OCCASION

This publication has been made available to the public on the occasion of the 50th anniversary of the United Nations Industrial Development Organisation.

DISCLAIMER

FAIR USE POLICY

CONTACT

Please contact publications@unido.org for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at www.unido.org

UNITED NATIONS INDUSTRIAL DEVELOPMENT ORGANIZATION
Vienna International Centre, P.O. Box 300, 1400 Vienna, Austria
Tel: (+43-1) 26026-0 · www.unido.org · unido@unido.org

D03383

United Nations Industrial Development Organization

Distr.
LIMITED

ID/WG.122/15
10 March 1972

ORIGINAL: ENGLISH

Meeting on Prefabrication in Africa and the Middle East

17 - 29 April 1972
Budapest, Hungary and Bucharest, Romania

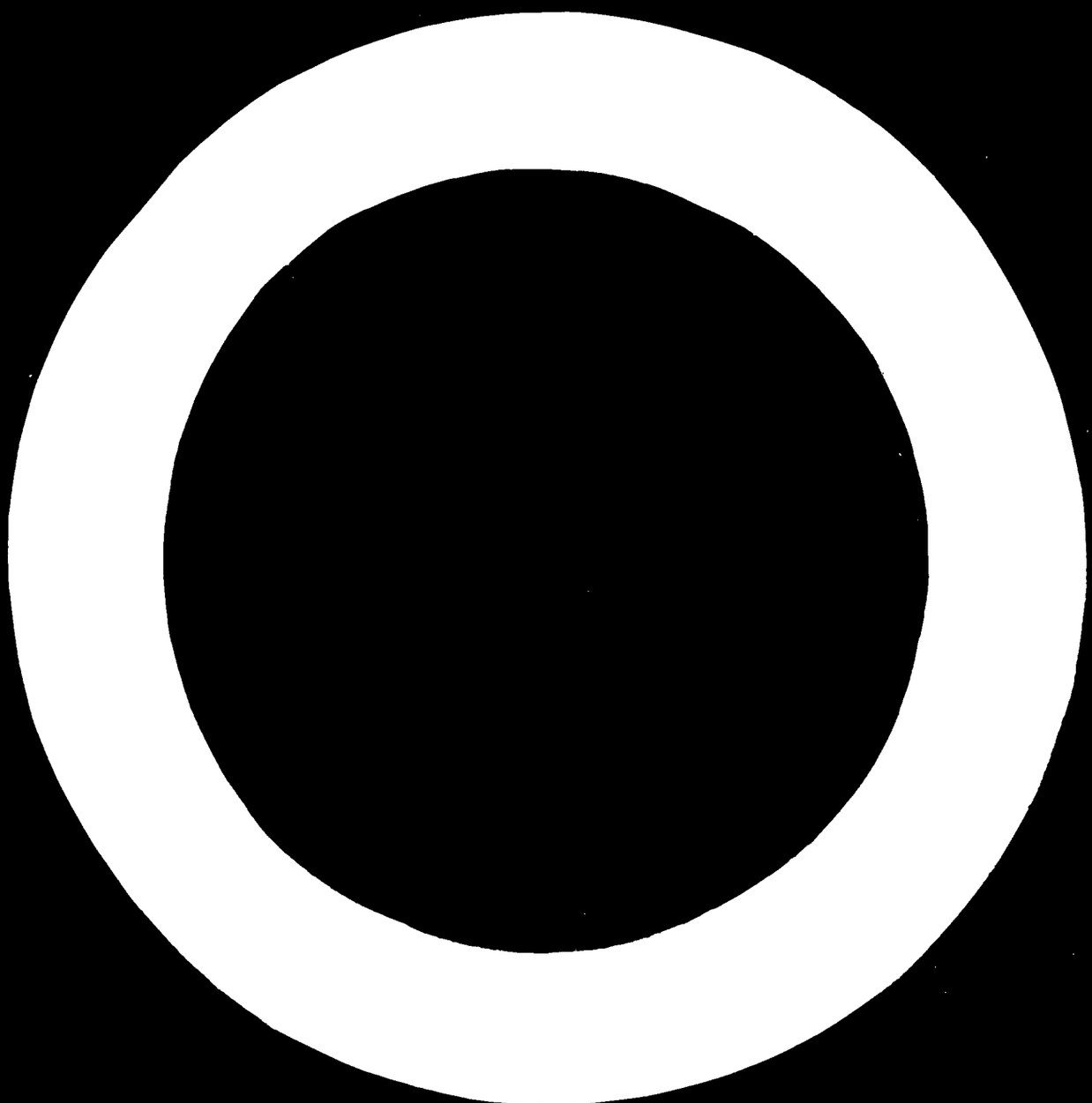
THE MANAGEMENT SYSTEM AND THE TECHNIQUES EMPLOYED BY LARSEN AND NIELSEN CONSULTOR A/S COPENHAGEN, AND GUIDELINES FOR ESTABLISHING A NEW COMPANY UTILIZING THE LN METHODS[1/]

by

Jes Lützhøft
Civil Engineer
Larsen and Nielsen Consultor A/S
Copenhagen, Denmark

1/ The views and opinions expressed in this paper are those of the author and do not necessarily reflect the views of the secretariat of UNIDO. The document has been reproduced without formal editing.

id.72-1436



The lecture is divided into two sections. The first section deals with the set up of our Danish enterprise Larsen & Nielsen Constructor A/S. The management concept and the techniques employed are described.

The second section includes some considerations on key factors, important for establishing a new company producing dwellings based on the IN methods.

The first section describes the theories and techniques on which our Danish company has based its activities. The objectives and the policies are dealt with. The adaptation of industrialized production methods in housing production is illustrated. The organization and the administrative concept are particularly emphasized. Subjects such as Market Research, Sales Policy, Production Planning, and Long Range Planning are mentioned. Further, the techniques employed and developed are described.

The second section illustrates some of the aspects one must consider when setting up a new industrialized housing enterprise. Feasibility Studies, Market Research, Investments, Break-even Point and Profitability Calculations are included. Further, the adaption of the projects to local building codes and local building requirements are described. An investment example together with an annual budget and a time schedule is included.

