



**TOGETHER**  
*for a sustainable future*

## OCCASION

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



**TOGETHER**  
*for a sustainable future*

## DISCLAIMER

This document has been produced without formal United Nations editing. The designations employed and the presentation of the material in this document do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations Industrial Development Organization (UNIDO) concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries, or its economic system or degree of development. Designations such as “developed”, “industrialized” and “developing” are intended for statistical convenience and do not necessarily express a judgment about the stage reached by a particular country or area in the development process. Mention of firm names or commercial products does not constitute an endorsement by UNIDO.

## FAIR USE POLICY

Any part of this publication may be quoted and referenced for educational and research purposes without additional permission from UNIDO. However, those who make use of quoting and referencing this publication are requested to follow the Fair Use Policy of giving due credit to UNIDO.

## CONTACT

Please contact [publications@unido.org](mailto:publications@unido.org) for further information concerning UNIDO publications.

For more information about UNIDO, please visit us at [www.unido.org](http://www.unido.org)

~~SP/Industrial Estates~~

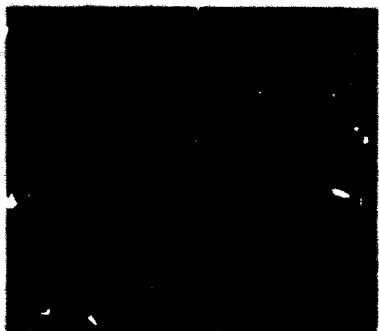
ST/CID/5

66.D.B.2

D03791



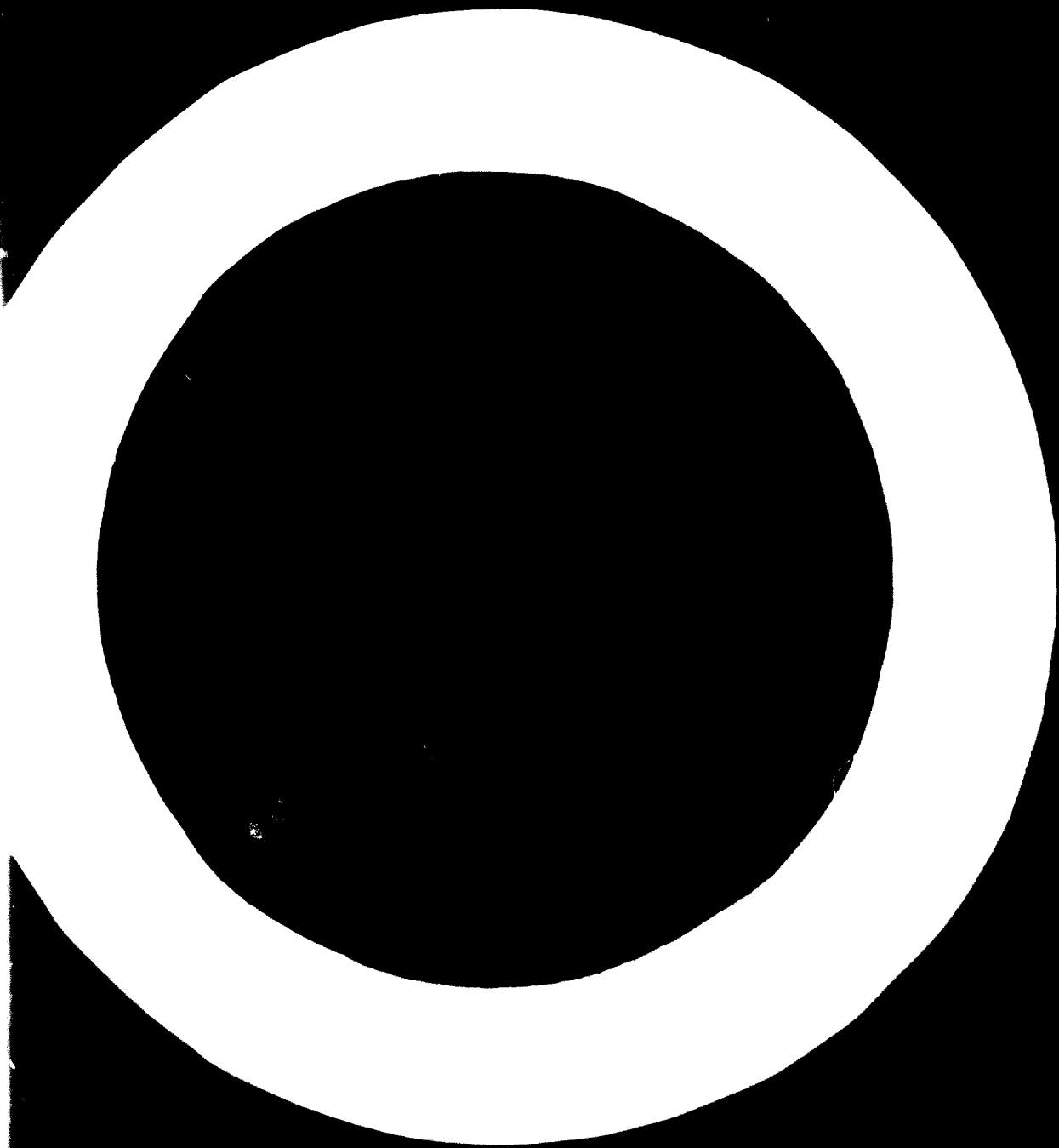
# INDUSTRIAL ESTATES IN AFRICA



UNITED NATIONS

**Part 1**

**REPORT OF THE UNITED NATIONS SEMINAR ON INDUSTRIAL ESTATES IN  
THE REGION OF THE ECONOMIC COMMISSION FOR AFRICA**



## REPORT OF THE UNITED NATIONS SEMINAR ON INDUSTRIAL ESTATES IN THE REGION OF THE ECONOMIC COMMISSION FOR AFRICA

(14 to 21 December 1964)

### ORGANIZATION AND ATTENDANCE

The United Nations Seminar on Industrial Estates in the Economic Commission for Africa (ECA) Region in was held Addis Ababa, Ethiopia, from 14 to 21 December 1964. The Seminar was sponsored jointly by the ECA and the Centre for Industrial Development and the Bureau of Technical Assistance Operations of the United Nations Department of Economic and Social Affairs.

The Seminar was attended by participants from twenty-one member states and associate member states of the ECA. The countries represented were: Basutoland, Chad, Congo (Democratic Republic of), Dahomey, Ethiopia, Gambia, Ghana, Guinea, Kenya, Madagascar, Mauritius, Morocco, Nigeria, Sierra Leone, Somalia, Sudan, Uganda, the United Arab Republic, the United Republic of Tanzania, the United Kingdom and Zambia. The Seminar was attended by observers from the Federal Republic of Germany, India, Italy, the Netherlands, Sweden, the United States of America and the Union of Soviet Socialist Republics. The Organization of African Unity was also represented by an observer. A list of participants, observers and United Nations Secretariat members is given in annex I.

The Deputy Executive Secretary of the ECA, Mr. F. A. N'Liba-N'Guimbous, welcomed the participants in the course of his opening address. The text of his speech is given in annex III.

Ato Gabre-Michael Paulos (Ethiopia), Economic Expert, Ministry of Commerce and Industry of the Government of Ethiopia, was unanimously elected Chairman. M. Mahamat Gabdou (Chad), Directeur Adjoint des Affaires Economiques of the Government of Chad, was unanimously elected Vice-Chairman.

The representatives of Dahomey, Guinea, Nigeria and the United Arab Republic were elected unanimously to form the Drafting Committee.

On 17 and 18 December the Seminar was addressed by Mr. R. K. A. Gardiner, Executive Secretary, ECA, who stressed the importance of regional and subregional action in promoting the development of industrial estates and the need for early implementation of the recommendations of the Seminar in countries of the region.

The report of the Seminar was adopted on 21 December 1964.

The Seminar closed with a note of thanks to the Chairman for his able conduct of the meeting.

### THE ROLE OF INDUSTRIAL ESTATES AND INDUSTRIAL AREAS IN POLICIES AND PROGRAMMES OF INDUSTRIAL DEVELOPMENT

The Seminar was of the view that one of the main purposes of its meeting was to draw the attention of governments of countries of the region to the role of industrial estates in policies and programmes of industrial development; in particular in programmes for the promotion of small-scale industries. Another major objective was to set standards for the establishment of industrial estates in these countries, in the light of the conditions and needs prevailing in the region. The formulation of recommendations on regional and international co-operation in the development of industrial estates was expected to be an important result of the discussion.

The Seminar considered that the subject of its discussions was not limited to industrial estates, but covered various forms of clustering of industrial enterprises on common sites. While it devoted most of its attention to industrial estates for small-scale industries, that is, to planned industrial communities featuring standard factory buildings with all the necessary utilities, common facilities, and service and assistance centres, it also examined the role of industrial areas providing only improved sites, which were particularly suitable for the establishment of larger industries. Some consideration was given to industrial zones, that is, to parts of an urban or suburban area reserved for industrial use, in which both estates and areas could and should be located.

The Seminar agreed that in countries of the region, great emphasis should be put on policies and programmes for the development of small-scale industries. It was convinced that provided guidance, assistance, training and support were given, small-scale industries could be set up by people from all walks of life with small financial resources and little or no technical and management experience and could begin operation with relatively unskilled labour. These characteristics were predominantly those of the indigenous group of the population of these countries. By promoting small-scale industries, particularly by means of industrial estates, a breakthrough of the indigenous entrepreneur into industrial activities and his participation in the industrialization of his country could be achieved.

It was observed that, in many countries of the region, the present allocation of scarce financial resources among urgent competing claims — agriculture, indus-

try, services, health, education and the like hardly permitted the undertaking of a comprehensive programme of small-scale industries and, in particular, of industrial estate projects. In many countries "Africanization" was a major policy objective, but the resources devoted to its achievement were often minimal. While the relative priorities necessarily varied from one country to another, the Seminar felt that some reallocation of resources towards small industry and industrial estate projects would be fully justified and, in most cases, possible.

There was a consensus of opinion that industrial estates were a particularly effective means of encouraging and supporting the creation, expansion and modernization of small-scale industries. Because of the weaknesses and handicaps due to smallness of size and scale of operation these industries were especially in need of guidance, assistance and support. One of the chief merits of the industrial estate was that the grouping of small industries permitted to integrate on it the various measures of assistance and support economically and effectively. The availability of standard factories offered for rent and of the various services and facilities was a powerful incentive to the creation of efficient new enterprises and, under certain circumstances, to the expansion and modernization of existing small units relocated on the estate. Other advantages were the development of inter-trading and inter-servicing relationships among occupants and, in certain cases, between them and large industries. Industrialization on the estate also stimulated development outside of it principally through the establishment of new trade and service undertakings and of industrial enterprises located in the neighbourhood. Thus industrial estates were developmental projects

which made it possible to achieve economic and social objectives of paramount importance to newly independent countries.

The Seminar recognized that an industrial estate programme was not a substitute for an over-all development programme for small-scale industries, but should be an integral part of it. The coverage of an industrial estate programme was necessarily narrow and the majority of small enterprises would remain and develop outside of the estates. These industries would need assistance other than factory accommodation and common services and would look to the Government for support and aid. Whether on the industrial estate or outside of it, small industries would need technical guidance and counselling, credit on liberal conditions, training of management, foremen and workers, assistance in procurement and marketing and so on. An industrial estate programme would have only a limited impact and usefulness if, on the one hand, it did not integrate all or most of these facilities and services and, on the other hand, it were not backed by an over-all development programme for small-scale industries, with a nationwide coverage.

In referring to small-scale industries, the Seminar had in mind modern manufacturing establishments, that is, enterprises using advanced tools and techniques of production and management and producing "new"

types of goods, in particular those replacing imports. It distinguished such industries from the handicraft, artisan and cottage industry types of undertakings, which cling to traditional processes, equipment and products. Although there was scope for technological improvements in traditional occupations, the possibilities of transforming them into modern manufacturing processes were limited. A programme of promotion of small-scale industries was aimed not at improving artisan production, but at creating and modernizing manufacturing establishments, small, but modern and efficient.

In order to identify the beneficiaries of the development programmes and in particular to determine their eligibility for admission on industrial estates, definitions of small-scale industries should be adopted by countries of the region; it was suggested that such definitions might appropriately take the form of ceilings on investment in fixed capital and, in some cases, of ceilings on employment.

It was expected that industrial estates would not only stimulate the establishment of new small-scale industrial enterprises, but also the expansion and modernization of existing ones allowed to settle on the estate. The Seminar felt that upgrading of existing enterprises by admission on industrial estates was an important objective of these programmes. Most of the existing indigenous enterprises occupied decrepit and unsanitary buildings, used obsolete and inefficient machinery and were unable, because of lack of credit and technical advice, to raise their productivity, productive capacity and employment. Admission of such enterprises in industrial estates should be accompanied by provision of credit for the renovation of their equipment and the strengthening of their working capital to permit increased employment and production. The basic benefits of industrial estates — common services, technical and managerial assistance, training and healthy surroundings — would further increase output, improve product quality and reduce production costs.

Rehousing of existing enterprises on industrial estates, under the same conditions, was also recommended as a counterpart of urban development and redevelopment schemes, especially slum clearance programmes. Such schemes often resulted in the expulsion of small industrial establishments whose existence and contribution to the national economy, however small, might thereby be annihilated. The Seminar felt that the struggling indigenous enterprises deserved every protection and support and recommended that industrial estate projects be planned as an integral part of urban schemes and programmes.

Another major objective of small industry promotion programmes, especially industrial estate projects, was to facilitate the growth of small-scale industry. The Seminar recommended that provision for eventual expansion of each factory building and of the estate as a whole be incorporated in its plan. A number of enterprises might, however, be able to outgrow the enlarged premises put at their disposal. The Semi-

nar felt that, inasmuch as such enterprises fulfilled the objectives of the development programme, they should not be penalized for their success by being forced to leave the estate. Also, it considered that enterprises outgrowing the definition of small-scale industry should not be forced to vacate their premises on the estate. Such a condition might have the effect of inhibiting the growth of healthy small units which might fear to lose their benefits by exceeding the definition's limits. This would clearly defeat the purpose of the programme. Moreover, forcing industries to leave would be a factor of instability on the estate, with adverse economic and social repercussions. Growing enterprises might be encouraged to set up additional new plants in industrial areas. In all likelihood their very success might enable them to put up their own factory buildings and to forgo some of the advantages of the industrial estate, for instance, the use of common service facilities. They might still, however be in need of technical assistance, especially if they set out to produce new lines of goods in their new plant.

The participants felt that the device of the industrial estate should not be used for the promotion of large concerns, whether national or foreign. Large industries had the means of constructing "custom-made" factories, and of securing the technical and managerial talent needed for efficient operation. Government assistance along these lines might, however, be required for stimulating the establishment of large-scale enterprises and for attracting capital from abroad where necessary. Industrial areas offering improved land, utilities, transportation facilities, zoning and the advantage of industrial clustering were the appropriate instruments for achieving these objectives. As mentioned earlier, industrial areas could also provide improved plots to expanding industries outgrowing the facilities of industrial estates, as well as to new or existing small-scale enterprises with strong financial means and competent technical and managerial personnel, which might not need the facilities of the industrial estate.

At the same time, it was considered that Governments should do everything possible to attract and facilitate the establishment of large industrial undertakings. In some cases facilities of broader scope than industrial areas should be provided for large-scale industries. These might include provision of various amenities, related infra-structure works and services, such as recruitment and training of labour, engineering and economic research and the like.

The Seminar felt that while resources should be found to promote small-scale industries and set up a few industrial estates, the present means at the disposal of most countries of the region would be inadequate to finance from the beginning any large programme in this area. The role of the first industrial estates was, however, of considerable importance. They should be devised as demonstration projects which would not only provide guidance for planning, constructing and operating further industrial estates, but would also induce local governments and private groups to follow suit. As the network of industrial

estates expanded in the course of time, their radiation effect would cover a broader territory. The action of the industrial extension services set up on each estate to meet the needs of both occupants and outside enterprises would be particularly significant in this respect.

The Seminar was convinced that in countries of the region industrial estates and industrial areas would serve at the same time as instruments of industrial development and of planned location of industry. Industrial location was an integral part of any industrialization policy. In the developing countries as in the advanced ones such policy was often oriented towards decentralization with a view to developing so far as possible all regions of a country, particularly the poorer ones, and checking at the same time the congestion of the larger urban centres. It was realized, however, that the industrial estates programme had to be large enough to exert a significant influence on the geographical distribution of industry throughout the country. In the conditions of most African countries, the latter objective had to remain for a long time subsidiary to that of promotion of industrial activity.

