economy plan.

It should not be forgotten that control and feedback are essential parts of a production management.

Effectivity and productivity must be controlled and followed up. It is only possible to keep the planned productivity by control.

In our companies, the building sites and the component factory call the central planning office every day and report how much has been produced that day. If the reported result deviates too much from the planned quantity, the persons in question are notified so that they can take the necessary actions in time to correct their work. The bigger the deviations are, the higher up the hierarchy of the company organization chart is alarmed.

If something has been "dropped on the floor" and you learn about it in time, you can probably grasp it again if you work overtime or during weekends.

In the sales plan it is advisable to overbook a little. This is not so important if you have orders consisting of one or a few very large orders (some thousands of flats). But, if your production consists of several minor orders (some hundreds of flats) overbooking is very welcome the day one of your clients for some reason cancels his order.

I should probably once again remind you not to forget the **infrastructure** in the planning.

It might be of interest to learn that in my country the Ministry of Housing may have realized years ago that Denmark could not overcome the housing shortage if industrialization of housing was not used. The Ministry also realized that it was difficult to ask private enterprises to invest in industrial housing facilities unless the enterprises had a certainty that they could sell their products. The Ministry made a five years plan in which it was stated that the minimum fraction

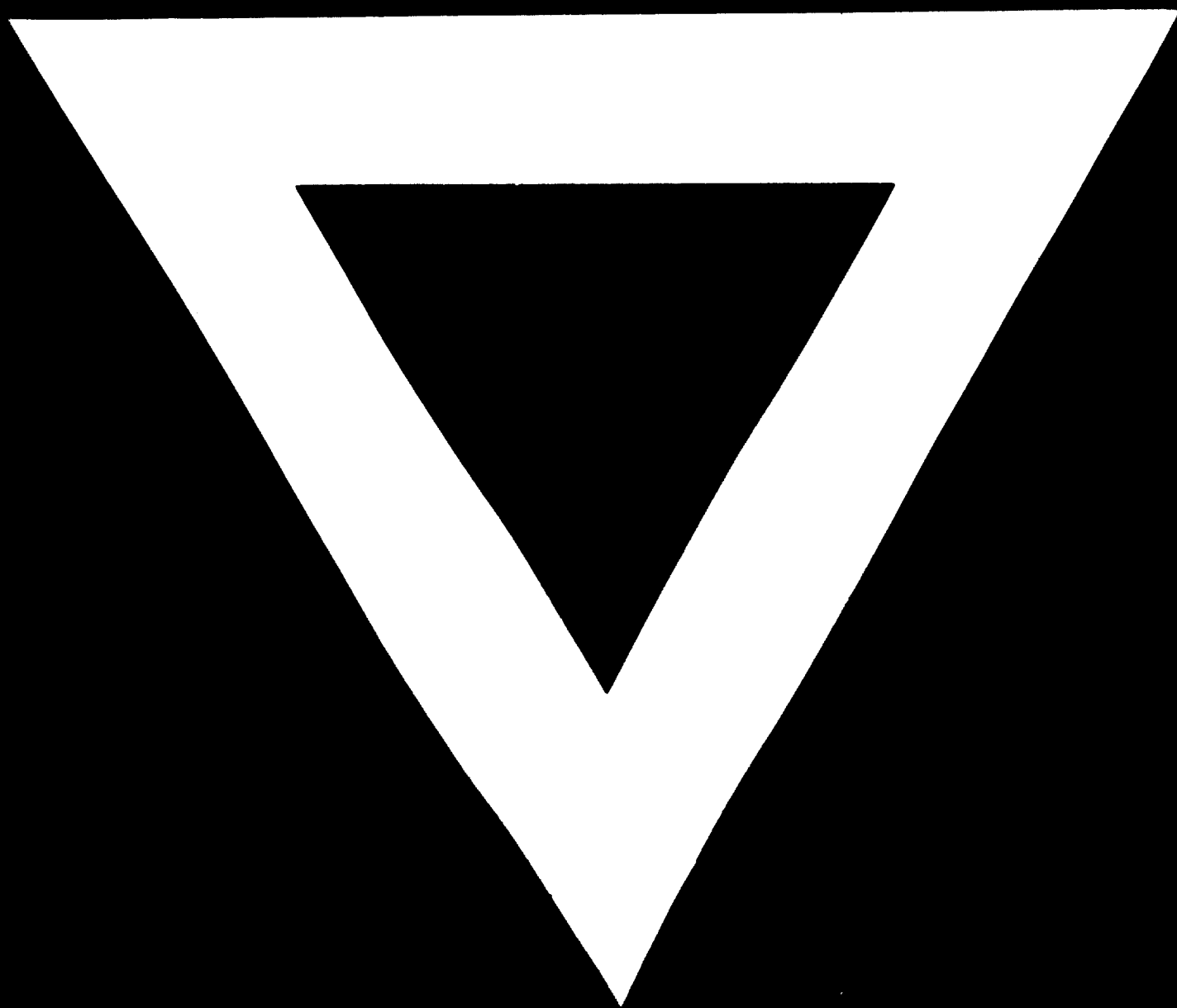
of the yearly production should be made by means of industrial methods.

In contradiction to most five year plans this was a "rolling" plan, being revised every year so that every year another was added to the plan.

Thereby the housing industry got a starting point, a push forward, so that today we can say that it has come to stay.







**18 . 12 . 73**