The Management System and the Techniques Employed by Larsen & Nielsen Constructor A/S, Copenhagen.

Any industrialized enterprise is based on a set of theories, objectives and policies, forming the ideology of the company.

To make the theories concrete a set of techniques is employed and developed. The techniques serve as tools materializing the policy in order to achieve the objectives.

Before describing the management concept of our Danish company, a brief introduction to the LN industrialized housing methods is given.

Our industrialized housing methods or the LN system are based upon the factory production of building components which after assembly on the construction site form the turnkey completed buildings. The reinforced concrete components with cast-in parts such as pipes, conduits for electrical wiring, etc., are the basic elements in the system, both in the production and in the structure of the buildings. The concrete components are produced in permanent factories from which they are transported to the erection site. Having erected the components, the finish work proceeds within the raw building. The project is delivered turnkey to the client.

Abroad, the LN industrialized building system stands for experience in the establishment and management of companies producing buildings on an industrialized basis. This includes know-how on:

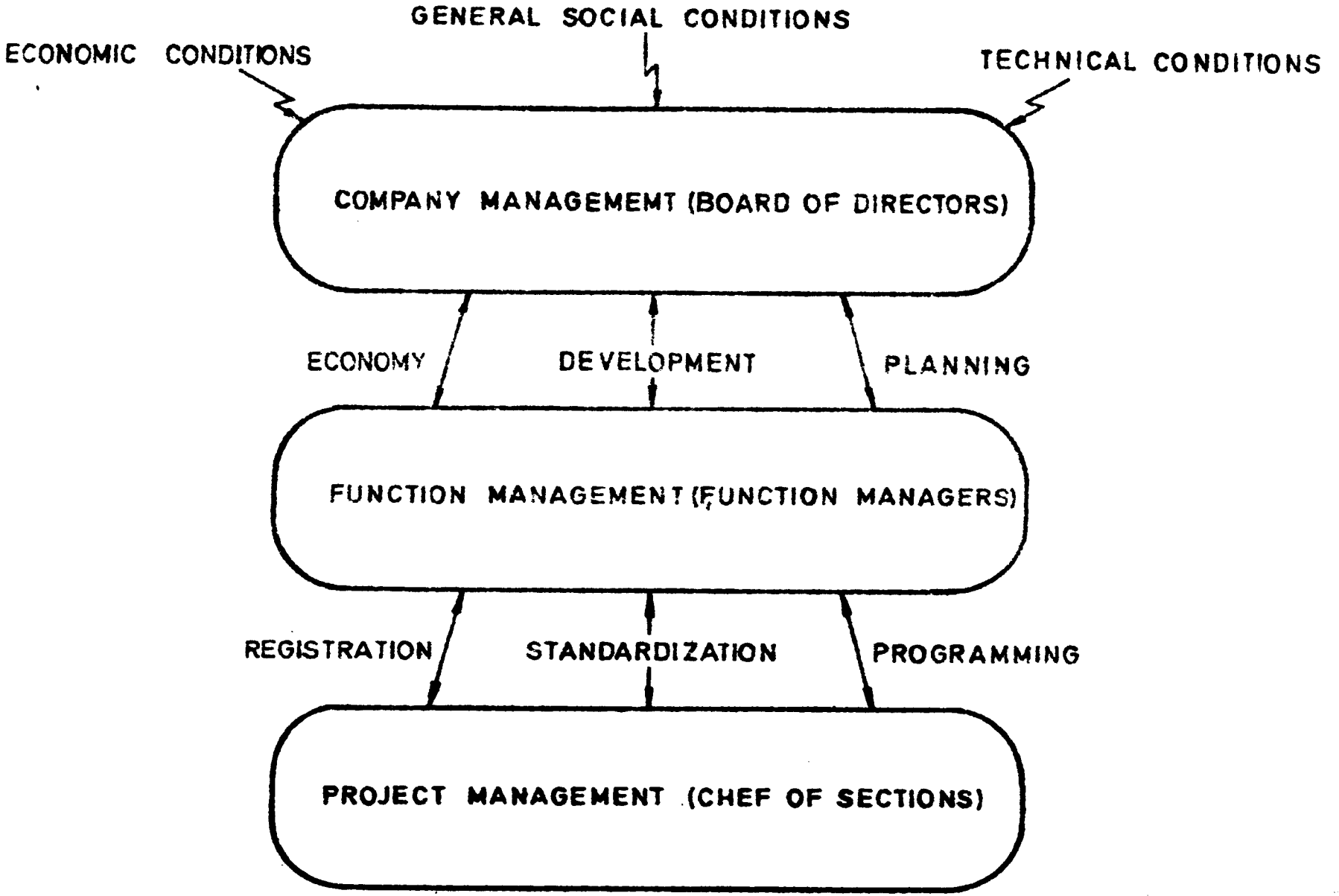
Market Research,
Production Development,
Process Development,
Purchase Organization,
Production Management,
Sales Organization,
Management.

The LN system covers a global know-how including the entire process from the planning to the handing over of the concrete building.

Industrialized housing is not only precasting and sale of reinforced concrete components. Industrialized housing means using an adaptation of the principles for industrialized enterprises. The main principles are mass production and the marketing of products which according to the market research cope with the market requirements. These principles require another management concept than an ordinary building contracting enterprise. The management system employed in our Danish company is based on the following seven main requirements:

1. Delegating of Responsibility and Authority.
2. Long term planning as well as short term planning to be established according to a certain pattern.
3. As far as possible the total coordination must be carried out direct between the responsible leaders and only exceptionally by mounting a step in the organization plan.
4. Integration especially with a view to acquiring the same specifications and standards as regards the consumption of resources in all departments of the company.
5. Large flexibility so that modifications in product, sale and purchase policy do not require a new system.
6. Application of quantified goals (to be expressed also in figures) and policy for all management levels (management by objectives).
7. As little and as relevant information as possible according to the principle of exceptional and liminal values in reports (management by exceptions).