Finally, the Seminar briefly examined the role of industrial estates in socialist economies. It thought that, since their role was essentially to stimulate private initiative, industrial estates as defined in this report might not always be provided. Some of the features of industrial clustering appeared, however, to be of great value. Government-owned factories could be set up on common sites, with consequent economies of scale in site development and factory construction. In some cases, contiguity could lead to cost-reducing inter-servicing or inter-trading among occupants. Common services could often be provided, as well as training and assistance facilities. It was likely that the distribution of industrial, residential and other zones in expanding urban and suburban centres could be planned with less difficulty, and the planned location of industry in smaller towns be achieved more effectively than in economies based predominantly on private enterprise. The Seminar felt that these problems deserved more attention and recommended that studies be undertaken on the subject.

In the course of a review of industrial estate developments in Africa, it was noted that actual experience in the field was limited. Information on plans and projects covered the following countries: Basutoland, Ghana, Kenya, Mauritius, Nigeria, Rhodesia, Somalia, South Africa, Uganda, the United Arab Republic and the United Republic of Tanzania. It was pointed out that no comparative study existed of the various types of institutions for the development and promotion of small-scale industries in different countries in Africa, and it was recommended that the FCA might undertake such a study.

#### PLANNING AND ESTABLISHMENT OF INDUSTRIAL ESTATES

The Seminar considered that the first step in planning and establishing industrial estates was for the Government of the country concerned to adopt poli-

cies and programmes oriented towards development of small-scale industries. As noted in the preceding section, the industrial estate was only one among the various measures for the stimulation and development of small industries and its effectiveness lay in its integration with other schemes of assistance. The Seminar noted that a few African countries had already formulated policies and programmes for the promotion of small-scale industries and acknowledged the importance of industrial estates in their national plans for development. The Seminar recommended that the attention of all African countries should be invited to the importance of taking early policy decisions on the development of small-scale industries and the role to be assigned to the industrial estate as an instrument for industrial promotion and development.

The Seminar stressed the importance of feasibility studies and surveys as an essential prerequisite for taking decisions on the establishment of industrial estates. It noted that the success of industrial estate projects would to a large extent depend on the thoroughness and care with which such studies were conducted and cautioned against hasty and ill-considered decisions on establishment of industrial estates.

A feasibility study might be undertaken by a team consisting of an industrial engineer and an industrial economist. The association of a civil engineer and/or architect-planner with the team during the latter part of its work would be necessary to formulate recommendations on suitable locations and sites for industrial estates.

In the special context of the shortage of entrepreneurs in African countries, industrial estates could play a vital role in stimulating new indigenous entrepreneurship. The feasibility survey should therefore have two objectives: (a) to determine the feasibility of industrial estates in different locations and make recommendations on the most suitable location and site, the type of estate, size, number and type of factories and other buildings, services, and facilities and costs; and (b) to recommend the industries which are most suitable for location in the estate to serve as a guidance to prospective entrepreneurs.

In determining the feasibility of industrial estates in a particular location, sufficient importance should be given to the assessment of demand, existing and potential, for good factory accommodation. The Seminar, however, noted that a very rigid application of the demand criterion might not be advisable in most countries of Africa. In some cases industrial estates might have to be established in the expectation that they would themselves generate the climate and incentive for new industrial ventures. However, it was important that the potential of a particular location for industrial development should be clearly established before a decision to establish the estate there was made.

The Seminar considered that an important service which a potential entrepreneur in an African country required was guidance and advice on the new industries which had prospects for success. In many countries there were no specialized agencies or service

institutes to provide this advice to prospective entrepreneurs; such a service might therefore have to be considered as part of the duties of the agencies responsible for the planning and establishment of industrial estates.

The Seminar recognized that the major difficulty in organizing feasibility studies was the shortage of personnel with training and experience in this field. It therefore recommended that the technical service agencies of the United Nations should assist the African Governments in conducting such feasibility studies.

The Seminar emphasized the importance of integration of industrial estate projects within the framework of urban or regional plans for development. An industrial estate was not a mere clustering of industrial buildings. Its success depended on the availability of a wide variety of supporting facilities and services such as houses for workers, transport and communications, hospitals, schools, playgrounds, and the like. An estate project could not on its own afford the cost of these services, but its location should be such as would enable it to get the benefits of these services without having to incur their direct cost. In deciding the location of the estate due consideration should be given to the availability of basic facilities such as power and water, proximity to market, sources of supply of labour and raw materials.

The Seminar noted that in most African countries the locations which offered the maximum facilities and advantages were the big cities, often the capital cities. However it was of the view that further concentration of industries in the big cities would increase the strains on their facilities and create in its wake the attendant social and economic problems. Location of estates in rural areas, on the other hand, had its obvious difficulties. In most African countries the rural areas lacked the basic facilities for modern industrial development and therefore were comparatively unsuitable as locations for industrial estates. Balancing all considerations, the Seminar was of the opinion that the best location for the first series of industrial estates in African countries were the towns. The Seminar expressed considerable interest in the problems of industrialization and development of rural areas, but was of the view that in the present stage of their development rural areas offered little scope for the success of industrial estates.

The Seminar noted the different concepts in industrial clustering, such as industrial areas, zones, townships and estates. It was of the view that industrial estates with general purpose and custom-built factories and provided with general and technical service facilities might be better suited to African countries. It considered that provision of developed plots in industrial areas for the use of medium and large industries side by side with industrial estates with factories for small industries would be an ideal pattern of development in most African countries.

The Seminar noted that the experience of other countries in organizing specialized types of estates, such as "single-trade" estates (that is, estates providing



factory accommodation exclusively to industrial units belonging to the same trade), "functional" estates (that is, estates in which the functions of one industry are subdivided among a number of small-scale units located in one place, each functioning according to a co-ordinated manufacturing programme) and "ancillary" estates (that is, estates in which different small-scale units manufacture components, parts and stores which are required by a large industrial unit on a subcontracting basis) was comparatively new and limited. It was of the view that the first series of estates in African countries were likely to be of the general pattern. However, the type of estates best suited for a country and location could be decided only on the basis of the results of the feasibility studies referred to earlier.

#### PHYSICAL PLANNING OF INDUSTRIAL ESTATES

The Seminar had before it a paper on *Planning, Design and Construction of Industrial Estates with Particular Reference to Africa* (E.CN.14.1E.7) which dealt with various aspects of over-all planning, design and layout of the estate, buildings and other facilities, building materials and construction, costs and programming, and legislation. It expressed its general agreement with the conclusions and recommendations contained in that paper.

There was agreement that well-designed factories on well-planned estates with adequate open space were not only pleasant to look at, but produced better quality work, greater productivity and reduced absenteeism. Good design was a sound investment since it produced not only good appearance but also greater industrial efficiency.

It was felt that the provision of open space needed special consideration, especially in overpopulated areas. Open spaces should be regarded as essential "lungs" or breathing spaces needed for the benefit of workers and neighbours alike. This was particularly important where there were industries creating noise and smell, since the open space could act as an effective buffer or filter zone.

The Seminar considered a number of technical questions relating to building techniques and materials for factory construction. It noted that technical advice could be obtained for construction of high buildings on unstable subsoils. Techniques such as chemical soil consolidation, piling and rafting had been successfully developed for such situations and Building Research Stations and similar bodies could provide detailed information. The deterioration of building materials was a difficult problem in the tropics, particularly in seaboard areas where salt-laden air was present. Again building research stations could give valuable help. The answer lay in carefully detailed design, the choice of corrosion resistant materials and the use of appropriate protective coatings. The importance of materials reflecting heat was stressed in connexion with the design of roofs in tropical areas. In this respect asbestos cement roof sheeting sometimes had advan-

tages over corrugated iron. The use of aluminum was also possible, but the problems of cost, noise during rain and possible sun glare often outweighed the advantages of its superior solar reflection qualities. A solution to the problem of structural failure in buildings was to appoint properly qualified professional advisers - architects, engineers and constructors - and to enforce rigidly building codes and by-laws relating to the structural safety of buildings.

In connexion with possible pollution from industrial plants, it was recommended that liquid waste should be given first treatment at source and then rendered harmless by a communal effluent treatment plant before discharge into the sewage system. Liquid trade effluent must never be discharged in an untreated state into sewage systems, rivers, lakes or other waterways.

It was agreed that air pollution was best dealt with by regulations requiring filtering and cleaning of fumes, smoke and dust at source, and by means of improved plant and special equipment for boilers. In some cases high-powered ejector fans could be used to force fumes high into the air where they could disperse quickly and harmlessly.

In relation to waste products it was suggested that some of these could be used by other industries and that by-product industries had often proved to be a valuable economic asset. Those solid wastes that cannot be used in this way must be destroyed by incineration or other means and finally disposed of in a rigidly controlled and regulated manner.

In discussing prefabrication and similar construction techniques for factory building many participants expressed the fear that these might be too complicated and costly for use in Africa at the present moment. It was agreed that sophisticated methods of prefabrication were over-elaborate for African needs but that the principles of standardization, dimensional co-ordination and modular design should be carefully studied. Simplified techniques of site pre-casting of concrete elements had been used in Africa and other developing countries with considerable success and a study of these to encourage their wider application was considered to be an urgent necessity. It was felt that such techniques could produce quicker, cheaper and better factory buildings and allow greater use to be made of the good dry building weather between rainy seasons.

The question of industrial development in special areas where land was scarce and expensive was raised. It was agreed that, although single-storey buildings were most favoured by industrialists, there were exceptional occasions when upward growth in the form of "flatted factories" and multi-storey factories was inevitable. The important factors were the maintenance of flexibility within such buildings and the choice of industries to be housed in this way. It was generally considered that clean, light industries with relatively small numbers of workers could be most conveniently housed in flatted factories, examples being clothing manufacturers, leather workers, jewellery makers and radio assembly units.

It was agreed that further study in depth was vital on many of the technical matters which had been discussed by the Seminar. Steps should be taken to see that the exchange of experience and technical information was improved between the African countries and that expert knowledge and experience of the highly industrialized countries should be made more readily available. It was felt that building research stations and similar institutions could help in this matter. The Seminar recommended that where building research establishments did not exist, their creation should be encouraged, and that building information and documentation centres should also be created, in order to make technical information and advice more readily available.

In conclusion, the Seminar expressed the view that economies in physical planning of industrial estates would be achieved if the following conditions were met:

- (a) Adequate over-all pre-planning
- (b) Right choice of site
- (c) Functional layout
- (d) Adequate provision of services and communications
- (e) Proper communal facilities
- (f) Careful choice of materials
- (g) Simple structural design
- (h) Provision for expansion in all aspects of the estates
- (i) Adequate plans for maintenance
- (j) Legislation to control the completed estate and its surroundings

The Seminar also recommended that the following surveys be undertaken:

(a) A survey of African building costs with particular reference to industrial buildings together with details of building labour wages in the various African countries.

(b) A study of African industrial building standards with a view to evolving a series of norms for use throughout the continent with particular reference to building components. This would include a study of dimensional co-ordination and modular design in relation to factory buildings.

(c) Case studies of industrial estates and factory buildings already built in Africa to cover: (i) planning and layout; (ii) costs and construction details; (iii) plans of completed projects with photographs if possible and, (iv) details of construction, town planning and factory legislation in the various African countries.

The Seminar further recommended that training courses and fellowships be provided for the benefit of architect-planners, civil engineers and other technicians involved in planning and construction of industrial estates.

## ORGANIZATION, MANAGEMENT AND FINANCING OF INDUSTRIAL ESTATES

There was a consensus of opinion that in countries of the region industrial estate projects would in general be sponsored and organized by the Government. This was consistent with the developmental nature of the projects. Such features as rental of premises below economic level, technical and managerial assistance, and some of the common service facilities representing non-recoverable expenditures were aimed at stimulating entrepreneurship, modernization and growth in the small-scale industry sector.

The Seminar felt, however, that all facilities on an estate need not be provided by the Government if feasibility studies or actual experience showed that private initiative was forthcoming to set them up. For example, a forge, a foundry or a heat-treatment plant could sometimes be set up on a commercial basis by the occupants of some estates, but would have to be supplied by the sponsoring authority in other cases. In most instances, a testing laboratory, a maintenance and repair workshop or a tool and machine lease shop would be an integral part of a government-sponsored project. In a more general way, the Seminar felt that because of the scarcity of financial resources in most countries of the region, the Government should welcome any contribution which the private sector might make to an industrial estate project.

The Seminar noted that certain types of industrial estates, such as functional estates, lent themselves particularly well to co-operative ownership and administration. It felt, however, that desirable as the co-operative movement was for strengthening small-scale industries, special promotional and educational efforts were to be undertaken if this form of organization, new to most countries of the region, were to take roots and spread. In the long run, the creation of privately sponsored, co-operative estates would be a desirable and possible objective. Every form of support should be given by the Government to such initiatives by private groups.

The Seminar recommended that the number of government departments involved in an industrial estate project should be as limited as possible, in order to facilitate and simplify administration and operation. Where a network of estates was to be set up, the creation of a special industrial estate authority might be useful. Whether in the case of a single estate or a network, a large degree of autonomy should be left to the management of the estates.

As already noted, the Seminar agreed that existing enterprises should be admitted to industrial estates, provided facilities were given them to renovate and improve their equipment, and that small indigenous entrepreneurs who without credit, training and assistance had managed to set up industrial establishments, however inefficient, deserved support and encouragement as much as relatively untried newcomers. Modernized existing enterprises would contribute to raising productivity, productive capacity and employment. Mere

existence was, however, not sufficient; potential for development should be taken into consideration.

The Seminar observed that the area surveys and feasibility studies undertaken at the planning stage would provide not only indication of the prospective industrial composition of an estate, but also guidance for promotion of entrepreneurship. It felt that admission rules aimed at influencing industrial composition and even priority of establishment would be justified in many cases; such rules might, in particular, facilitate the early establishment and effective operation of common service facilities, which required an effective and sustained demand on the part of the occupants. A more restrictive assessment of eligibility might sometimes be justified on estates located in or near large urban centres, where entrepreneurship could be more easily stimulated, than on estates in small towns where more liberal admission rules might be required.

For obvious reasons admission policies had to be restrictive on specialized industrial estates—single-trade, functional or ancillary. Inasmuch as the prospects for the development of such estates were based on careful surveys and studies, restrictive rules would not result in slowing down occupancy.

The Seminar briefly considered the question of admission to an estate of entrepreneurs from other regions of the country. It felt that no discrimination on such basis should be allowed, since every contribution to entrepreneurship and development should be welcome.

There was a consensus that standard factories should be offered for rent, since this was one of the strongest inducements to entrepreneurship and occupancy. Rent subsidization, for a limited period and on a degressive scale, could be considered as a necessary incentive. As already mentioned, outright sale or hire-purchase of standard buildings could be practised at the same time, but no subsidies should be provided for such transactions.

It was recognized that technical and managerial assistance, credit supervision, modernization requirements, as well as control of safety, hygiene, labour legislation and the like encroached to some extent on the management of individual occupants. The Seminar felt that such controls by the estate authorities, aimed at improving, educating and protecting them, were entirely justified.

The Seminar noted that in most developing countries industrial estate projects were financed by public authorities—central, state, provincial or local governments, development or investment banks or corporations, sometimes in co-operation with each other. In many countries projects were sponsored and financed by the central government, in particular at the inception of the programmes. Where projects were sponsored by state or provincial governments, financial assistance was sometimes provided by the central government in the form of long-term loans at normal or concessional rates of interest, grants or both. The forms of co-operation between public authorities involved in industrial estate projects varied: the financing of land acquisition, site development, factory construction

and establishment of common service facilities was frequently divided in different ways among them. The Seminar agreed that in countries of the region financial contribution from government authorities would be essential at the inception of the programme; the respective contribution of the various public bodies or agencies would vary from one country to the other and sometimes from one project to another. As the programme developed and the benefits of industrial estates were demonstrated and publicized, encouragement would be given to increasing participation by private groups in particular by co-operatives, commercial lending institutions and corporations.

In the long run, as some of the developmental objectives of the estates were being achieved, economic rents and other charges would permit recovery of a part of the initial investment. Sales of standard factories to tenants or even transfer of the whole estate to the occupants grouped, for instance, in a co-operative association would also become possible. The revenue from rent or sales would normally be used for further developmental projects. For obvious reasons technical assistance and some other servicing facilities would continue to be provided by the Government.

As mentioned earlier, the Seminar considered that, in spite of the scarcity of financial resources in most countries, some reallocation of public funds towards programmes in the field of small-scale industry, and especially industrial estates, would be necessary. In some countries, however, domestic resources could not be mobilized to the required amount and contributions from international, multilateral or bilateral sources would have to be sought. This question is referred to in the next section.