To meet these basic requirements we are operating with a decision model including only three management levels. The uppermost level is the company management. The next level is the function management and the lowest level is the project management. All important external influence



MANAGEMEMT LEVELS

and information are accumulated in the long range company management (more than two years). In return the current management (less than two years) and corresponding external dates are accumulated in the mid level, the function management, which itself executes the transverse coordination between the functions of the company: Development, Planning, Economy, Sales, Projects, Purchase and Production. The company management and the function management are connected by the physical and economic planning and by the product and process development.

The project management is executed currently by each particular department (Sales, Design, Purchase, Production, etc.) for each particular job. This management level executes jobs independently within the framework established by the function management and is operating up to one year ahead.

The connection between the function and project management is established by the programming (EDP and detailed planning) standardization of products and processes and by registration work of the central accounts department. An EDP based integrated system has been elaborated for the project management.

The company management defines the objectives for the goals of the company. The position the company is endeavouring to obtain, the desired economic growth, the policy, particularly the financial policy as regards independence, are elements on which the objectives are based. The company policy is established to achieve the goals. This policy indicates the activities, the types of products, the financing possibilities, the ways of managing and organizing and the efficiency plans the company has to follow in order to obtain the objectives of the goals.

ADMINISTRATION CHART

1)

Goals of the company

Policy of the company

Product policy — Sales policy — Production policy — Purchase policy

5-year plan

2)

Masterplan and budgets

3)

Sales-plans — Projecting-plans — Prodution-plans — Purchese-plans

The five year plan contains the policy (with quantative indications in figures) for products, sales, production and purchase. Further, it includes plans for product and process development, for turnover, for required production capacity and other resources. An investment plan and a profit and financial budget are also included in the five year plan.

The first phase of the five year programme is the elaboration of market researches and supplier prognosis. These forecasts are the basic information for the establishment of the first proposals of new products and new processes. The next phase is the physical planning by which a coordination of sales, products, supply and production possibilities are carried through on the basis of alternative estimates. The output of the physical planning is a volume and capacity planning, as well as a personal planning. The third phase of the five year programme is economic planning based upon the output of the physical planning and the planned financial policy. The economic planning has two main outputs i.e. a profit budget and a financial budget. When these outputs correspond with the goals and the policy of the company, the planning procedure has been completed. If not, the procedure has to be recommenced in order to find another alternative coping with the company goals and policy.

The function management is established to ensure that the coming two years of the five year plan are realized. This work requires a transverse coordination of the physical and the economic planning. This coordination results in plans, programmes and schedules for the project management. These plans are master plans, working budgets, control procedures, standard levels for consumption of resources, long range frame agreements for purchases, standards of products and processes, efficiency planning, personnel planning and product and process development schedules.

The key functions of the project management are calculations, production planning, material planning and production control for the individual projects. In medium and large size firms, each of these functions easily assume such proportions that the coordination becomes quite extensive. If this happens, the organizational level in charge of this function will of course have to clear up and compare the conditions of the basic dispositions. Consequently an integrated system for production planning and material planning, as well as for production control is necessary in order to obtain uniform and clear management of the individual projects. In Larsen & Nielsen Constructor A/S we have established an integrated EDP system for running the projects through the project management level.

This rather brief introduction of the management system we have chosen in our Danish company only gives an impression of the general ideas on which the management is based. We have endeavoured to adapt the management system to the actual external conditions under which we operate. The selected system is considered to be the best solution for the actual market conditions. However, a change in these conditions may result in a change in the management concept. The management system is of course also dependant on the product we supply. Turnkey produced buildings include numerous different building parts. Some of these are delivered to the concrete component factory, others are delivered direct to the construction site. The coordination of this material flow together with the control of the delivery price, delivery time, quality and quantity requires a very elaborated and detailed system for the project management. This complicated management system is reflected in the management of the individual functions in mid level of the organization chart. In our company the function management level is divided into the following departments:

Sales,
Purchase,
Design,
Economy,
Production of Standard Products,
Production of Individual Projects.

This pattern of the management chart was elaborated during the late sixties. It is developed for function determined problems and is naturally meant to be refined during the coming years, partly because of the great rises in wages and partly because of the decrease in costs using electronic data process. The building up of an actual integrated management system, possibly on an EDP basis i.e. systems which comprise all management levels is going to be the challenge to all managers and systems people during the seventies. In order to find a solution of the tactical planning in industrial enterprises we shall probably in the course of a couple of years find planning methods which are far more general than the ones known today.

To materialize the policy certain techniques are employed. Since the beginning of the fifties, Larsen & Nielsen have been constantly developing new and better methods for the production of housing projects. Today the methods utilized by the Danish company and its 22 licensees in 12 countries are refined tools used by trained, unskilled workers.

One of the ideas behind industrialized production of housing projects is the completion of the components in the factory to as high a degree as possible. Consequently the concrete component factory plays a central role in the company concept. Our factory in Denmark is situated 10 km outside Copenhagen. It is a permanent factory, consisting of 6 bays. The capacity of the factory is 2,500 dwelling units per year in one shift corresponding to about 250,000 tons concrete. The factory is made up of three sections.

The first section consists of a dump chute for the receiving of the concrete aggregates and a conveyor which takes the aggregates to the silos. Below the silos we have weighing aggregates, automatically operated so that the operator of the mixing plant can, by a push-button system, order a certain mix of aggregates from the silo complex. The cement is stored in the silo beside the aggregate silos, and is also automatically weighed and transported to the mixing station.

The second section consists of the production halls. It contains three mixing stations, one for special concrete and two bigger ones for normal concrete. Special concrete is used for facades, gables and parapets. The mixing station delivers the concrete to the production lines. In our factory we have two different systems of producing concrete components. The automatic mould conveyor on which the moulds are moved on rolls is used for the production of the hollow cored slabs and interior walls. The mould conveyor is divided into different stations at which the different operations take place. The first station is the demoulding station. Here the component is lifted from the mould. At the next stations the mould is cleaned and mould oil is applied on the mould surfaces by means of an automatic oil spraying system. The next station includes the reinforcing and the placing of cast-in pieces, such as lifting bolts, etc. At the last station the concrete is poured into the mould from the concreting machine, which is placed in connection with the concrete mixing station. Having completed the concreting, the surface of the component is trowelled by means of an automatic surface treater. Hereafter the moulds with the components are transported to temporary stock in the production bays. Here the components are cured by means of steam which is introduced under tarpaulins covering the stocks. After curing the moulds are lifted by the overhead cranes and transported to the first station on the conveyor. Here the moulds are stripped, the components are transported still horizontal to a control point and then to the stockyard. After curing 5 days, the components are ready to be transported to the erection site.