The Seminar considered that programmes of promotion of small-scale industries would be largely ineffective if sufficient capital were not made available by financing institutions to extend credit on liberal terms to new entrepreneurs or to existing industrialists desiring to modernize or expand their enterprises. This applied in particular to industrial estate programmes. It noted that in many developing countries special financing institutions for small-scale industries had been set up; hire-purchase schemes for the supply of machinery to small producers were an effective form of "supervised credit" combining technical assistance with financial operations; schemes of credit guarantees or insurance permitted to minimize the risk of lending by commercial banks to small-scale industries. The Seminar recommended that appropriate financing measures be adopted as an integral part of programmes for the development of small industries and, in particular, of industrial estate programmes. It considered that the improvements in productivity and management of small industries resulting from technical assistance, training and other promotion measures would increase their credit worthiness. It was expected that the performance of small-scale industries on an industrial estate would serve to demonstrate this fact.

The provision of common service facilities and of industrial extension centres was a basic feature of indus-

trial estates in the developing countries. Many of the common service facilities were mainly aimed at improving the productivity of the occupants and reducing their production costs; they might also serve the needs of small industries located outside of the estate. This was the case, for example, of a tool room, testing laboratory, maintenance shop and information centre. Other services – canteen, dispensary, police and fire protection, and the like – contributed both to the welfare and efficiency of the occupants. The Seminar considered that the government should set up and operate those servicing facilities which could not be provided on a commercial basis.

It was realized that common facilities could be set up economically only if there was a sufficient and sustained demand for their service. Their type and number depended upon the size and industrial composition of the estate. Only a few common facilities could be provided on the smaller estate, and it was suggested that in that case arrangements for co-operation among the large and smaller estates might sometimes be devised.

The technical and managerial assistance centres on the estates would serve the needs of both occupants and outside industrialists. At the same time they would provide guidance and advice to prospective entrepreneurs. On the larger estates other institutions might also be provided. According to the needs and means they might include training centres, design centres, marketing and export promotion bureaux, prototype production and training centres, quality control associations and the like.

The Seminar considered that programmes for the promotion of small-scale industries should include, besides the benefits discussed until now, inducements such as tax and tariff exemptions, abatements or rebates, reduced rates on utilities, facilities for procurement of scarce raw materials and government purchasing schemes. Such inducements would be made available to all small-scale industries throughout the country. No special inducements should be provided to the occupants of the industrial estates since the facilities of the estates were a powerful inducement in themselves and the occupants were in a relatively privileged position with respect to outside industrialists – an inevitable consequence of a developmental project. The only special inducement which in most countries appeared to be necessary was temporary subsidization of rent. Only in exceptional circumstances, for instance, in the case of industrial estates in backward areas, some additional incentives or higher rates of benefits might prove to be necessary for stimulating or attracting industrial entrepreneurship.

#### REGIONAL AND INTERNATIONAL CO-OPERATION IN THE DEVELOPMENT OF INDUSTRIAL ESTATES

The Seminar considered that there was considerable scope for regional and international co-operation in the development of industrial estates. In many cases such co-operation was a prerequisite to formulating, planning, constructing and operating industrial estate

projects. Regional and subregional co-operation were of special importance: knowledge and experience gained in some countries of the region could often be of great value not only to neighbouring nations placed in similar economic, social and climatic conditions, but also to countries in other parts of the continent. International co-operation permitted to call upon expert talent and educational and training facilities from overseas and to make use, with appropriate modifications, of the experience gained in a large number of advanced and developing countries of other regions. In view of the scarcity of financial resources in the region, international financing of industrial estate projects assumed particular importance.

With a view to accelerating the initiation of industrial estate projects in African countries, and carrying them out with maximum effectiveness, the Seminar recommended that the following measures be considered by the countries concerned, African regional and subregional organizations, the ECA, the CID, the specialized agencies and other international and national organizations:

1. The Seminar recommended that in all countries of Africa the present report be circulated to all government departments and agencies involved in problems of industrial development, in particular of promotion of small-scale industries, as well as to town and country planning agencies and other concerned bodies.<sup>1</sup>

2. All organizations responsible for industrial estate development in countries of the region should send periodically to the ECA all relevant information for dissemination throughout the region; for each project, information should cover economic and technical data, including plans, construction specifications, types of building materials, and the like.<sup>2</sup>

3. Research on estate and factory layout, design, use of local construction materials and the like, and drawing up of relevant norms and specifications should be undertaken by appropriate agencies on a regional or subregional basis.

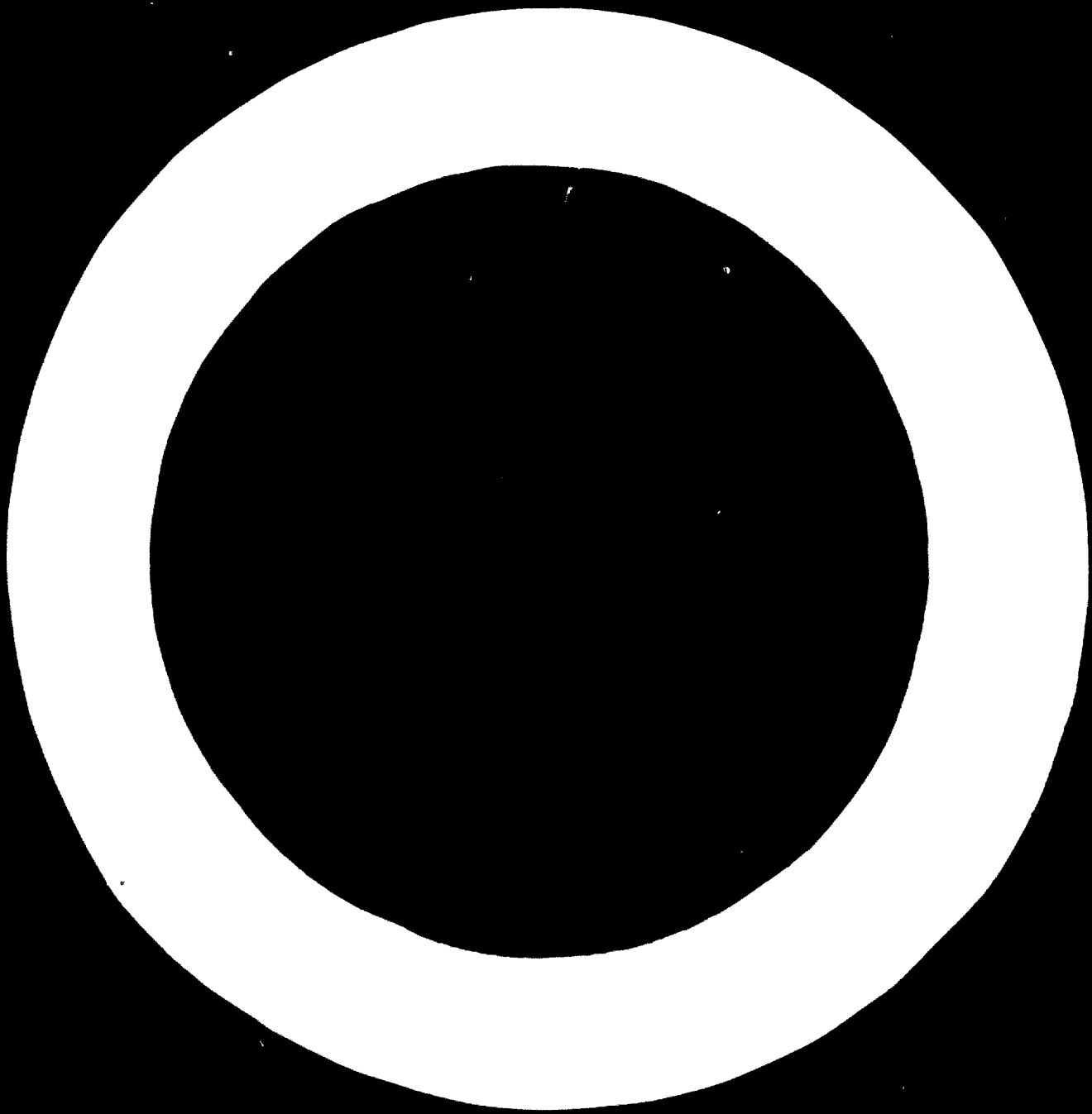
4. Study tours and observation teams in African and other countries should be organized for the benefit of countries of the region.

5. Training courses on small-scale industry and industrial estate development, area surveys, feasibility studies and the like, might be organized by the ECA, the United Nations – for instance, in connexion with its African Training Programme – the Economic Development and Planning Institute, Dakar, and institutes in various countries providing courses on small-scale industries.

6. Implementation meetings or working parties of national personnel, international experts and staff

<sup>1</sup> Governments should be encouraged to communicate directly with the ECA, giving briefly their intentions and plans before establishing industrial estates in their respective countries.

<sup>2</sup> ECA for its part will in the meantime forward the report of the Seminar on Industrial Estates and such other technical material as is thought will be of practical use to them at this time in preparing their plans.



from the CID and from the ECA, including study tours, might be organized at the request of Governments by the United Nations under its technical assistance programmes. Such meetings would be held for countries actively engaged in planning industrial estate projects with a view to facilitating and improving their implementation.

7. Advisory services and consultations on economic, technical, financial or assistance problems would be provided upon request by regional advisers of ECA.

8. Expert advice and fellowships might be requested from the United Nations under the regular and expanded programmes of technical assistance for operations of relatively limited scope and duration in the field of small-scale industries and industrial estates. Assistance for projects covering all or several phases of the establishment of a demonstration industrial estate, from early planning to beginning of operations, which would usually extend over a period of several years, might be requested from the United Nations Special Fund; as a rule, such assistance would include provision of a team of experts, award of fellowships to the counterparts of the United Nations experts and national personnel involved in the project, and provision of certain types of equipment and supplies for certain common service facilities. Special Fund assistance might also be requested for the establishment, as part of an industrial estate, of a small-industry service institute and of pilot plant facilities on an estate.

9. Short-term visits by staff and technical advisers of the CID and the ECA might be requested under the technical assistance programmes for consultations on policies and programmes in the field of small-scale industries and industrial estates and for advice on further technical co-operation projects, including if need be assistance for the preparation of submissions to the Special Fund.

10. Assistance might also be requested from specialized agencies of the United Nations and other organizations providing aid under international multi-lateral or bilateral programmes.

11. Financing of investment in industrial estates, including plant and equipment, might be requested from a number of international, regional, subregional and foreign development banks, corporations and associations.

The Seminar noted that the United Nations would publish in 1965 the present report, some of the papers prepared for the Seminar and a survey of industrial estate plans and projects in countries of the region, under the title *Industrial Estates in Africa*. To carry out the survey, the CID would address early in 1965 a request for information to all countries of the region. The Seminar recommended that all countries submit up-to-date information on relevant plans and projects to the CID in New York by 1 June 1965.

The Seminar also noted that the CID planned the convening of seminars on industrial estates in other regions and of seminars on small-scale industries, as well as the preparation of a series of research projects

in the field of small-scale industry and industrial estates, and expressed interest in such projects since the findings and recommendations obtained would be likely to be of interregional significance.

Finally, the Seminar recommended that an item on small-scale industries and industrial estates be included in the agenda of the forthcoming African Regional Symposium on Industrialization to be held in Cairo and that the present report be submitted to that conference.

#### Annex I

#### LIST OF PARTICIPANTS

*Chairman:* Ato Gabre-Michael Paulos (Ethiopia)

*Vice-Chairman:* M. Mahamat Gabdou (Chad)

#### *Member and Associate-Member Countries*

##### BASUTOLAND

Mr. Michael D. R. Irwin  
Assistant Secretary  
Department of Finance  
Maseru

##### CHAD

M. Mahamat Gabdou  
Directeur Adjoint des Affaires Economiques  
Fort Lamy

##### CONGO (Democratic Republic of)

M. Joseph Tshinkela  
Chef des Sections Développement Industriel et Investissements  
Ministère du Plan et de l'Economie Nationale  
Léopoldville

M. Daniel Shakembo  
Chef de la Section des Investissements  
Ministère du Plan et de l'Economie Nationale  
Léopoldville

M. Jean-Louis Lacroix  
Chargé de Cours à l'Université de Léopoldville  
Léopoldville

##### DAHOMY

M. Raffet Loko  
Ingénieur Economiste  
Directeur de l'Industrie  
Cotonou

##### ETHIOPIA

Ato Gabre-Michael Paulos  
Economic Expert  
Ministry of Commerce and Industry  
Addis Ababa

Ato Berhane Haile  
Industrial Research Assistant  
Ministry of Commerce and Industry  
Addis Ababa

##### GAMBIA

M. Abdoulai A. Njai  
Lands Officer  
Bathurst

**GHANA**

Mr. Kwaku Agyei-Gyamfi  
Senior Industrial Promotions Officer  
Ministry of Industries  
Accra

**GUINEA**

M. Koly Namady Kourouma  
Cabinet du Ministère du Développement Economique  
Ministère du Développement  
Conakry

**KENYA**

Mr. J. Barrage Wanjui  
Executive Director  
Industrial and Commercial Development Corp.  
Nairobi

**MADAGASCAR**

M. Robert Raoely-James  
Economiste  
Ministère de l'Economie  
Tananarive

**MAURITIUS**

Miss Margaret Findlay Makins  
Town and Country Planning Officer  
Ministry of Housing, Lands and Town and Country Planning  
Port Louis

**MOROCCO**

M. Abdelmalek Loudghiri  
Chef du Service des Investissements à la Direction de l'Industrie  
Rabat

**NIGERIA**

Mr. Chukwuemeka Ezeji-Okoye  
Principal Industrial Officer  
Ministry of Commerce and Industry  
Lagos

Mr. A. A. Oke  
Senior Engineer  
Lagos Executive Development Board  
Lagos

Mr. G. A. O. George  
Finance Officer  
Lagos Executive Development Board  
Lagos

**SIERRA LEONE**

Mr. Joliffe A. M. King  
Assistant Trade and Industries Officer  
Ministry of Trade and Industry  
Freetown

**SOMALIA**

Mr. Aden Amin Awil  
Assistant Secretary  
Ministry of Industry and Commerce  
Mogadiscio

**SUDAN**

Mr. E. Amir Yousif  
Senior Industrial Engineer  
Industrial Bank  
Khartoum

**UGANDA**

Mr. Elliott E. Wake  
Assistant Secretary  
Ministry of Commerce and Industry  
Kampala

**UNITED ARAB REPUBLIC**

Mr. Mahmoud Salama  
Director General  
Egyptian Organization for Standardization  
Cairo

**UNITED REPUBLIC OF TANZANIA**

Mr. Ferdinand A. Kinyaiya  
Assistant Industrial Officer  
Dar-es-Salaam

**UNITED KINGDOM**

Mr. John Burgess  
Consultant  
London

**ZAMBIA**

Mr. James S. Cowle  
Principal  
Ministry of Commerce and Industry  
Lusaka

*Intergovernmental Organizations***ORGANIZATION OF AFRICAN UNITY**

Ato Iassu Andemicael  
Economic Officer  
Organization of African Unity  
Addis Ababa

*Observers***FEDERAL REPUBLIC OF GERMANY**

Dr. Werner Reichenbaum  
Third Secretary  
Embassy of the Federal Republic of Germany  
Addis Ababa

**INDIA**

Mr. K. V. N. Menon  
Commercial Secretary  
Embassy of India  
Addis Ababa

**ITALY**

Mr. Carlo Garavelli  
Commercial Attaché  
Embassy of Italy  
Addis Ababa

**NETHERLANDS**

Mr. N. van Dijk  
Chargé d'Affaires  
Royal Netherlands Embassy  
Addis Ababa

**SWEDEN**

Mr. Per Kettis  
First Secretary  
Embassy of Sweden  
Addis Ababa

#### UNITED STATES OF AMERICA

Mr. Arthur Stillman  
Second Secretary  
Embassy of the United States of America  
Addis Ababa

Mr. Donald F. Miller  
AID Economist  
United States AID  
Addis Ababa

#### UNION OF SOVIET SOCIALIST REPUBLICS

Mr. Alexandre Abramov  
Counsellor  
Embassy of the Union of Soviet Socialist Republics  
Addis Ababa

#### UNITED NATIONS SECRETARIAT

Mr. P. C. Alexander  
Technical Adviser  
Small-scale Industry Section  
Research Division  
Centre for Industrial Development

Mr. I. Krestovsky  
Chief, Small-scale Industry Section  
Research Division  
Centre for Industrial Development

Dr. S. D. Mehta  
Industry Section  
Economic Commission for Africa

Mr. C. Umeadi  
Housing Section  
Economic Commission for Africa

#### OTHERS

Mr. Edward D. Mills  
Consulting Architect  
London

#### Annex II

#### AGENDA

1. Opening addresses
2. Election of Officers
3. Adoption of the agenda
4. General discussion on the role of industrial estates and industrial areas
5. Planning the establishment of industrial estates
6. Physical planning and engineering aspects
7. Organization, management and financing of industrial estates
8. Regional and international co-operation in the development of industrial estates
9. Other business
10. Adoption of the report of the Seminar

#### Annex III

#### ADDRESS BY Mr. F. A. N'LIBA-N'GUIMBOUS, DEPUTY EXECUTIVE SECRETARY, ON 14 DECEMBER 1964

On behalf of the Executive Secretary, I am happy to welcome you to the Headquarters of the Economic Commission for Africa and to this Seminar on Industrial Estates.

As you know, this Seminar is jointly sponsored by our Secretariat and the United Nations Centre for Industrial Development, New York, which is represented here by Mr. Krestovsky and Mr. Alexander. I should like to take advantage of their presence to express the ECA's gratitude for the contribution made by the Centre and its collaboration, which show the interest that it takes in industrial problems in Africa.

When the United Nations at Headquarters level and at the level of the regional economic commissions first tackled the question of industrialization, particularly with regard to industrial estates in the developing countries, the emphasis was placed on small- and medium-scale industry. It was thereby recognized that, by developing small- and medium-scale industry, one of the main aspects was being dealt with and at the same time a step was being taken towards solving the problem of adapting industrialization to the conditions prevailing in developing countries.

As far back as the first session, the attention of our Commission was drawn to the problem of industrialization, and our Secretariat was requested to take a special interest in it. This interest took two forms. Firstly, a Standing Committee on industrialization was established and has already held two meetings, and secondly a particularly well-staffed division was set up in our organization to deal with all aspects of industry. In addition, today's meeting of your Seminar under the joint auspices of the CID and the ECA confirms this attention and fittingly supplements the action taken by our Secretariat in the form of industrial co-ordination missions. Although these missions covered vast and inadequately defined subregions, they nevertheless revealed the immense industrial possibilities existing in Africa. In carrying out these activities, we are very much aware—and we wish to repeat this—that we are only at the beginning, only at the stage of defining the tasks before us. The proposals that we have prepared to achieve greater continuity in our work will be consolidated or will even find better expression as a result of the work of this Seminar.

The task that we must take up here with you, which is much more your task than that of the United Nations, comprises a certain number of sectors in which you will doubtless first wish to study in detail the nature of the instrument, the tool, that is to say the industrial estate, as well as the possibilities and limitations of these estates. Then, on the basis of experience gained in other parts of the world, as well as of the limited but direct experience of African countries in relation to industrial estates, you will try to determine the role of these estates under the conditions existing in Africa, taking into account of course the special situation in the various countries of the continent. You will then probably wish to touch on the even vaster subject of the policies to be applied in developing small- and medium-scale industries and to assess the role of industrial estates in this development process as it appears in your respective countries. Finally, I hope that your discussions will lead to some practical suggestions concerning the formulation of a programme for the establishment of industrial estates.

In this connexion, I should like to point out that a major industrial research institute has, through the intermediary of the Government concerned, offered to help us conduct the necessary studies at subregional level. We hope that, in about four months we shall be able to start putting this project into effect in the field.

Thus, Gentlemen, you see that the task in which we hope to associate you from now on is a considerable one, but you will certainly agree with me that it is an inspiring one. I wish to say now succinctly we are that by combining your efforts with our own sufficient determination will be maintained on both sides, which is one of the conditions for final success. I hope that your stay here may be richly instructive, but that this may be an effective enrichment, that is to say one that is concrete and realistic. May the Seminar have every success and may you have a pleasant stay at Addis Ababa and in this hospitable country of Ethiopia.



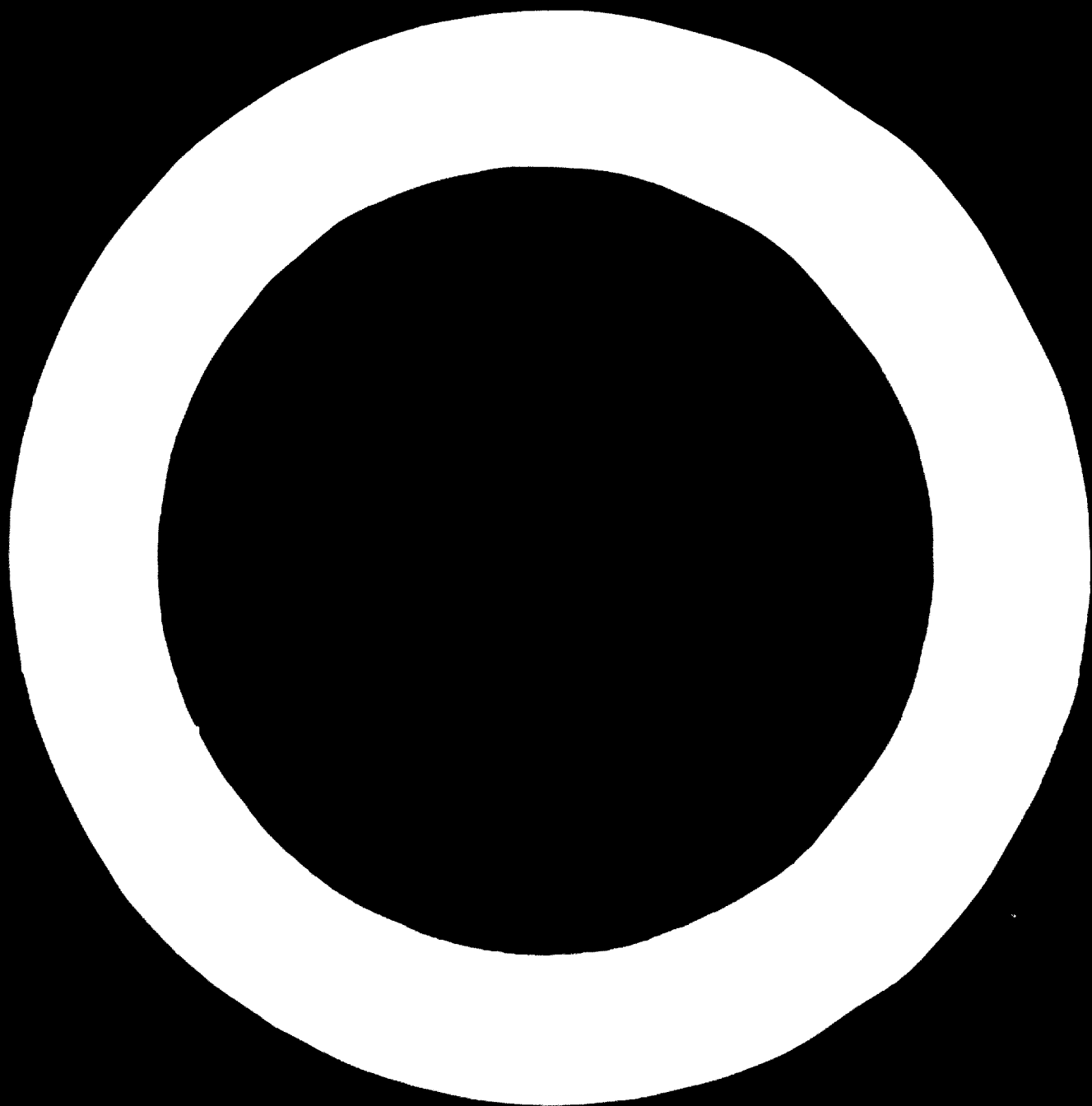
**Annex IV**

**LIST OF DOCUMENTS**

<i>Symbol</i>	<i>Title</i>	<i>Symbol</i>	<i>Title</i>
E/CN.14/IE.2	The Role of Industrial Estates in Policies and Programmes for the Development of Small-scale Industries	E/CN.14/IE.5	United Nations Activities in the Field of Industrial Estates
E/CN.14/IE.3	Industrial Estate Developments in the UAR	E/CN.14/IE.6	Types of Industrial Estates
E/CN.14/IE.4	The Yaba Industrial Estate in Lagos, Nigeria	E/CN.14/IE.7	Planning, Design and Construction of Industrial Estates with Particular Reference to Africa
		E/CN.14/IE.8	The Potential Importance of Industrial Estates for African Countries
		E/CN.14/IE.9	A Review of Industrial Estate Developments in Africa
		E/CN.14/IE.11	The Definition of Small-scale Industry

**Part 2**

**PLANNING, DESIGN AND CONSTRUCTION OF INDUSTRIAL ESTATES  
WITH PARTICULAR REFERENCE TO AFRICA**



## PLANNING, DESIGN AND CONSTRUCTION OF INDUSTRIAL ESTATES WITH PARTICULAR REFERENCE TO AFRICA<sup>1</sup>

### INTRODUCTION

"The urgent need of many developing countries to accelerate industrialization and to raise living standards has made it imperative to undertake practical programmes designed to further social and economic progress. The industrial estate is a recent addition to the many techniques which have been successfully applied in order to encourage industrial development in the developing countries."<sup>2</sup>

An industrial estate consists of an area of land allocated for factory buildings which are sold or leased for manufacturing purposes. The land is developed in accordance with a comprehensive plan, which includes roads and other means of communication, services and site preparation carried out in advance of building work. Factory buildings are erected either as standard units of various types or to meet the specific requirements of a particular industry. Industrial estates are areas of controlled development in the town planning pattern, and by means of zoning, restrictive covenants and other devices, their form and growth is regulated for the benefit of both the occupants and the community at large.

The industrial estate can play an important role encouraging and expanding small-scale and medium-sized industries within the framework of a national industrialization programme. For this reason, among others, the concept is particularly relevant to the developing countries of the world, which can not only benefit from the experience of already highly industrialized countries such as the United Kingdom and the United States of America, but which can at the same time avoid some of their more obvious mistakes.

The idea of the industrial estate is now over 70 years old, and the experience gained not only in Europe and America but also in Africa, India, the West Indies and other parts of the world is available to aid new ventures in the developing countries.

### PHYSICAL PLANNING

#### *Location*

One of the most important factors contributing to the success or failure of an industrial estate is its

physical location. It is vital, therefore, that any broad siting decisions should be made in the light of national and regional planning policies. In this respect, industrial estates can be regarded as one of the means of organizing land use in an economical way and ensuring the proper segregation of the various uses. However, the haphazard establishment of industrial estates can never be an adequate alternative to a national economic development programme; the proper integration of local projects with over-all development plans is vital if the establishment of industrial estates is to be fully effective.

Before any detailed consideration is given to location, a regional development survey is essential, this must determine the economic and industrial potential of a given area in the light of national needs. Such basic investigations should include a study of existing and potential resources in relation to raw material, labour, communications and consumer demand. Existing industry, its variety, technical and economic problems and growth possibilities will provide indications of the needs of the region and the type of development best suited to those needs.

Research surveys must be thorough and can be of great value, particularly when industrial estates are intended to encourage the industrial development of rural areas. Such areas are generally difficult to develop industrially, and a regional survey will often reveal that essential basic requirements for industry cannot be provided economically. Any rural development project must therefore be regarded initially as being purely experimental and might well consist of a group of small local industries and handicrafts based on the traditional materials and skills of the district. These could then develop as local technical difficulties and prejudices are overcome.

At the other extreme, industrial estates located near large centres of urban population readily attract industrialists both large and small, since the resources of materials, power and labour are easily available. One of the objects of the establishment of industrial estates is the transfer of industry from congested urban areas to encourage expansion and provide more congenial working conditions. These conditions can often be met near established urban centres, and such developments should be co-ordinated with clearance schemes in the existing built-up areas so that unplanned urban industrial slums can be cleared and the land redeveloped for other purposes. For urban projects the basic survey is of vital importance to ensure that overconcentration of population is avoided and care is taken that

<sup>1</sup> Paper originally presented to the Seminar by Edward D. Mills, C.B.E., F.R.I.B.A., M.S.I.A., Architect, London.

<sup>2</sup> United Nations, *The Physical Planning of Industrial Estates* (Sales No. 62.II.B.4).

the demands of existing industries do not curtail the establishment of new enterprises.

To avoid the heavy concentration of industry around major towns, serious consideration should be given to the development of industrial estates in relation to the smaller urban centres, where land is cheaper and additional population can be more readily absorbed. In many countries experience has shown that the siting of industrial estates near smaller towns has encouraged the establishment of new industries and made the planned development of the township a practical proposition. Such growth may be slower than can be expected near the large urban centres, but nevertheless it is well worth while in relation to an overall pattern of industrialization.

The location of certain industries is conditioned by special considerations. Heavy industry such as steel mills, chemical plants or oil refineries will need to be sited near ports for easy shipment of raw materials and finished products. Cement works and similar plants must of necessity be planned adjacent to the deposits of raw materials for economic working, and power production units will often need to be near the source of fuel supply. Industrial estates can frequently be developed in relation to such major groupings to encourage the growth of smaller ancillary industries working in close collaboration with the major plants.

In some cases, by-products from the major industries can be successfully exploited, and in others, allied industries can be usefully developed on a neighbourly basis. In Uganda, for example, a cement works situated adjacent to limestone deposits has resulted in the establishment of a growing asbestos-cement factory on an adjoining site and the establishment of a phosphate plant following the discovery of local mineral deposits.

The location pattern of industrial estates must inevitably be a flexible one if the full industrial potential of a country is to be realized. By means of comprehensive national and regional planning, the location of industrial estates can assist in the development of urbanization policies, encouraging industrial decentralization, planned concentration or rural growth, according to specific needs.

#### *Physical factors*

Following the general determination of location, the choice of a particular parcel of land must be decided by the physical factors of the sites available. Seemingly unsuitable sites can be successfully developed where special needs and considerations compel this course of action. Generally, poor sites burden a project with abnormal initial costs to such an extent that the scheme never becomes economically viable and the ultimate objective is seldom realized.

A site selected for development as an industrial estate should be level or capable of being levelled at a reasonable cost. Site falls should not normally exceed 1 in 10. The subsoil should be stable, to provide adequate foundations for buildings and plant without recourse

to expensive ground works, such as piling, and it should not be swampy or liable to flooding or subsidence. Land which may require considerable site works should not normally be chosen, but where other important considerations exist modern engineering technology can overcome apparently serious disadvantages. Modern piling techniques, chemical soil consolidation, large-scale earth moving and other possibilities are available and can be employed in special cases.

The shape and size of a piece of land in relation to its development is of particular importance in any tropical region. It must allow the proper orientation of any buildings to be erected on it and be of adequate area to allow an estate of economic size. Normally the cost of land is not the largest financial consideration in the total development outlay of an industrial estate, and cheap land which is inaccessible for goods or workers, or likely to entail considerable development charges is a poor bargain.

Local site investigations are essential before the final choice of a plot of land is made; these should include test bores to determine subsoil conditions, a site survey to determine levels and the collection and analysis of relevant data, such as records of earthquakes, floods, abnormal weather or any other natural conditions. All these will assist in reaching a final decision concerning the suitability of the site for development.

#### *Communications*

In parts of the world such as Africa, where the distances between centres of population can be considerable, the question of communications is important. This is particularly true where industrial development is concerned. However advantageous the physical characteristics of a site, if it cannot be conveniently reached by one of the major means of transport its value is greatly reduced for industrial purposes. It may be possible to create new road or rail access, but this will be costly and time consuming.

Industrial developments need railways, roads, harbours, waterways and airports, and the type of transport facilities available in any given area will help to determine the type of industry an estate may hope to attract. All industries need transport to bring raw materials to them, to carry finished products away and to facilitate the movement of labour.

Because of its flexibility and economy, road transport is often most suitable for industries which are concerned with raw materials and finished goods which are not bulky. Since industries of this type are often located on an industrial estate, the importance of an adequate highway system linking the estate to the main centre or a national highway network must be underlined. Good roads to the nearest town are also of importance for workers, to provide them with easy access to their homes whether they travel on foot, by cycle, motor car or public conveyance.

Rail transport is mainly needed by heavy industries with bulky raw materials and finished goods. If such

industries are expected to develop in a chosen area, the possibility of linking with an existing railway network is important. If sidings are to be linked with the estate, then the railway users should be grouped together to avoid unnecessary rail track and crossings. If a rail spur is not to be provided on to the actual site, then easy road access to the nearest railway goods yard is essential.

In most parts of the world, water transport is still the cheapest method of conveying bulky loads, and for certain industries, such as petroleum, flour and heavy engineering, sites for industrial estates adjoining a deep-water canal or port can offer economic advantages which will often counterbalance any disadvantages. Rail, road and water access, such as the Trafford Park industrial estate in England possesses, make this one of the most successful schemes of its kind.