Due to the fact that facade and gable components are much more geometrically versatile than deck slabs and walls, and contain cast-in parts, we have chosen to cast these components in stationary moulds. These moulds are placed in four bays parallel to the bays for the slab production. Concrete is transported to the moulds by means of overhead travelling

cranes carrying the concrete in buckets which can easily be emptied over the mould. Having poured the concrete, the component surface is smoothed by hand tool. Hereafter, steam is introduced into the mould table proper. The steam is circulated for some hours until the mould is ready for stripping. Before stripping the mould is tilted to a nearly vertical position. Then the crane lifts the component out of the mould, transports the component to a control check point at the end of the production bay and after checking the component is carried by the overhead crane to the stockyard where curing takes place for the next five days.

From the stockyard the components are loaded on trucks. Horizontal components are transported horizontally by means of standard trucks. Vertical components, however, are transported almost vertically on specially designed lorries with a steel structure supporting the components.

At the erection site the components are taken directly from the lorries by the erection crane to the actual erection place in the building. The erection crane normally has a capacity of 150 tm. The component is placed on its permanent place immediately, and is braced with specially designed steel brace devices. The hooks of the crane are released and the component is adjusted vertically and horizontally, while the crane lifts the next component to the erection spot. For accurate erection optical plumps are used to ensure that the building goes up vertically. The crane, being the most expensive equipment at the site, is utilized to the highest possible degree. One crane can easily erect 250 sq.m. of flats in one 8 hour day. The erection of the exterior walls, facades, and gables must be made very carefully especially in cases where the outside of the building is one large vertical plane. The slightest deviation from the crane and the slightest deviation of the vertical and horizontal lines in the crane can be easily observed.

The exterior walls are normally sandwich panels of two layers of concrete with an insulation layer in between. The facade are supported only in the upper corners of the interior

layer. They are, so to say, hung on the diaphragm walls. The crane does not release such a facade component until its position has been absolutely controlled. When controlled, bolts are arranged to ensure the fixing of the component to the diaphragm walls. After erection of the exterior walls, a special hanging ladder is suspended from the upper floor. It is possible from this ladder to insert neoprene strips closing the joints between the facade and the gable components. Other scaffoldings are not necessary.

Having completed the raw building or the carcass, the crane and the erection crew moves to another building for erection. Finish work then starts and the different crews performing various finish work move into the building. The finish work is divided into two categories. First the raw finishing comprising connection of pipes to the central heating system and including the dry packing of horizontal joints and the grouting of vertical joints is performed. Here the doors and windows are placed in the building. Hereafter, the building is completed and the second stage of the finish work can take place in the closed building. This second stage comprises floor laying, painting, wall papering, and installation of kitchen appliances, cupboards, etc. Finally the building is inspected before handing over to the client.

Establishment of a New Industrialized Housing Enterprise.
Phase 1. Preinvestigations.

Before the establishment of such an enterprise certain pre-investigations may be performed in order to assure the feasibility of the project. In the following I have mentioned some of the most essential factors which must be considered prior to the launching of the project.

The housing demand within the area envisaged must be evaluated. Statistical reports issued by the government or the municipality are some of the basic information sources in this regard. If the housing demand is very great it is not necessary to estimate it very accurately. On the other hand, when the market is limited and it is especially questionable whether there is room for industrially produced housing the evaluation of the housing demand must be carried out carefully. It is also imperative to define the population group for which the housing company will build. The housing types, the house rent and the building cost, depend of course very much upon the income level of the people for whom the dwellings are intended. Again official statistics may be helpful in splitting up the population into different income categories.

Having established the market requirements in relation to the income groups, the market approach can be defined. Bearing in mind that industrial housing methods involve heavy investments which require some years with full utilization of the production capacity for depreciation, the selected market section must comprise sufficient demands for at least three to five years. In order to assure a reasonable basis for the project, the possibility of obtaining long term contracts with for instance, the local Ministry of Housing or another governmental agency or a private client must be examined. Such a contract is often deemed necessary prior to the commencement of the project. Anyhow the possibilities for the financing of the production have to be secured before the starting of the project. In this connection it is important to have established from the very beginning how the buildings can be sold. Are they to be rented out to the tenants or are they to be sold to the clients. In the first case the landlord should probably purchase the buildings directly from the producer. In the second case the company may consider financing the buildings until they are taken over by the owners. It is imperative that the financing problem is solved at a very early stage of the project. Possibly the solving of this problem requires the establishment of a new mortgage institution which may be sponsored by the government.

After this initial investigation an outlined design of the housing types can be performed. The building costs are estimated

simultaneously with the design. This estimation, however, requires knowledge of the investment which must be written off on the production. So the design of the buildings to be produced must be broken down into a list of concrete components. This list serves as an input for a preliminary lay-out of the production facilities with an equipment list. An investment budget can be established based on this information. With these computations in hand, the estimated price for the dwelling is calculated. It is then controlled that the cost of the dwellings corresponds to the house rent the would be tenants can afford. If the figures do not correspond a redesign must be performed until the cost matches the market price level.

The examination of the possibilities for providing capital for the investment in the production facilities is also important. Here the joint venture with foreign investors and may be the system sponsor comes into the picture. However, some local capital must be provided, either from a governmental institution or from the private sector. As to the joint venture, many organizations in the United Nations and many semi-governmental organizations in the wealthy countries are prepared to step in as co-partners with the system sponsor. The possibilities for the formation of such a joint venture must be investigated during these preinvestigations. Further, the legal aspects and the possibilities of obtaining a licence from the local government for the establishment of the joint venture must be examined.