River access can also be useful, but the possibility of seasonal changes in water level should be examined. In some areas even large natural water courses disappear completely in the dry season.

Although the role of air transport in industry is still in its infancy, a site with easy access to an air strip will grow increasingly important in the future. Already industrialists in East Africa are finding air transport for sales representatives, executives and customers an economic proposition, and the urgent delivery of smaller goods can well be made at reasonable cost by air. In Jamaica the Industrial Development Corporation has established its own strip in conjunction with the Kingston industrial zone, and the international airport is only a short distance away. There is no doubt that air transport, particularly in Africa, where considerable distances often have to be covered, will play a much greater part in the future in relation to industry. This factor should be considered when the choice of sites for industrial estates is being made.

Few sites will have all the communications advantages described, but a survey of the means of access is part of the basic evaluation of any area under consideration, which must not be discounted.

### *Services*

All industries need services of some sort and unless an estate is so large that it can conveniently create its own supplies, it must depend upon existing sources. The establishment of an industrial estate in an area may well overtax existing facilities, and these must be carefully examined before a final siting decision is made. The three major needs are electricity, water and drainage, and if supplies of any of these are inadequate the success of any industrial undertaking is seriously jeopardized.

Electricity is the principal source of power for most forms of manufacture. If adequate supplies are available from existing power lines, or if new lines can easily be run from the generating plant, this is a great advantage. If existing power plant has to be extended, this will be costly, and the alternative of generation on the site for the benefit of the estate may be worth

consideration. High voltage supply from a national power grid by overhead line to local transformers is the most economical solution. A project such as the Owen Falls hydroelectric scheme in Uganda illustrates what can be done in many parts of Africa. Interrupted or erratic electricity supplies can dislocate production programmes and a growing industrial estate will have increasing demands for power which must be envisaged at the planning stage of any new project.

Any development whether urban or industrial needs water, and however desirable a site may be for industrial development a shortage of water can be a very serious drawback. The amount of water required by different industries varies considerably: the chemical industry, for example, uses considerable quantities for production, cooling and general purposes. Available sources of supply include existing public supplies, rivers, lakes, canals or wells. Water from rivers or lakes may need local purification. Before an industrial estate is planned, careful estimation of possible water requirements must be made, and if supplies are limited heavy users of water should not be located on the estate. Water conservation needs to be practised in many parts of Africa. Storage of storm water in the rainy seasons may be practical in some areas.

Plans must be made at an early stage for drainage facilities in any proposed industrial area. This factor has a bearing on the choice of a factory estate site. Land which cannot be drained economically can be a serious liability. Industry needs three types of drainage, which must be kept separate: soil drainage, storm water drainage and trade effluent disposal. Factory estates near large urban areas may well be able to utilize existing sewage systems if they are able to take the additional load. In relatively under-developed areas local facilities may need to be provided for the specific use of the estate. A separate treatment system for soil drainage will be needed, and industrial effluents must be treated by the producing industry *before* discharge into any sewage system.

In areas of heavy rainfall inadequate storm drainage can be a serious nuisance. If proper drains are not available, roads and even buildings become flooded, causing damage to plant and goods.

Other services which may be required by individual factories are usually provided locally, preferably on a group basis for economy, such as steam and compressed air. Gas may not always be available, but it can usually be provided in bottled form if it is essential. Telephone communication is important; in outlying areas a local exchange may be useful to serve the industrial estate if an existing exchange is not available.

### *Economic factors*

These can be grouped under one heading since their importance will vary with the pattern of the estate. A rural estate may well be dependent upon local raw materials and, to some extent, markets within reason-

able distance. An urban estate, with its improved communications, can draw raw materials from a greater distance and send finished goods further afield. Where food processing units are envisaged, the proximity of the producing areas to the processing plant is of importance; for example, the sugar factories of Jamaica are situated near the plantations for obvious economic reasons. Similar factors will apply to plants using minerals and other bulky materials. Final costs can be materially reduced if raw materials of this kind have only a short distance to travel before processing.

To ensure a successful enterprise, labour must be available and long journeys to and from work should be avoided since they are both tiring and expensive. If a selected site has all the advantages listed and yet cannot draw upon an adequate labour force, the chances of success are strictly limited. The creation of new industrial communities with housing and the necessary social amenities is an expensive proposition.

New townships can be created with their own industry and commerce; this has been the policy in Great Britain in relation to the development of the New Towns, but even in such cases as Stevenage, Harlow and Crawley they have been based on existing communities. This policy has been necessary to deal with the over-spill of the large cities of Britain.

In Africa the right pattern would seem to be the planned expansion of the existing smaller urban areas, strategically placed in appropriate regions against the background of a national plan. By such means existing housing and social amenities would be available for the labour force of the industrial estate, and planned growth of community facilities can run parallel with the development of the industrial zone.

## DESIGN

### *Types of estates*

Assuming the successful location of a factory estate project following the surveys previously mentioned, the type of estate must be determined according to the local and regional needs. This decision can be reached after careful consideration of development trends in the area which will have been investigated before the location is finally settled.

The three broad categories are single-type estates, mixed-type estates and single-industry estates.

Single-type estates may be a group of simple workshops for local handicrafts or similar work in a rural area, an estate of standard nursery factories to encourage new industries near a small urban community or an estate of standard factories with communal facilities to rehouse dispossessed industries from slum areas of a large town.

A mixed-type estate may consist of custom-built factories for specific industries, standard factories and nursery units with a wide variety of services to improve productivity and lower manufacturing costs. Such estates will usually require a large site and need

to be located near an established centre of population with a wide range of facilities available.

Single-industry estates are usually located in certain areas because of specific needs or conditions; examples such as special raw materials, particular forms of transport or long-standing local traditions have already been quoted. An example in England is the original establishment of the potteries in the Midlands, where the ready availability of cheap local coal was the determining factor 100 years ago.

### *Estate layout*

Whatever type of factory estate is established in a given location, the layout can materially affect its success or failure. Good estate planning is vital; inadequate planning is ultimately expensive, inhibiting growth and causing perpetual frustration. Expert architectural and planning advice on the problem of estate layout is a sound investment.

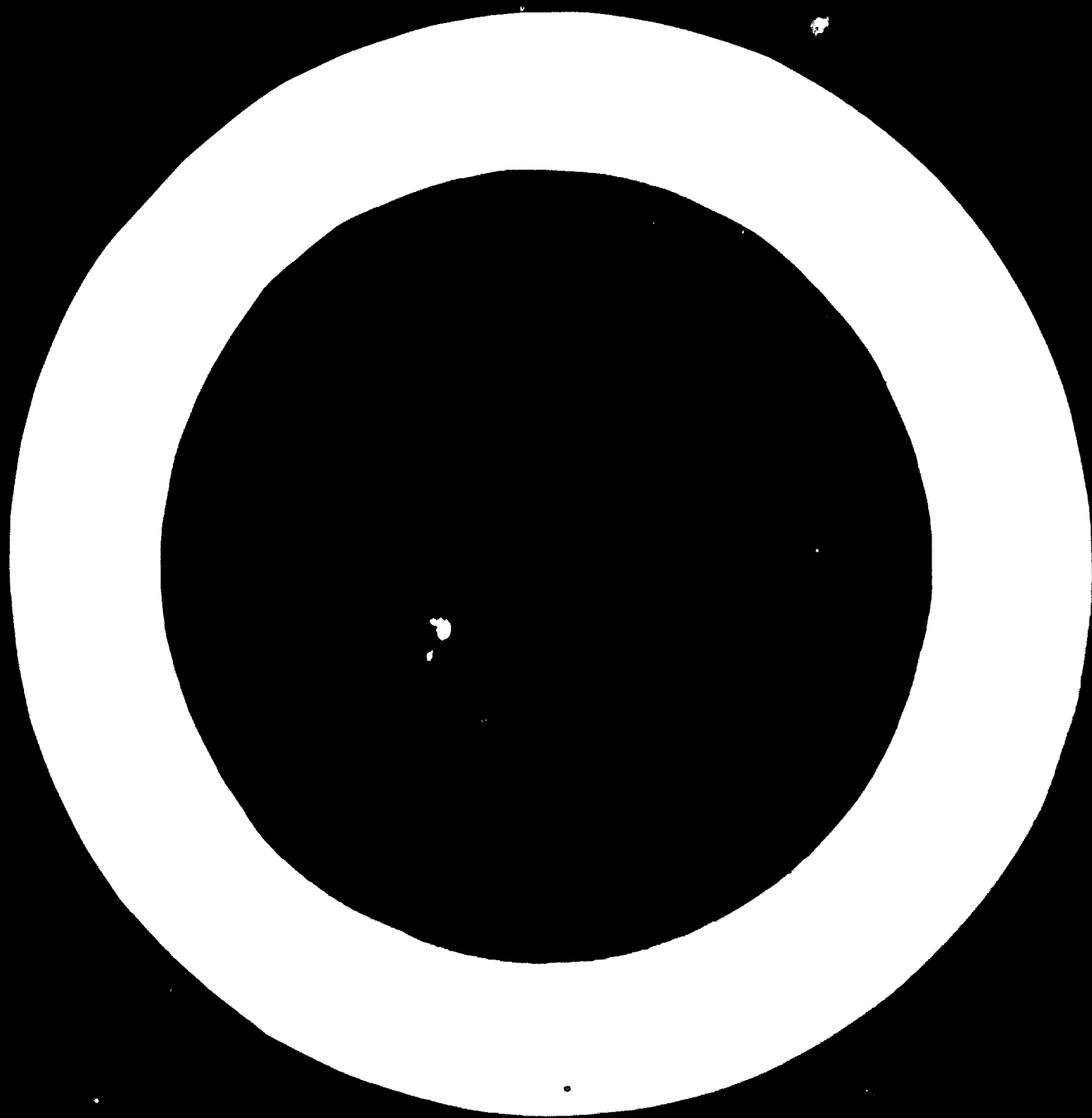
Layout problems can be divided into four categories: road systems, services, factory plots, and communal facilities and open spaces. The right relationship of these elements will vary with the different types of industrial estates.

General principles can be broadly stated, but before any detailed design work is commenced the necessary design data must be collected and properly analysed. The information needed will include: (a) a physical and geological survey of the actual site; (b) a district survey covering communications, available services, population and local facilities, and (c) an estimation of manufacturing needs based on the types of industry envisaged, their water, power and services needs, labour requirements, possible hazards and other similar factors.

The size of any given estate cannot be a subject for generalization and will vary from case to case. Such points as availability and cost of land, number and size of firms to be accommodated and other local and regional factors will determine the general pattern. However, over-all provision for planned expansion is always an important consideration and must be regarded as a basic planning factor.

Road systems and services should be considered as allied problems. Basic road patterns must be determined as a first step to estate layout, and electricity cables, drainage runs, water mains and other services planned to follow the road pattern. Such services must be installed at the same time as the road construction to avoid subsequent and costly engineering work. Road widths will be determined on the basis of estimated traffic flows, with main routes, secondary and service roads according to needs. An economic proportion of roads to total estate area is in the region of 25 per cent, and one-way systems have much to commend them.

For ease of repair and connection, main services, run under soft strips between road and footway are to be recommended in principal traffic routes. Over-dimensional roads are wasteful of space, but congested





ted roads, due to inadequate size, are a constant source of delay and annoyance and inhibit expansion. The initial development of a site may not include a complete road system, but the ultimate pattern must be determined at the outset so that growth can be orderly and in accordance with a master plan.

One of the most serious contributions to congestion in any road system is vehicle loading and unloading. This must never be allowed to take place from the circulation routes of a factory estate. Hard standings or loading bays must therefore be provided within the curtilage of the individual factory sites, with adequate facilities for vehicle turning. This requirement can be satisfied by determining reasonable "building lines", which set the actual building back from the rear of the pavement, and by planning service roads within the site for side or rear unloading.

In many countries, car parking is a serious problem. In the United States car parks often cover larger areas than the factory and, while this problem may not yet have reached unmanageable proportions outside large townships in Africa, rising standards of living will bring an increase in car ownership. Development plans must envisage this eventuality and land be reserved for this purpose.

Cycle and scooter parking space can best be arranged immediately adjacent to the factory buildings, but cars, apart from a minimum space for visitors and the like, should be parked in communal areas serving the whole estate. Standards vary, but one car space per 1,000 square feet (93 square metres) of factory area is a useful basis for calculation. In the first stage of development car space will be needed only for senior staff and visitors, say two or three spaces per factory unit.

Services have been referred to in relation to drainage runs and the like, but basic plant for service supplies may be needed, such as sewage treatment plant and similar utilities. These must be planned in a central position so that pipe runs are kept to economical lengths, at the same time care must be taken to avoid nuisance from smells, smoke and so on.

The car parks and some utilities may well be planned in relation to designed open space in a factory estate. They are not alternatives to open space, which is essential to provide both visual relief and breathing space. If natural features exist on the site, such as mature trees, a small hillock or similar feature, these can often be preserved as a basis for landscaping. Approximately 10 per cent of a site area should be reserved for permanent open space to avoid overcrowding. This must be provided separately. The preservation of existing mature trees is important, as the shade they give is valuable in tropical countries.

Expansion and natural growth must be considered at the initial planning stage and can be catered for in three ways: additional land for the expansion of the estate area individual factory growth and movement within the estate for growing enterprises from a small unit to a larger one. The last two alternatives will be considered later.

Additional site area for over-all expansion should be acquired at the same time as the basic land area. If this is not done, land values will rise and increased costs affect the economics of the project at a later stage. Services must be planned to cater for expansion. Reserve land should also be acquired for the ultimate expansion of non-manufacturing facilities.

Communal facilities, when these are to be provided, should be planned so that they can serve the entire estate efficiently. They will be described in detail later, but at the layout stage it is important that they should be considered and convenient space allocated to them even if they are not erected in the first phase of the development.

### *Types of factory buildings*

Types of factory buildings on any estate will be determined by the industries to be housed, and this will involve either a selection policy in relation to the prospective occupants or a survey of potential users as a guide to design standards. The two major categories of buildings will be the custom-built factory and the standard factory.

Custom-built factories are those designed specifically for a particular firm and planned to suit their detailed needs. These can either be designed and erected by the estate authority, if they have the necessary professional skills, or undertaken by architects appointed by the firm concerned. This type of development is usually confined to large industrial concerns and it is usual for the authority to lease "prepared" or improved sites for this purpose. Such sites are levelled and provided with roads and services laid to the site boundary. On mixed estates, referred to earlier, larger sites on the perimeter are often reserved for this purpose.

Standard factories, however, are those designed and built by the estate authority to a general pattern to achieve maximum construction economy. They can vary in size according to their purpose.

Nursery factories are small-scale standard factories designed for new but potentially expandable firms; they will usually be the smallest unit of an estate. The first nursery factories in Great Britain consisted of single buildings of 6,000 square feet (557 square metres) in area, divided into four 1,500 square-foot units, designed so that a manufacturer could have from one to four units. More recent examples average about 2,000 square feet (186 square metres) each unit, 70 feet  $\times$  30 feet (21 metres  $\times$  9 metres) in terraces, allowing a firm to have one or more units as needs demand.

This pattern appears to be applicable to African conditions; when an industry outgrows the nursery stage, it moves to a larger standard factory. Small terraces of nursery factories of this type would also be particularly suitable for experimental rural or village workshops. A small estate of nursery factories at Yaba in Nigeria was the first African example, and its success has led to further developments of a similar kind in Nigeria.

Crafts workshops or "worksheds", even smaller in size, have been built in rural areas of India and are proposed for Nigeria to house local craft and service industries usually found in overcrowded residential areas.

Standard factories, which can house the growing manufacturer from the nursery estate, the developing industry from the overcrowded urban area or the new industry must be of simple design to allow easy expansion. This type of factory will be built before its occupier is known. The basic unit will vary, but the objective should be to provide any floor area from 2,000 square feet to 20,000 square feet or more.

Standard factory designs should be capable of providing floor area as needed without a variety of alternative patterns - the number of types must be kept to a minimum. If the smallest standard factory area is 6,000 square feet (557 square metres), then a nursery factory tenant who is too large for two nursery bays of 4,000 square feet (372 square metres) can take the smallest standard factory and thereafter increase in size according to his plot area by planned units. This form of modular progression allows flexibility within a standardized range. Standard factories of this kind are suitable for light industry and should be designed with reasonably clear open floor area, good lighting and ventilation and easy extendability. When the actual land area is selected for the standard factory, it will be chosen to allow for expansion. Site coverage must be controlled by the authority by specifying plot ratio of land to buildings and by determining building lines, side and front setbacks and so on.