Another essential factor at this stage is the geographical placing of the factory. The factory must of course be placed in the vicinity of the would be building sites. Further, it is important that the distance from quarries and cement factories is not too far. The availability of personnel and workers must also be considered in this respect. The possibility of renting a plot from the government or from the housing agency must be considered. The possibility of finding an investor with a useable piece of land may also be considered.

The presence of electricity supply, water supply and sufficient sewage also has an influence on the selection of the land for the factory.

The basic materials for concrete component production are of course cement, fine and coarse aggregates for concrete and water. These materials must of course be at hand in sufficient quantities and in good qualities. With regard to the cement, one must at this stage decide whether the factory shall be operated in one or two shifts. Two shift work requires that the moulds can be cast and stripped within one shift. This again necessitates the employment of rapid curing cement. If cement of such quality is not available, steam curing must be considered. However, steam curing requires more equipment thus resulting in bigger investment. A balance point between these two different production methods must be found. Further tests on the concrete aggregate, both fine and coarse aggregates must be performed during the preinvestigations. These tests give an indication of the quantities to be used in the future production. The transportation of the aggregates from the quarry to the factory must also be perused. Are the roads leading from the quarry to the factory for instance, able to carry such heavy traffic. Are there any regulations for heavy traffic during the rush hours in the traffic system. All these problems have to be solved before the commencement of the project.

Another essential investigation is the examination of the local market for availability of heavy equipment such as cranes, trucks, lorries, fork lifts, etc. Non-availability of such material means import of the equipment. This again leads to the question of possible Customs hinderances and Customs Duties. Such duties must be included in the calculations of the investment.

Further, it may be necessary to find out whether any Import Licence or Import Permission is necessary. The availability of cast-in parts and built-in parts such as for instance, lifting bolts, reinforcement, insulation, etc., which can be considered as cast-in parts and windows, doors, window panes, etc., which are considered as built-in parts as they are built-in the components during the curing period in the stock-yard, must also be considered. If these building parts are not available in the local markets, the importation of these parts is a must. Consequently, customs regulations have to be examined for these parts too. This also applies for special material such as for instance mould oil, retarders, neoprene strips, etc.

The question of the performance of the finish works has to be examined. Normally a newly established company will prefer to let the main part of the finish work be carried out by local sub-contractors. In the beginning the company will naturally prefer to concentrate on the production of the concrete components. So the market has to be researched for probable sub-contractors for painting, joining, installation of sanitary fixtures, etc. If such contractors are not available the neighbouring countries may be able to supply them. In this regard the availability of materials for these works also has to be investigated. This applies particularly to the availability of pipes, kitchen appliances, roofing, flooring, etc.

It is also important to obtain approvals from the authorities. Such approvals may be necessary for the construction of the factory, for the conclusion of a licence contract with a foreign company or for the construction of buildings mainly consisting of prefabricated components. As to the licence for the construction of the factory, it should be rather easy to investigate the possibilities for obtaining such a licence. As regards the official approval of the conclusion of a licence contract under which know-how is supplied from the system sponsor to the local company, the matter is far more complicated. Many aspects must be considered before the road is clear for such an agreement. The contract under which know-how is supplied necessarily involves pay back of royalties, normally fees for consulting engineering services too.

Such payments are often difficult to legalize and may be one of the main obstacles for the establishment of the know-how contract. Other problems are the protection of foreign investments in the developing country. If the system sponsor is requested to invest in the joint venture his investment must be protected against nationalization. Besides repatriation of the investment without any loss for the investor must be investigated. Patent rights and the payment for the utilization of such patents are also aspects which have to be contemplated during these phases of the project. Altogether the establishment of the know-how contract requires extensive considerations during the preinvestigation phase.

Having compiled all this basic information it should be possible to establish an investment budget with reasonable exactitude. With this in hand it is again possible to estimate the annual budgets. These are divided into variable costs which are deducted from the sales thus giving the gross profit. The fixed costs are deducted from the gross profit and this results in the net profit. Hereafter profitability computations such as net profit over owners equity, net profit over sales and gross profit over sales are computed. When these profitability computations come out with satisfactory results the preinvestigations are more or less completed.

On the other hand, when the profitability is insufficient to secure proper reinvestments in the operations, the design and estimation must be revised until a satisfactory result is obtained. Finally, it must again be controlled that the design and sales price correspond to the market requirements.

The preinvestigation for such a complicated and complex project as in industrialized housing enterprise is really a demanding task requiring expertise from statisticians, economists, engineers, bankers, etc. Specialists in industrialized housing are also necessary in this initial stage of the project.

Several of the U.N. organizations and of the governmental institutions for aid to developing countries are ready to establish contact between local officials or business men interested in setting up a housing industry, and specialists able to perform the preinvestigation studies for such an enterprise. Besides, some of these organizations are interested in financing the feasibility studies.

Phase 2. Establishment.

With a positive feasibility report, it will often be possible to find the prospective investors and to get them together. During these first meetings between the joint venture participants, the objectives of the would be company must be laid down. Further, the policy for achieving these objectives must be established and an outline schedule for the initial phases of the materialization of the policy should be drawn up. One of the first problems to be solved is the securing of a letter of Intent for a housing scheme or project of a reasonable size. By a reasonable size we mean the project of a size matching at least two years full production of the company. During the feasibility phase prospective clients for such a contract have been contacted and preliminary negotiations have already been made with these clients. However, the attainment of such an agreement probably takes some months and until the joint venture has such a contract in hand, heavy investments in factory facilities are not justifiable. To enable the company to preplan liquidity and profit, the contract with the client must invariably include a payment schedule according to which the company is paid for the buildings supplied.

With a good contract or Letter of Intent in hand, the formation of the housing company commences. As mentioned in the former section, the first problems which crop up are legal questions in connection with the establishment and in connection with the conclusion of the contract with the system sponsor. Other problems as for instance, tax, or let us hope tax exemption, licenses, working permits for foreigners, etc., also have to be solved during this phase. The regulations for the joint venture including the contract between the joint venture partners and the system sponsor have to be officially approved by the authorities before the company is legalized.