#### *Factory layout*

Any type of factory building must be designed for the efficient performance of the process to be carried out within its walls. A standard factory must be capable of being laid out within the external walls in a logical manner so that the work carried out can follow a natural flow.

The simplest natural flow is: delivery, raw materials, processing, packing, finished product, dispatch. This simple route is the basis of even the most complicated manufacturing process. There can be many permutations and elaborations, but this is the foundation of them all.

Internal divisions in any standard factory are normally provided by the occupant to his own specifications, and the basic "shell" shape must therefore allow a simple variation of internal layout. Theoretically a square basic unit has much to commend it because it needs the minimum wall area in relation to floor area. However, other problems, such as roof spans, arise, and a basic module of 60 feet x 30 feet (18 metres x 9 metres, a double square) for a nursery factory could be the basis of a useful additive pattern. Half modules, say 30 feet square, could be usefully considered as workshop units.

All factories will require lavatory accommodation for both sexes, and the location of this needs careful

consideration. There is a strong case for separated toilet blocks, and these can be as elaborate or simple as the industry needs. For example, dirty industries will need shower accommodation, where clean industries will not. The toilet blocks can be linked by covered way to the main factory building.

#### *Building design*

Circulation has already been mentioned as an important factor in the design of any factory building. It is a basic factor in all types of building. The circulation of personnel, of raw materials, of products in the course of manufacture, of finished products must all be considered and traffic flows arranged so that a free flow at all stages is maintained, without obstruction or confusion. Cross traffic should be avoided, and circulation routes should be as direct as possible.

Climatic considerations play a very important part in the design of buildings in the tropics. The three major problems are sun, rain and wind. The tropical sun is hot and bright, and overheats the wall, roof and window surfaces on which it shines, and paving surrounding a building reflects the heat on to the structure. Buildings must therefore be designed so that walls and windows have the minimum exposure to the sun by placing the long axis on the average path of the sun and providing wide overhanging eaves to create shade. If the walls are built of material which does not readily transmit heat from outside to inside and are well protected from direct sun, reasonable comfort can be obtained.

The greatest area of a building exposed to direct sun is the roof, and means must be employed to reflect the heat from the surface and reduce heat transmission as much as possible by the right choice of materials and carefully detailed design. Care must be taken to avoid creating a heat reservoir which stores the heat during the day and gradually emits it: a light roof structure therefore has much to commend it.

Any glazed area in roof or walls acts quickly as a means of transmitting heat. Unprotected glass allows heat into a building and retains it. Glass surfaces must accordingly be shaded by means of louvers, sunbreakers or other ways to prevent heating up of the glazing. Corrugated sheets of glass-fibre-reinforced polyester resin can be a useful alternative to glass for roof and high-level wall glazing.

Rain in the tropics can be sudden, heavy and wind-borne. Building design must therefore cater for an abnormally high water run-off. The wind-driven rain, which can reach almost hurricane force in parts of Africa, becomes practically horizontal at times and can force its way through water checks, louvers and rebates, necessitating very careful detail design. Heavy rainfall can cause soil erosion around a building which could damage foundations and other parts of the structure. In many areas roof gutters are prohibited or at least discouraged because of the possibility of mosquito breeding. Where gutters are designed on industrial buildings, they should be generously dimensioned,

easily accessible and with adequate falls, preferably to water chutes rather than down pipes. By careful planning storm water can be collected in the wet season and stored in underground tanks for use after suitable treatment. This has been done successfully in West Africa and elsewhere.

Wind can be both a blessing and a curse, and driving rain has already been mentioned. Ventilation of buildings in the tropics is most important particularly in industrial buildings. Air movement is needed to create comfort conditions and, while electric fans can do the job, they are second best to natural air movement. In Africa the draughts that are a nuisance in England become highly desirable.

Buildings in any hot climate should be designed with cross-ventilation. In hot, humid regions windows and permanent ventilation openings should be planned to encourage a through breeze at working level. In arid regions, where winds are hot and dry in the summer and cold in winter, ventilation openings, windows and the like can be reduced for comfort.

Few industrial undertakings on the average estate will be able to afford costly artificial ventilation plant; natural breezes must therefore be exploited for ventilation purposes.

Natural lighting must be carefully considered in all industrial buildings. Buildings oriented so that the main axis runs from east to west have already been recommended and, where the width of the factory is not more than 30 to 40 feet (9 to 12 metres), wall glazing can provide adequate daylight for a small building. The window area will vary from 10 to 20 per cent of the floor area. With larger buildings roof lighting will be necessary to achieve an even level of natural illumination. This can be achieved in a variety of ways, but the most economic and efficient for general purposes is the double pitched roof with glazing along the slopes or with a monitor. The problem, however, is the reduction of heat transmission through the glass from direct sun, and so north light roofs are worth consideration. The area of roof lighting needed will vary with the level of daylight required and this will depend on the industry concerned. Problems such as shadowing, glare and heat penetration must be considered in the design of any form of factory glazing.

Artificial lighting in factory buildings is largely conditioned by the type of work carried out and the intensity will vary considerably. For example, at one extreme the recommended value of illumination for an assembly shop for rough work is 7 foot-candles (Grade 6B) and, at the other end, for a very fine instrument assembly shop, 100 foot-candles (Grade 2B).

Good lighting, both natural and artificial, can contribute materially to higher production and safer, more accurate and efficient working. Common faults to be avoided are: (a) glare due to insufficiently shielded light sources; (b) too few lighting fittings; (c) excessive brightness contrast between fittings and background; (d) ceilings that are too dark in colour; (e) excessive shadows due to poor layout of fittings;

(f) light sources at incorrect height, (g) too great a variation of light intensity from one area to another, and (h) unhappy relationship between lighting and colour scheme.

Colour in factories is a comparatively new science. The correct use of colour can not only improve standards of appearance and cleanliness, but can reduce accidents, increase production and improve the workers' morale. Background colours should be carefully selected in relation to the work carried out in any given area. White is generally unsuitable as it gives rise to glare; neutral, restful colours which provide a suitable contrast in hue with the work in hand are to be recommended.

Machinery colours should provide a suitable brightness contrast with both the task and the immediate background. The working area of the machine should be the brightest spot in the field of vision. Standardized identification colours should be used for marking hazards and service pipe lines.

Services in a factory building are like the arteries in a human body. The variety of services will change with the types of industry; a full list would include electricity, gas, water, steam, compressed air, vacuum, drainage and so on. Constant alteration and maintenance of service lines in a factory is inevitable; they must therefore be accessible and easily identified. An orderly arrangement which allows easy connexion of plant or machinery is essential, and adequately sized mains will make the installation of new and larger plant less difficult. Pipe work should be properly protected, and hot water and steam mains adequately lagged.

Water may not only be needed for domestic and process use, but for fire fighting and in some cases for sprinkler systems. Each manufacturing unit should have a reasonable stand-by storage tank for emergency use. An estate water tower for general storage is also of value in case of temporary shortage.

Where the factory process produces any form of effluent, this must be treated at source and rendered harmless before discharge into the estate sewage system is allowed. This is of particular importance in the chemical and allied industries. Where considerable quantities of trade effluent are envisaged, a separate estate effluent drainage system is essential. Effluent must *never* be discharged into rivers, streams or water-courses.

Where a number of factories require such services as steam, compressed air and the like, these should be located in a position on the site where they can share a common generating plant for efficiency and economy of operation.

Most manufacturing processes produce waste products of one sort or another, and where these cannot be consumed within the process, they must be stored for general collection and disposal in such a manner as to avoid untidiness, smell or other nuisance. The dumping of trade waste must *never* be allowed on or around the factory estate.

### *Communal buildings and facilities*

Communal services for certain users have already been mentioned, but an industrial estate should provide other forms of communal facility in the shape of amenities which would be uneconomical if provided individually by each factory owner.

All tenants on a factory estate will require storage accommodation and where small individual industries are concerned a co-operative warehouse will provide centralized storage space so that a manufacturer can rent the floor area he needs at any given time. Such communal warehouses must be designed in a central position with good access and carefully planned loading facilities. The size of the building will vary, but with the universal use of fork-lift trucks for palletized goods, a clear height of at least 18 to 20 feet (5.5 to 6 metres) is essential. Spans can follow those chosen for the standard buildings on the estate. Daylight is of little importance. Security against theft and unauthorized entry is vital.

Administration facilities will be required for the proper running of all but the smallest industrial estates, and the administration building can be either a simple suite of two or three offices or contain a variety of amenities for communal use. The most necessary of these amenities are canteens and health facilities. The former should provide simple meals in pleasant surroundings away from the workshop atmosphere; the latter may be only a basic first-aid unit (which should be regarded as the minimum provision), but it can be designed to provide more comprehensive medical treatment if the size of the estate warrants it.

Other communal facilities should be considered for large and medium-sized industrial estates, and these may include a children's crèche and rest room, bank, post-office, telephone exchanges, training centre and similar units. A trade training centre could well be associated with communal repair and maintenance workshops. A small samples show-room and exhibition space will be welcomed by the individual tenants, since this will enable them to exhibit their goods to potential buyers in attractive surroundings away from the working area. This facility could be regarded as essential for an estate of any size; even tenants of a rural workshop scheme would benefit by such provision. Lettable office space is sometimes useful for industrialists who prefer to separate the manufacturing and commercial aspects of their work.

Even if these amenities are not provided at the initial stage of development of an estate, land should be allocated for them in a convenient, accessible and prominent position for development as the estate grows. The provision of housing and social amenities may have to be considered in certain special cases, but in general it is more satisfactory if an existing community can be expanded.

### *Design for expansion*

This has been mentioned several times in various contexts and should always be kept in mind. If growth

and expansion are not considered, then the success of an industrial estate can be materially inhibited. Growth can be catered for by the following means: (a) provision of adequate land for general expansion; (b) initial reservation for expansion of car parks and all communal facilities; (c) adequate provision of roads, main services and utilities; (d) sufficient variety of standard factory sizes and prepared sites; (e) adequate control of plot coverage ratio and other restrictions; (f) foresight in advising tenants on size of plot in relation to ultimate growth potential; (g) detailed design of buildings to facilitate extension and modification; (h) flexible pattern of transfer from nursery factory to standard factory and custom-built factory.

Not all industries on an estate will want to expand, but since one of the merits of the factory estate is the flexibility of accommodation, this factor must underlie all design considerations. The estate must aim at attracting healthy, expanding industries as well as those that need assistance. It is probable that 50 per cent of the industries attracted to an industrial estate will grow to some degree in the first five years of their tenancy.

## CONSTRUCTION

### *Materials and techniques*

When considering the choice of materials for the construction of buildings on an industrial estate in Africa, it is important that a careful survey of local materials and building skills should be carried out before any decisions are reached. All buildings require materials and labour to assemble them. Generally speaking, labour costs are low in Africa in comparison with European or American standards, but they will inevitably rise as standards of living rise. Since building costs have a considerable bearing on the economic viability of an industrial estate project, the question of appropriate building materials for construction purposes is of great importance.

Imported building materials, because of their high cost, should therefore be limited as far as possible and local materials and skills developed, both in connexion with traditional building methods and new techniques adapted for local use. The African craftsman is not only skilled with the materials he has used for generations, but can quickly learn new techniques which can result in speedier and more economic building.

Cement is a universal building material, and the part it plays in modern construction makes it indispensable. It is now regarded as an essential basic building material. It is rapidly replacing in African countries traditional materials, such as timber, mud, sunburnt brick and thatch. In comparison with highly industrialized countries the cost of cement is generally high in Africa. This can be lowered by a greater expansion of domestic production and a corresponding reduction in cement imports.

In 1961, for example, the West-African region imported over 1.5 million tons of cement; domestic produc-

tion is capable of producing less than 25 per cent of the demand. It is reasonable to assume that this pattern is repeated in other regions of Africa. Cement works already exist in many regions of Africa, and the quality of the material produced is high. With increasing industrial, educational and other building programmes the establishment of new cement manufacturing plants is of great importance.

Road and site works techniques must be briefly considered before discussing materials for buildings. Excavation and levelling can be done by hand or machine; the choice of technique will be decided by economic factors. In the developing countries, where unskilled labour is plentiful and wage rates low, the use of expensive machinery may not show any advantage in either speed or cost over traditional handiwork. As labour costs rise and competition for labour becomes more acute, the machine will gradually prove to be a more economic proposition for bulk earth moving, levelling and excavation.

Road construction alternatives will vary under different circumstances, but the three major road materials are concrete, tar macadam and soil cement. The costs decline in the order given. The cheapest form of road construction is the soil cement technique, which has been used in Kenya on experimental highways. Results suggest that this has been very successful and a similar specification could be considered suitable for roads on medium sized factory estates. All roads, whatever their construction, must have a firm, consolidated bed; otherwise they will fail and need constant maintenance. If the subsoil is not solid, suitable hard material must be imported, laid to an appropriate thickness and well consolidated before the topping of concrete, tar macadam or other material is applied. Drains can be of stoneware, concrete or pitch fibre, according to the cost and availability of supplies, bearing in mind the purpose for which the system is to be used.

The design of the structure of an industrial building dictates the type of materials to be used in its erection. The earlier recommendations concerning spans, open planning and flexibility all pre-suppose some form of framed structure where the walls are non-load-bearing and the roof is carried on an independent frame. Such a frame is essential if the building is to be capable of adaptation, extension and modification without expensive rebuilding. Structural frames can be in timber, steel, aluminium or concrete. Of these alternatives, timber is best used for roof trusses only, because of the danger of termite attack. Even then, it is only suitable for small craft workshops with a low fire hazard and relatively short spans in conjunction with load-bearing walls. Hardwoods must be used and, although long-span techniques such as lamination or the use of bolted connectors are available, the problems of fungus and insect attack and fire hazard need serious consideration.

Steel is generally expensive since it is an imported material, and aluminium for structural purposes, apart from roof trusses, is not practical. When steel is used

it must be employed economically, and such developments as light-weight space frames using light tube sections have much to commend them. Deep beams and trusses using small section material with welded joints show considerable savings in cost for both manufacture and erection over heavy section steelwork. All steel must be protected from corrosion, which can be rapid in hot, wet areas if adequate precautions have not been taken.

Pre-cast concrete has many advantages for industrial structures, both for structural frames and roof trusses. Pre-cast concrete portal frames with pre-cast concrete purlins and sheeting rails can be made to standard patterns and are economical to cast and erect for spans of 30 to 40 feet. Larger spans can be achieved without difficulty. Pre-cast frames can be made in reasonably manoeuvrable units which can be quickly erected, either with cranes or simple lifting tackle. A wide variety of units is possible and standardization of dimensions and types leads to considerable economy. To reduce steel content the technique of pre-stressing can be employed for standard beam and roof truss manufacture. Pre-stressing techniques are not complicated and trained work teams can quickly master the necessary skills under experienced supervision. Pre-cast concrete framing members have a high fire resistance, are not affected unduly by changing climatic conditions, do not suffer from insect or fungal attack and require little maintenance or protective treatment.

Walls in a framed structure are non-load-bearing and can therefore be made of any material which can support itself or be hung from the frame. Walling materials must be robust to withstand accidental damage and be able to keep out the weather and suffer no deterioration. The most suitable materials are burnt brick (where suitable basic material is available), concrete block or stabilized earth blocks. Suitable materials for brickmaking are not always readily available and therefore hand or machine made concrete blocks to standard sizes have become a universal walling material in all parts of Africa. They have few disadvantages, stand up well to tropical climatic conditions and need only a colour wash finish. Stabilized earth blocks have been used experimentally in West Africa with success and, providing suitable "laterite" is available, they may well offer a cheaper alternative to concrete blocks for walling to simple industrial buildings, particularly in rural areas. They can be made to standard sizes either by hand in wooden moulds or by machine. Stabilized earth blocks have been used for housing in many parts of the world, and a considerable amount of technical information is available.

Roofing materials for factory buildings will vary with the local supply position. The three principal alternatives are corrugated galvanized iron sheeting, corrugated aluminium alloy sheeting and corrugated asbestos cement sheeting. For standard factory buildings of the type normally erected on an industrial estate, the flat reinforced concrete roof slab is expensive and has other disadvantages, such as the retention of solar

heat. A light, sheeted roof on purlins supported on trusses or portal frames has the advantages of cheapness and adaptability. The shape can vary according to design considerations, but the materials remain constant. Purlins of steel, timber or pre-cast concrete are all suitable under different circumstances depending upon the spacing of trusses or frames and the span of the building. Of the alternative roof coverings, aluminium is light in weight, giving good solar reflection, but noisy during rain; it is generally expensive as it has to be imported. Asbestos cement is cheaper, especially if locally manufactured; it gives reasonably good solar reflection, but its brittleness tends to make it easily damaged in transport. Galvanized corrugated iron is the cheapest roof sheeting; it is tough but noisy in rain and needs protective treatment to prevent rapid corrosion. It is not a good solar reflector.

Floors in all types of buildings on an industrial estate warrant careful thought for they constitute a large part of the building cost and often receive heavy wear. It is important that factory floors should be strong enough to take machine loads, be resistant to shock, abrasion and vibration, and provide a surface which is easy to clean, non-slippery and reasonably comfortable to the feet.

No one floor will meet all the requirements, but the base on which the floor is to be laid is common to all finishes. It must be solid; a 6-inch (15.24-centimetre) slab is usually adequate, laid on a well-consolidated base of hard material. Where heavy machinery is envisaged, this must be provided with separate foundations designed to spread the load from the machine. Floor toppings will range from a simple 2-inch (5.08-centimetre) cement screed to concrete tiles or special floor finishes which will stand up to the processes carried out in a particular factory.

Termite protection must be considered in relation to floor design. Any timber must either be termite resistant or treated with one of the available preservatives (preferably under pressure). The floor and sub-floor must be properly designed by the inclusion of constructional barriers near the ground at changes of level and at joints to prevent the entry of termites. If timber can be avoided at ground level, this is advisable. However, termites will attack timber packing cases, composition boards, books and the like if they can reach the inside of a building, and adequate protection against them is essential.

Other structural parts of an industrial building, such as windows, doors and louvers, will also need consideration in relation to the materials used and their general design. These will be needed in considerable quantities even on a moderately sized industrial estate and should therefore be standardized and dimensionally co-ordinated to ensure economy of production and easy interchangeability. This aspect of the problem will be dealt with in detail later.

Windows, doors and shutters will be either of metal or wood. If local supplies of suitable termite-resistant timber, such as iroko, myuli, teak or mahogany are available, these will be most suitable; even with these

sapwood should be avoided and metal or concrete stools provided to avoid door frames and the like making contact with the ground level. Metal windows, doors and shutters are usually expensive since they have to be imported and need protection against corrosion. Louvers and sun-breakers can be made of asbestos cement; in this material they do not need protection from corrosion, termites or any other attack. Corrugated sheets of glass-fibre-reinforced resin are a useful alternative to glass for roof glazing. They give a good diffused light and do not transmit solar heat as readily as glass. They are made to match the standard corrugation of other sheeting material and are in production in several parts of Africa. The light-weight quality and the fact that they do not break easily make them readily transportable.

Other materials and fittings will vary according to the type of building envisaged, the process to be carried out and the economic situation. Custom-built factories for established concerns may well be able to afford to use highly specialized forms of building construction and large quantities of imported material. These fall outside the scope of this paper, which is primarily concerned with simple, easy-to-build factories, which can be made available at low rents.

#### *Building standards*

Experience has shown in many parts of Africa that, given the materials and technical advice, African building labour can produce buildings of a quality and standard of finish equal to those of most of the more highly developed countries. However, in order to achieve economy in building basic factory structures certain design techniques can be employed.

Roof and floor spans relate closely to building costs and, while unlimited clear spans are attractive for industrial buildings, they are also expensive. The larger the span, the greater the cost. Spans of 30 to 40 feet, already mentioned, appear to be the most reasonable compromise, and portal frame structures with a bay spacing of 15 feet and a span of 30 feet will meet most of the requirements of the average standard factory, a nursery factory or an industrial estate. This unit can easily be used as a module for the entire development. A typical pattern is developed in diagrammatic form on the basis of this module in the illustration in Annex 1. Even if a single standard span is not established, the number of alternatives should be reduced to the minimum for economy. Heights may vary, but they should also be restricted; for example, given a minimum height of 16 feet, they could rise by increments of 2 feet to 24 feet as a maximum where portal frames are used. Load-bearing walls can be of any height, based on the standard coursing of the block-work used; cutting of blocks should be avoided as wasteful.

Building components of many kinds will be needed on even the smallest factory structure, and for ease of construction and economy a complete range of well-designed standardized building components should be

created. These could be mass produced regionally or locally according to particular needs. The components — doors, windows, shutters, louvers, partitions, sunshades and so on — must be simple and robust in design and capable of easy installation.

Dimensions of all components must be properly related and co-ordinated so that the various units fit together easily without cutting or waste and so that non-standard make-up pieces are not required. If the correct dimensional pattern is chosen, it should be possible to build up any number of composite units from one or two simple basic units, just as a wide variety of buildings can be built with a standard block. Windows are a useful example. From a single basic unit of suitable size, with appropriate couplers, a considerable variety of window walls can be built up, and, given two or three basic units, the alternative arrangements are considerable. At the same time, the window units should be related to the door units, the chosen bay sizes and the individual walling block sizes so that everything fits together. The development of a dimensionally co-ordinated range of standardized building components for the construction of all buildings on an industrial estate can be a very important contribution to building economy, and, if such standards can be accepted regionally or even nationally, the economic value can be immense.

There is no reason why a standard pattern should not be agreed among all the African countries; such an undertaking would need expert advice and would take some time, as it should be based on local investigation and research. Such a project resulting from the United Nations Addis Ababa Seminar could be of great value to the developing countries of Africa.

#### *Building economies*

Factory fabrication or site fabrication? This is a question which is being raised in the developed countries of the world and, while it is of less importance at the present in Africa, it must be briefly mentioned. Much building work in Africa is most economically carried out on the building site to reduce transport and other costs. Even concrete pre-casting, block making and joinery work is efficiently carried out under simple temporary protection. For many industrial estates this may still be the desirable technique, but with standardization there is a strong case for manufacture of components, such as pre-cast frames and trusses, blocks, doors and windows and so on, in centralized factories or yards to serve a region in which several industrial estates are to be built. With careful design all or some of the components can also be suitable for other buildings, such as schools, churches, hospital blocks and even housing.

With the rapidly developing transport systems in African countries, the conveyance of units ceases to be an insuperable problem and building-component manufacturing units, such as timber mills, cement works or steel mills, could be established by Governments near the raw material source, thus providing work on the spot of a permanent nature and for local

labour. This would reduce to a minimum the casual labour on site to cover site preparation, erection work and specialist trades.

Building economies are closely linked with the questions of standardization, dimensional co-ordination and prefabrication. The use of labour has already been mentioned, as well as the choice between site labour and workshop or factory labour. The latter can be offered more continuous employment, better working conditions, better machinery and plant and greater freedom from weather variations. The result should be a higher standard of workmanship, a better understanding of the job in hand with opportunities for apprentice training and the development of specific craft skills. Even site labour needs to be used with forethought, and construction phasing and site organization to this end will be dealt with later.

Maintenance of any form of building has a bearing on its economies; a building which requires constant minor repair soon becomes a liability rather than an asset, and the industrial estate as a whole must be properly maintained to present a clean, tidy and attractive appearance, and proper facilities must be provided for such maintenance at design stage. Suitable simple accommodation for maintenance staff should be attached to any administration building with storage for equipment adjoining.

Individual factory building maintenance will be the responsibility of the respective tenants or owners and this will be minimized if the buildings are properly designed and the correct materials chosen. Short-lived materials should be avoided and those which can be quickly affected by weather, fungal or insect attack should be properly treated when installed and regularly maintained or avoided altogether. Gutters, if any, should be regularly cleaned out, painted surfaces should be periodically repainted and water storage tanks cleaned out and suitably treated. In this way the life of the buildings will be extended and their appearance maintained.

#### **COSTS AND PROGRAMMING**

##### *Master plan*

The detailed plan of any industrial estate must be completed before the work is carried out on the site. This master plan must not only lay down the zoning pattern for the immediate development area, but must plan in broad outline the future pattern of growth. The master plan must present on paper and preferably also in model form the total layout, the grouping of industries, the allocation of space to communal facilities and must lay down the directives which will be needed to preserve the visual appearance of the finished estate.

By means of the carefully prepared master plan and strict adherence to it, a well-planned estate can be moulded into a visual as well as a functional unity. Too often the question of visual design is dismissed as of little importance on the assumption that industry and

ugliness are inevitable companions. At last industrialists in the highly industrialized countries are beginning to realize that well-designed factories, attractive landscape, good colour schemes and orderly industrial estates materially contribute to higher productivity and fewer accidents because of better factory house-keeping, less absenteeism and a higher morale among the workers. Good design in factory buildings means simple, uncluttered structures, well-chosen colours and lettering, pleasant facing materials, no untidy additions or advertising hoardings and the preservation of trees and landscape. These things are not expensive, but they need planning, fore-thought and adherence to the rules laid down.

Industrial development is urgently needed, and this fact can often lead to skimping of preparation work and commencement of work on site before all the plans are completed and a proper programme prepared. Time spent in thorough preparation is never wasted; in fact, more time spent by a few people before building work is commenced often means time saved by many workers on the construction site. The preliminary surveys and studies of site, surroundings and needs must be carried out thoroughly.

The master plan, detailed layouts, design drawings, details and specifications must all be finalized before work commences and a comprehensive time and progress chart prepared for the whole of the activity: surveys, design, construction and completion. In this way the efforts of all concerned can be co-ordinated, and problems of supplies, of information and of manpower can be solved before they occur on site, when time and effort is especially valuable.

Any building programme must take into account the proper phasing of the entire building development. The erection of elaborate community facilities before any factory buildings would obviously be uneconomic. The rule must be "essentials first". Main roads and essential services always have priority, followed by the central utilities and the factory buildings. Care must be taken when temporary communal accommodation is provided to ensure that it has a specified limited life. Wherever possible, the core of permanent communal buildings should be erected for later expansion and elaboration when circumstances permit. Generally, temporary buildings are not cheap and they usually last too long, finally becoming inefficient and expensive eyesores.

Proper phasing of the development will allow early occupation of at least part of the estate, with obvious economic benefits, but even this can be dangerous since access to a factory across unmade roads and through half-completed buildings is both discouraging and leads to untidiness. The pattern of erection should therefore be planned so that those who occupy buildings finished early in the programme do not have to pass through areas under construction.

Design economies have been mentioned earlier several times and can be usefully summarized as follows:

1. Adequate over-all pre-planning.
2. Right choice of site.

3. Functional layout
4. Adequate provision of services and communications.
5. Proper communal facilities.
6. Careful choice of materials.
7. Simple structural design.
8. Provision for expansion in all aspects of the estate.
9. Adequate plans for maintenance.
10. Legislation to control the completed estate and its surroundings.

Standardization has also been emphasized earlier; this can play an important part in the economies of any project. Standardized interrelated components, which take advantage of the essentially repetitive nature of the buildings and their separate parts, can not only cheapen building costs, but also increase speed of building erection, thus ensuring earlier financial returns. Not only should locally available or readily made materials and components be used, but the range limited as much as possible. If this limited range is well chosen, and the individual design is good, the final overall design will have a unity which is visually satisfying and financially advantageous.

### *Contracting*

In most parts of Africa, reliable building contractors can be found to carry out building work of considerable size. In another field, the author has recently been responsible for the design of the Cathedral of St. Andrew at Mbale, in Uganda, which was built by a *local* contractor (as opposed to a foreign firm) using entirely African labour. The result was a simple but impressive building, of high craft quality at a low cost, which could not have been achieved if imported labour and material had been employed. If the initial design processes take into account the skills and materials available, the local contracting experience can produce good buildings cheaply. Contractors exploiting traditional skills can usually learn new ones as the occasion demands and, with experience and training, will build in new ways as economically and skilfully as in the old ones.

The best advice is always the cheapest in the long run, particularly when repetition allows it to be spread over an extensive programme.

An alternative to the use of local contracting facilities, especially where these are limited, is for the estate development corporation to develop a direct labour programme whereby labour is engaged locally and materials are bulk purchased direct from manufacturers or supply sources. This will necessitate the organization of a proper site planning and supervision department, staffed by trained personnel.

Whichever method is adopted, proper site organization is essential so that labour is not ungainfully employed and time and material wasted. A site operations programme is essential so that the entire construction



programme runs smoothly from start to finish. Labour must be available when it is required, and proper facilities provided for it. Materials and components must be ordered and delivered to the site according to programme, and contract pre-planning carefully arranged so that the right materials are available at the right time. For each job a properly planned progress chart should be prepared which sets out the sequence and time schedule for all the stages of the various building operations. Adequate storage facilities must be provided for tools, equipment and materials on the site to prevent damage, deterioration or pilfering. Proper security measures are essential since building materials are valuable and often in great demand.

In many parts of Africa, modern building plant is in short supply, but labour is plentiful. Excavation, site levelling and clearance can therefore usually be most economically carried out by traditional hand methods. For good quality work, concrete must be mechanically mixed and carefully controlled. Cranes and hoists may not be available, but with an adequate labour force and considered design, pre-cast concrete units can be accurately erected using hand techniques with a simple block and tackle and shear-legs. Where only inexperienced labour is available, workers can be trained to carry out the unskilled tasks under the supervision of skilled building craftsmen, and, with the use of standardized components, the assembly work can be efficiently executed with the minimum of expert supervision.

On a large project a training unit can be set up and a trial assembly bay established for this purpose. Team-work is important, and gangs who work well together should be kept as a unit throughout the contract.

There is a great deal of useful work to be done in the field of design and construction research for industrial building in Africa. Studies should be made of the problems of the design of tropical buildings and the experience already gained in various parts of the continent classified and evaluated. Trial erections should be built and their suitability for tropical use tested under the varying conditions to be found in the hot, wet zones and the hot, dry zones. The building research stations in Africa can help in this way and, together with the knowledge and experience of experts in factory design and construction from the developed countries, a pattern of activity can be established for the African situation.

#### *Management techniques*

While this paper is not concerned with the management of an industrial estate after it is occupied, the management of the activities through which its completion is achieved is important. The application of management techniques to the building industry is being studied in many countries, and although there is the danger of creating a mystique out of something basically simple important lessons can be learned.

Team-work, and its value, is one of these lessons. Any building project requires the skills of many people,

both professional and technical, and the successful completion of a national programme of industrial estates will call for a variety of skills. The list will include architects, town planners, engineers, geologists, surveyors, economists, geographers and biologists among a few. The essential is that they should work together as a team, each contributing his own skill. Every team needs a leader who not only makes his own contribution, but co-ordinates the work of the other team members. The architect-planner can usually fill this role most successfully, for he is the person who should be concerned with the entire project from initial conception to final completion. His skill and training in both practical and aesthetic matters make him the key figure, and the appointment of an experienced architect can be a material advantage to any project.

Another of the lessons of management studies is the importance of clear channels of communication between the team members, a careful demarcation of areas of responsibility and the establishment of a basis of understanding. Given good will and a desire to co-operate, a well-organized team can work efficiently and harmoniously.

Costs have been discussed in this paper by inference rather than by direct statement. This is due to the fact that over such a vast area as the African continent, the differences in labour costs, material prices and other economic factors make it useless to attempt any over-all comparison. The tables in Annex II may be of some assistance, but comprehensive building cost studies based on African experience have rarely been carefully documented. With all new projects it is important that cost information should be collected and properly analysed so that this information is available for subsequent projects.

Cost analysis can play an important part in the design process of an industrial estate or a factory building. The figures in Annex II, based on English experience, are of interest, but detailed studies of African examples would be of greater value. It can readily be seen that at the design stage a team working to a determined budget can allocate expenditure and thus design in such a way as to match the pre-determined cost pattern.

Cost control is the tool used while the building work is under way. Here the quantity surveyor plays an important role as the "building accountant". A careful check must be kept on the cost pattern as any work proceeds; variations, alterations and changes of mind must not be allowed once the building work has commenced. If this rule is broken, it is impossible to keep an adequate check on costs, and inevitably the final expenditure will exceed the budget. Time is money in building as elsewhere, and if delays are caused by alterations to plans, not only will completion be delayed, but site overheads will increase and costs rise. Undoubtedly costs will vary, labour rates may increase and materials prices or delivery charges rise. The quantity surveyor can check the accuracy of such claims and forecast the likely effect on the final cost so that any budget revisions can be made.

Good costing records during a building contract and a thorough analysis after completion can together provide valuable data for future design use.

## LEGISLATION

### *Planning and construction*

The planning of industrial estates should be linked with the preparation of development plans for urban and rural areas. In many parts of Africa such plans already exist and with them the legislation to ensure that they are followed. Wherever necessary the existing town planning legislation should be strengthened to ensure that industry, whether in estates or in large individual units, is confined to areas zoned for industrial use. Zoning laws should be designed to encourage a good neighbour policy as between industry and other land users. High standards for industrial development can make a relatively close relationship between industrial and residential buildings possible. Zoning must always take into account the need for expansion and the importance of communications.