Having passed this crucial threshold the provision of the funds for the investments, and the provision of the land for the factory must be arranged. Transfer of know-how and funds from foreign partners and banks must be arranged. Credit must be obtained, both long term credit or mortgate for the financing of the purchase or rent of the land and for the supply of machinery and construction of the factory building. These financial affairs require good bank connections and profound knowledge of the financial and economical system of the country.

Simultaneously with the provision of funds and land the consulting engineer starts design of factory buildings, equipment, special equipment, and specification of factory and site erection equipment. Preliminary quotations for equipment are requested and the transportation costs and Customs Duties, etc., are estimated.

The construction of the factory building will probably be carried out by a local contractor able to perform a job of this magnitude. Tender documents are performed by the consulting engineer comprising Bills of Quantities, Conditions of Contracts, Drawings, etc. After tendering, the contractor is selected and the construction of the factory can begin within a short time. From the beginning of this phase a programme for the entire establishment of the company encompassing all facets has been given to a planning department, either recruited and employed by the company or carried out by the consulting engineer.

Carefull planning is imperative for the successful carrying through of such a complex project. Moreover, with a Letter of Intent or a Contract for the supply of buildings, a Contract which normally includes time limits, it is of utmost necessity that the planning is commenced from the very beginning in details and followed up frequently during the progress of the project.

Some months after the commencement of the construction of the factory, the first equipment must be installed in the raw building. So simultaneously with the tendering of the factory buildings, supply contracts with the manufacturers of the equipment must be concluded. However, this is not the only binding thing in the schedule. The design of the buildings to be produced and the subsequent design of the moulds in which the concrete components shall be produced is of much more importance. This design and manufacture is tightly linked to the programme of the factory and the factory equipment. As the factory is not able to operate until the last moulds are installed it is essential that the design of the dwellings and the perfected design of the moulds and the manufacture of these moulds is performed at the same time as the preliminary and final design of the factory building and the factory equipment. In immediate succession of this design, the transport equipment and the site equipment has to be specified and manufactured. Further, on the basis of the component drawings for the building project, cast-in parts and built-in parts must be specified and purchased. Contracts with sub-suppliers and sub-contractors for finish work shall also be negotiated during this phase.

Recruiting of personnel for the different departments in the organization which are gradually established is also a key factor during this phase. Employment of foreigners normally requires special permission as regards their stay and work. Negotiations with Unions must also be commenced now in order to have clear guidelines for the hiring of workers.

In due time before the production starts, erection plans and production plans must be performed. Here the erection plan is reflected in the production plan. In other words the erection plan is laid down first and according to this plan the production plan is prepared.

Annex I, II and III show a typical investment budget, an annual budget based on the investment budget, and a time schedule for the starting up phases for an industrialized housing enterprise.

Naturally the setting up of a new enterprise includes many other activities and aspects than mentioned above. However, it has been my intention to indicate some of the most important problems in connection with the establishment of such an enterprise.

It is my hope that this lecture may serve as a guideline for you when you are going to contemplate starting up industrialized housing production in your own country.

A N N E X I

NOTIONAL INVESTMENT BUDGET

			US.$.
1.	Factory site including fence-wall 25.000 sqm.		75,000
2.	Factory Building:		
	Factory hall 3,000 sqm.	100.000	
	Workshops 850 -	40.000	
	Administration 200 -	10.000	
	Stockyard	50.000	200.000
3.	Factory Production Equipment:		
	General equipment	60.000	
	Special equipment	50.000	
	Mixing station	60.000	
	Concrete Transport Equipm.	20.000	
	Further equipment	60.000	250.000
4.	Component Transport Equipment		10.000
5.	Site Erection Equipment:		
	Crane (100 tm) with traverses	50.000	
	General equipment	20.000	70.000
6.	Steel Moulds		200.000
7.	Starting and running-in cost		40.000
8.	Consulting engineering service:		
	Factory lay-out, factory building, design, equipment specification	40.000	
	Building Project Design	40.000	
	Steel mould design	40.000	
	Instruction	30.000	
	Travel expenses etc.	20.000	170.000
9.	Equipment transport costs and custom duties:		50.000
		Carried forward	1.065.000

		US.$.
	Brought forward	1.065.000
10. Equipment installation		15.000
11. Working Capital		240.000
12. Initial licence fee		20.000
TOTAL	US.$.	1.340.000

Proposed financing:

Share Capital	US.$.	540.000
Loans	US.$.	800.000

A N N E X II

NOTIONAL ANNUAL BUDGET

			US. $.
Sales:			
600 apartments of 70 sqm. at $. 50,-			2,100.000
Variable Costs:			
Salaries:	Production, Erection and Finish	200.000	
Materials:	Concrete	150.000	
	Reinforcement	200.000	
	Insulation	10.000	
	Cast-in parts.Doors, windows,misc.	250.000	
	Mould oil,spacers etc.	10.000	
	Fuel, electricity&water	20.000	
	Repairs and maintenance	30.000	
	Finish works	500.000	
Licence fee:	1% of sales	21.000	1,391.000
Gross Profit			709.000
Fixed costs:			
Salaries:	Administration staff	100.000	
Depreciation:	Buildings	20.000	
	Equipment	50.000	
	Transport equipment	3.000	
	Site erection equipment	14.000	
	Steel moulds	67.000	
	Starting and running-in costs	8.000	
	Consulting services	31.000	
	Equipment transport costs	10.000	
	Installation costs	3.000	
	Initial licence fee	4.000	
	carried forward	310.000	709.000

Brought forward	310.000	709.000
Interests on loans 10% of 800.000	80.000	
Insurance taxes	30.000	
Mail, telephone,cars etc.	30.000	
Sales expenses	20.000	470.000
Net Profit		239.000

Profitability Computations:

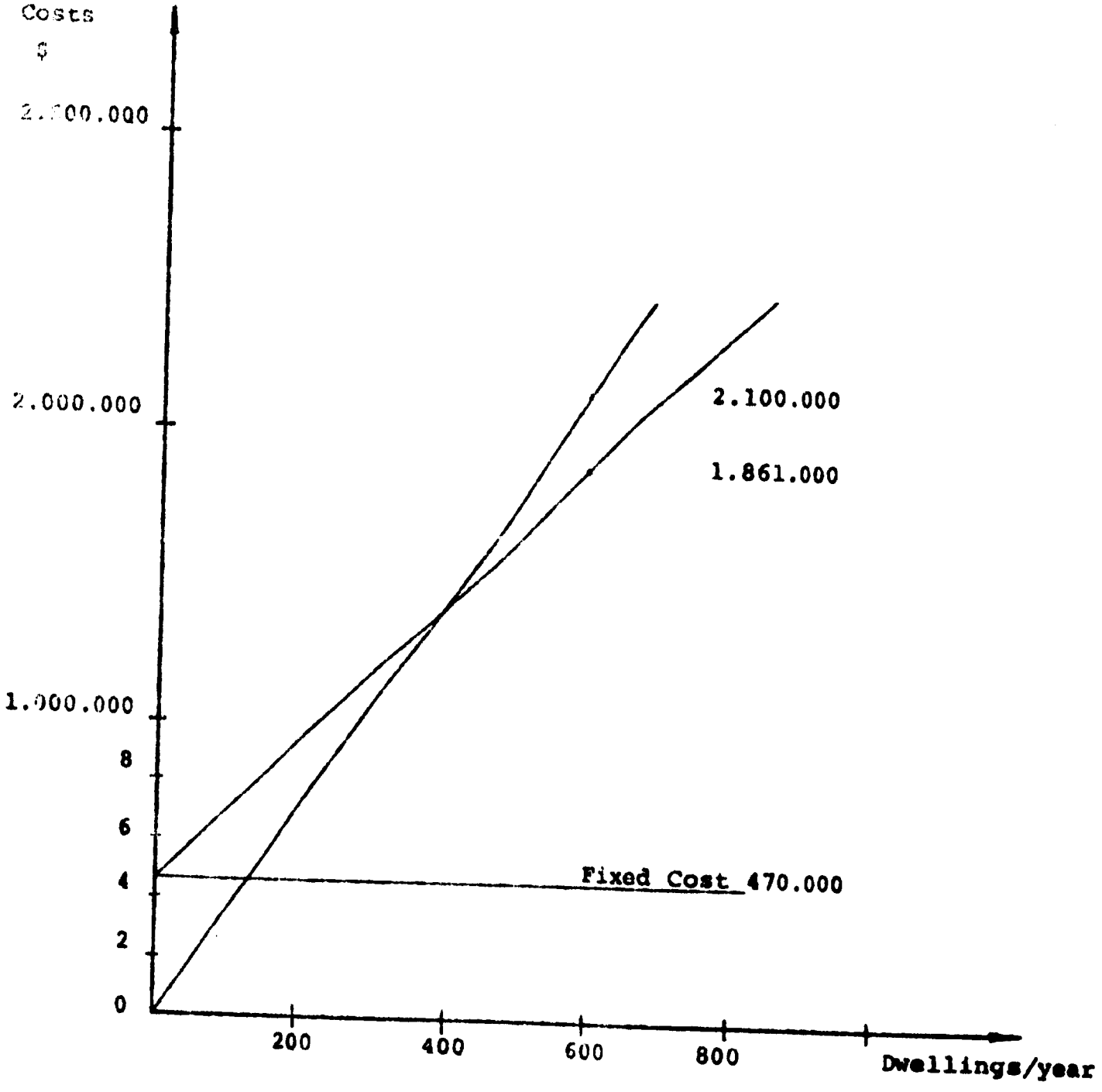
$$\frac{\text{Net Profit}}{\text{Owner equity}} = \frac{239.000}{540.000} = 44\%$$

$$\frac{\text{Net Profit}}{\text{Sales}} = \frac{239.000}{2.100.000} = 11\%$$

$$\frac{\text{Gross Profit}}{\text{Sales}} = \frac{709.000}{2.100.000} = 34\%$$

A N N E X III

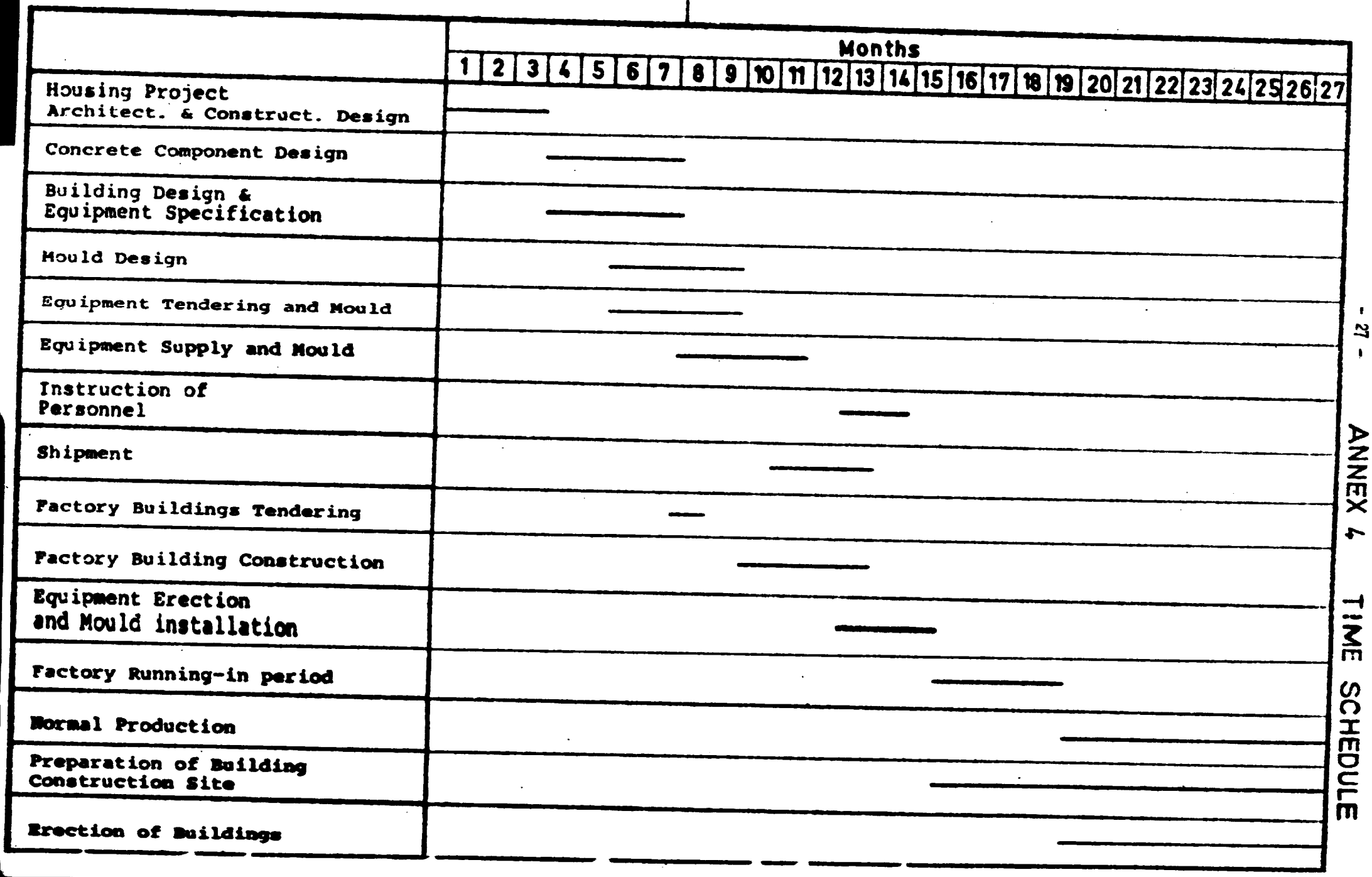
BREAK-EVEN CALCULATION

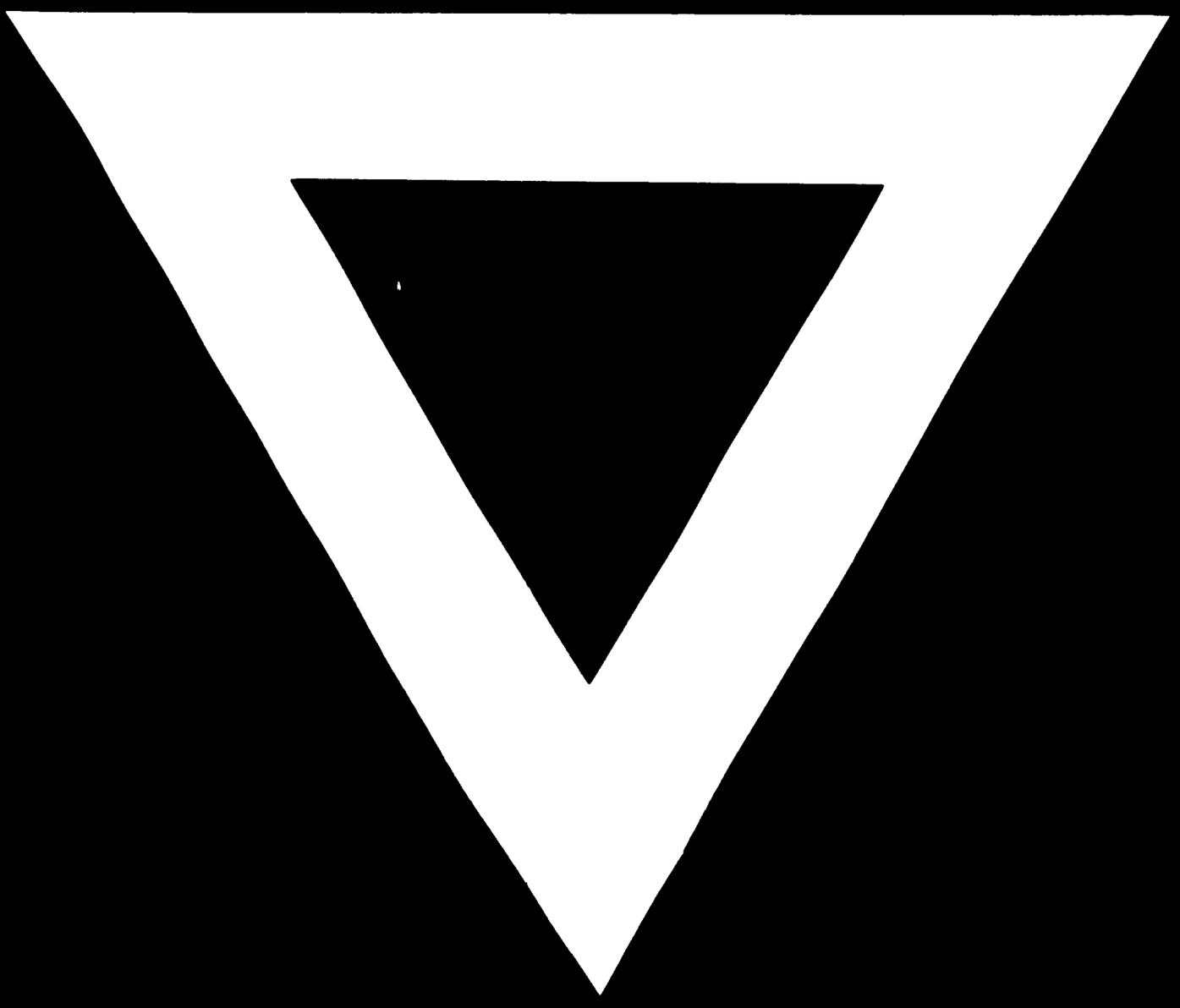


Fixed costs	470.000
Variable costs	1.391.000
Total costs	1.861.000

Break-even point: 400 dwellings per year.

ANNEX 4 TIME SCHEDULE





20.12.73