Any planning legislation should be designed to indicate what may be done in a particular area, a positive approach always being more satisfactory than a negative one. If an analysis of industrial performance is made, it will be seen that this can be broadly expressed in terms of needs, hazards and nuisances. *Needs* cover such things already mentioned under planning, such as transport, labour, space and utilities. *Hazards* will include traffic, fire and explosion risks. *Nuisances* will include noise, smells, waste products and smoke. Using these three categories, industries can be roughly classified and their effect on neighbouring non-industrial development estimated. By this means a zoning pattern can be created so that a proper relationship between industry and both town and country can be established.

Strict control by means of estate regulations must be maintained over the industrial estate to ensure that unauthorized development is prevented and that the estate is properly maintained. By-laws relating to refuse clearance, unauthorized building additions, preservation of landscape, building and road maintenance, smoke and nuisance control, effluent disposal and approved processes are vital to ensure that the original planning and aesthetic standards established for the estate are maintained.

Fringe development must also be restricted, especially when the estate borders on a main highway. Unauthorized building outside the estate must be prevented; shack dwellings, substandard factory buildings and squatting trading slums can grow quickly on the boundaries of a thriving estate and, once established, they are difficult to eradicate. Appropriate land use controls must therefore be rigidly exercised in order to avoid such unwanted development, which is not only unsightly but is usually unhygienic.

Building construction regulations exist in most urban areas of Africa and their scope extends over many rural areas also. In many cases these regulations were

based on the "Home" building regulations of the original colonial powers concerned. These have served a useful purpose in the past, but have often not been brought up to date. It is therefore possible to find building regulations in parts of Africa which are far more restrictive than those in developed countries.

Building regulations should therefore receive regular scrutiny to ensure that they are not inhibiting progress by failing to take into account new building materials and techniques. Close liaison with established building research stations is essential so that economy of construction can be achieved by allowing the use of the most up-to-date building methods. In many countries building regulations are being rewritten, based on "performance standards". These specify what building materials and construction must *do* rather than what they should be. For example, instead of specifying materials and thickness for walls and roofs, the desired degree of fire resistance, strength and protection against weather can be set out to allow freedom of choice among the variety of alternatives available. Such performance standards will encompass both traditional methods and allow for new ones. To help the builder who does not wish to break away from known materials, "deemed to satisfy" clauses can be included, which are in fact examples showing how the required performance standards can be reached with traditional techniques. Such building codes cater for the present and the future and need less frequent revision than normal mandatory ones.

When building regulation revisions are under consideration, these factors should be borne in mind and the collaboration of building research stations, with their testing facilities, sought. The creation of building research facilities where they do not already exist should be regarded as an important step in any national industrialization programme.

Safety regulations during building construction require only brief mention. If they do not exist, then simple safety rules based on experience in the developed countries should be devised. They should deal with the use of machinery, the protection of workers, precautions against fire or explosion and the storage of inflammable and dangerous materials. They must be rigidly enforced. The building industry in all countries has a bad accident record, and safety on building sites is a good investment, for injured workmen and damaged building work are luxuries no project can afford.

### *Industrial regulations*

This paper is not primarily concerned with the running of an industrial estate after completion, but industrial regulations have a bearing on building design and maintenance.

Health regulations are concerned not only with the factory buildings after occupation, but should apply to the building operations as well, in relation to the provision of first-aid units, sanitary accommodation, canteens and similar facilities. These must be regarded as obligatory on all construction sites.

**Department of Economic and Social Affairs**

**INDUSTRIAL ESTATES  
IN AFRICA**



**UNITED NATIONS**  
**New York, 1965**

Factories Acts are concerned with buildings and amenities as well as purely industrial matters. Annex III lists the sections of the Factories Acts of 1937 and 1948 of the United Kingdom, which have a particular bearing on matters relating to buildings for manufacturing purposes. Because of their comprehensive nature they can be regarded not only as a guide to specific issues, but also as a pattern which could be followed in developing countries which have the task of framing similar legislation.

#### CONCLUSION

The future prosperity of any country depends to a large extent on the production efficiency of its industry. This in turn depends upon the efficiency of the buildings used for industrial purposes and the manner in which they are related to each other and their neighbours on individual sites or industrial estates. No country can afford unplanned factories or badly laid out factory estates. In the past, in all countries of the world,

many factories have grown up in a haphazard fashion, and little consideration has been given to either the comfort of the workers or the efficiency of the operations to be carried out.

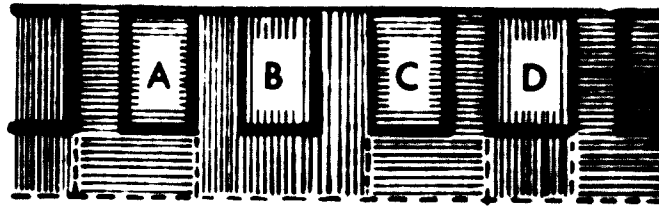
The developing African nations, with their plans for rapid industrialization, can benefit greatly from the experience of the highly industrialized countries of the world and they can also learn from their mistakes. An "industrial revolution" need not leave for posterity squalor, ugliness and chaos; these things are difficult to eradicate once established, but can easily be avoided if imagination and skill are applied to the task. The United Nations Seminar on Industrial Estates in Africa was a valuable contribution towards this end, and it is hoped that this paper will provide a useful and practical basis for future action.

Experience has shown that well-designed factories on imaginatively planned industrial estates can encourage a higher level of productivity, stimulate better workmanship and result in happier and healthier workers.

Annex I

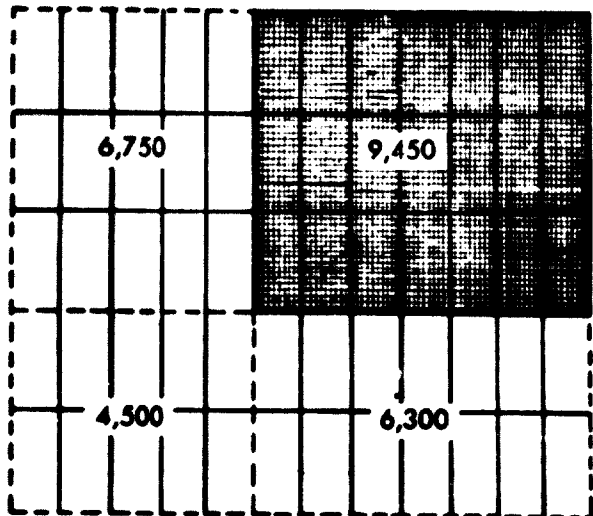
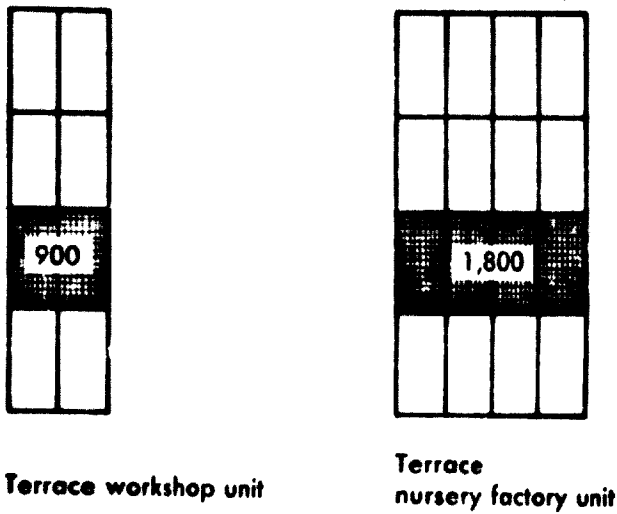
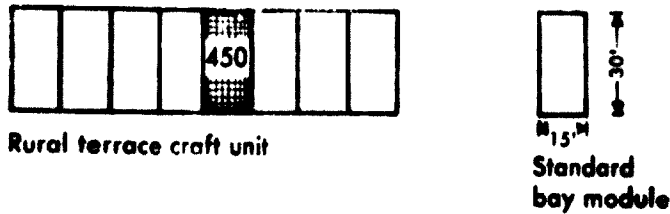
DRAWINGS AND DIAGRAMS

FIGURE 1. FACTORY ESTATE PLANT LAYOUT DESIGNED TO FACILITATE INDIVIDUAL EXPANSION



NOTE: Method of operation. The plots are laid out so that there is a gap between factories equal to half the width of a factory and a space at the rear equal to half the depth of the factory. If factory B wants to expand it can do so to three times its original extent without having to move. Having done so, its neighbours A and C can only expand 125%. A factory such as D which is flanked by neighbours which have both expanded is limited to a 50% expansion at the rear.

FIGURE 2. BASIC MODULAR FACTORY BAY UNIT CAPABLE OF A VARIETY OF PLANNING ARRANGEMENTS



Typical standard factory—expanded in four stages from 9,450 sq. ft. to 27,000 sq. ft.

FIGURE 3. DIAGRAMMATIC LAYOUT OF SMALL RURAL INDUSTRIAL GROUP BASED ON 30-FT. x 15-FT. MODULE. (A) ADMINISTRATION AND SHOWROOM. (B) WORK SHOP UNITS. (C) NURSERY FACTORIES. (D) CRAFT UNITS.

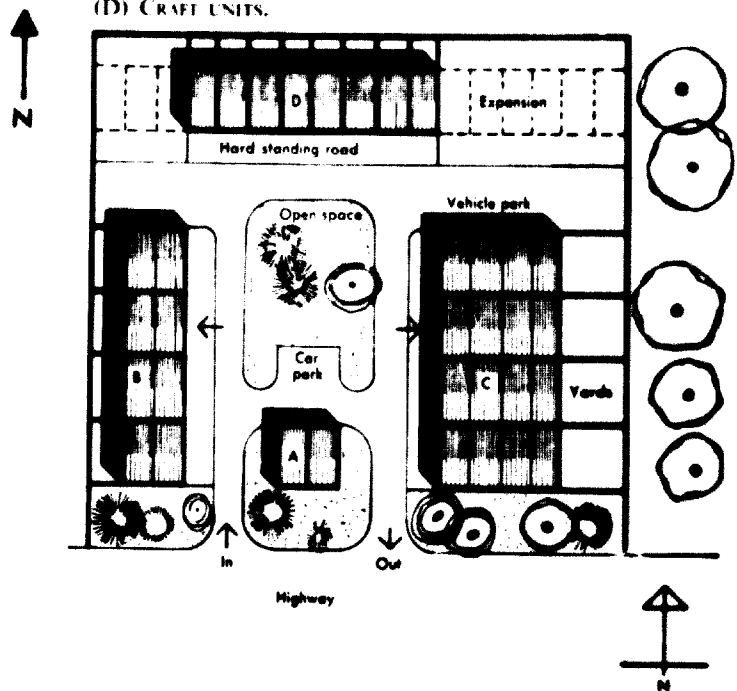


FIGURE 4. PLANNING OF INDUSTRIAL ESTATE — HARLOW  
NEW TOWN, GREAT BRITAIN

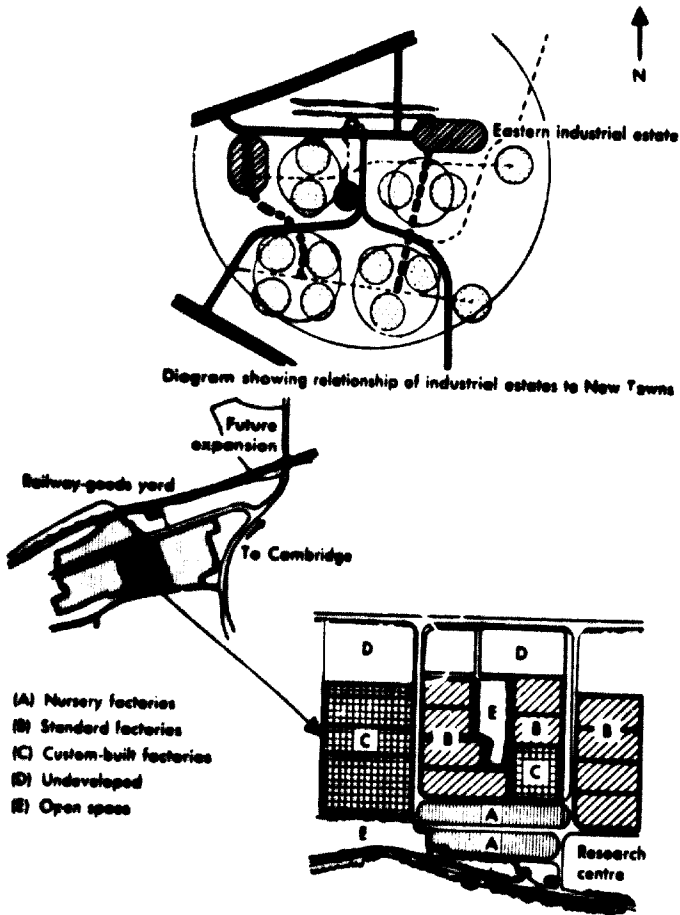


FIGURE 5. LAYOUT OF INDUSTRIAL ESTATE — JA-EA, Ceylon  
(A) NURSERY FACTORIES, (B) STANDARD FACTORIES, (C) CUSTOM-BUILT FACTORIES, (D) NON-COMPATIBLE FACTORIES.

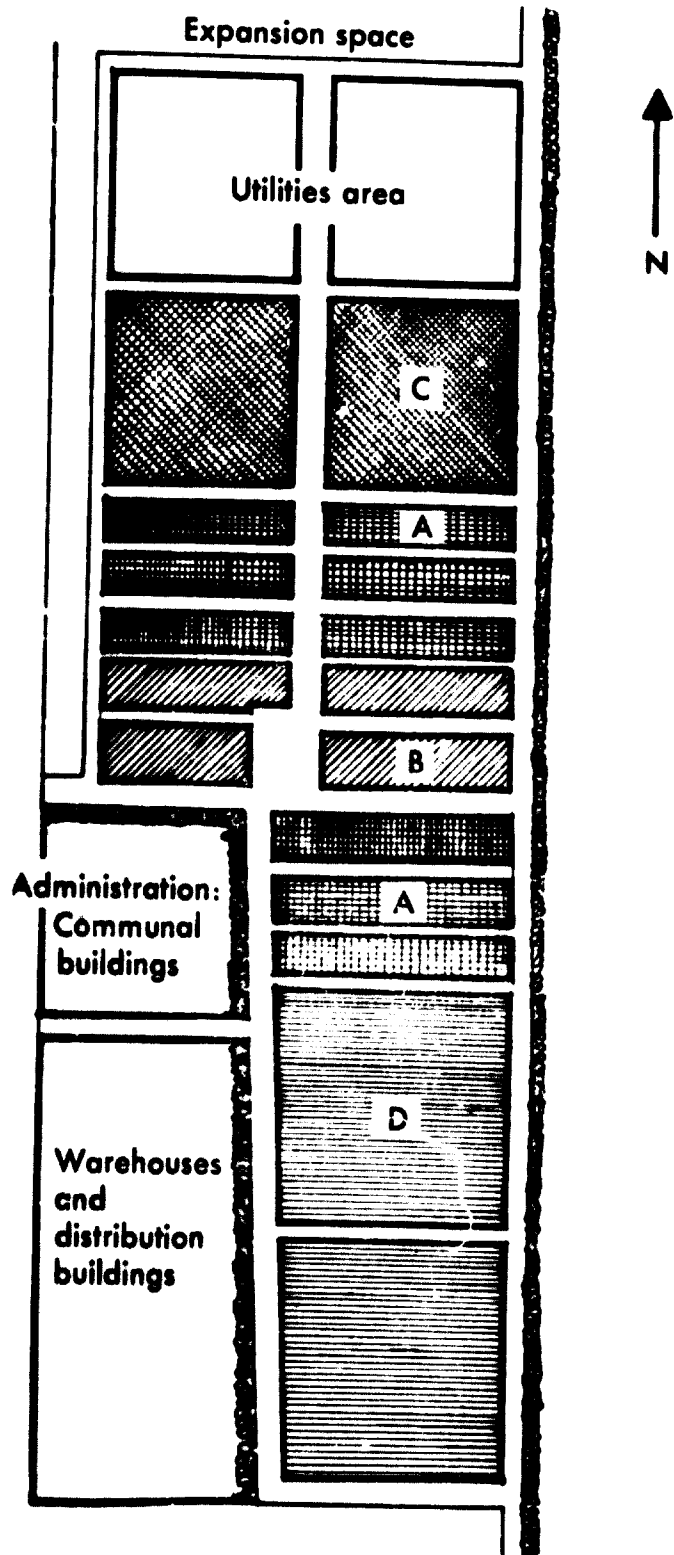


FIGURE 6. EXPANSION PLAN FOR INDUSTRIAL AREA -- NAIROBI, KENYA

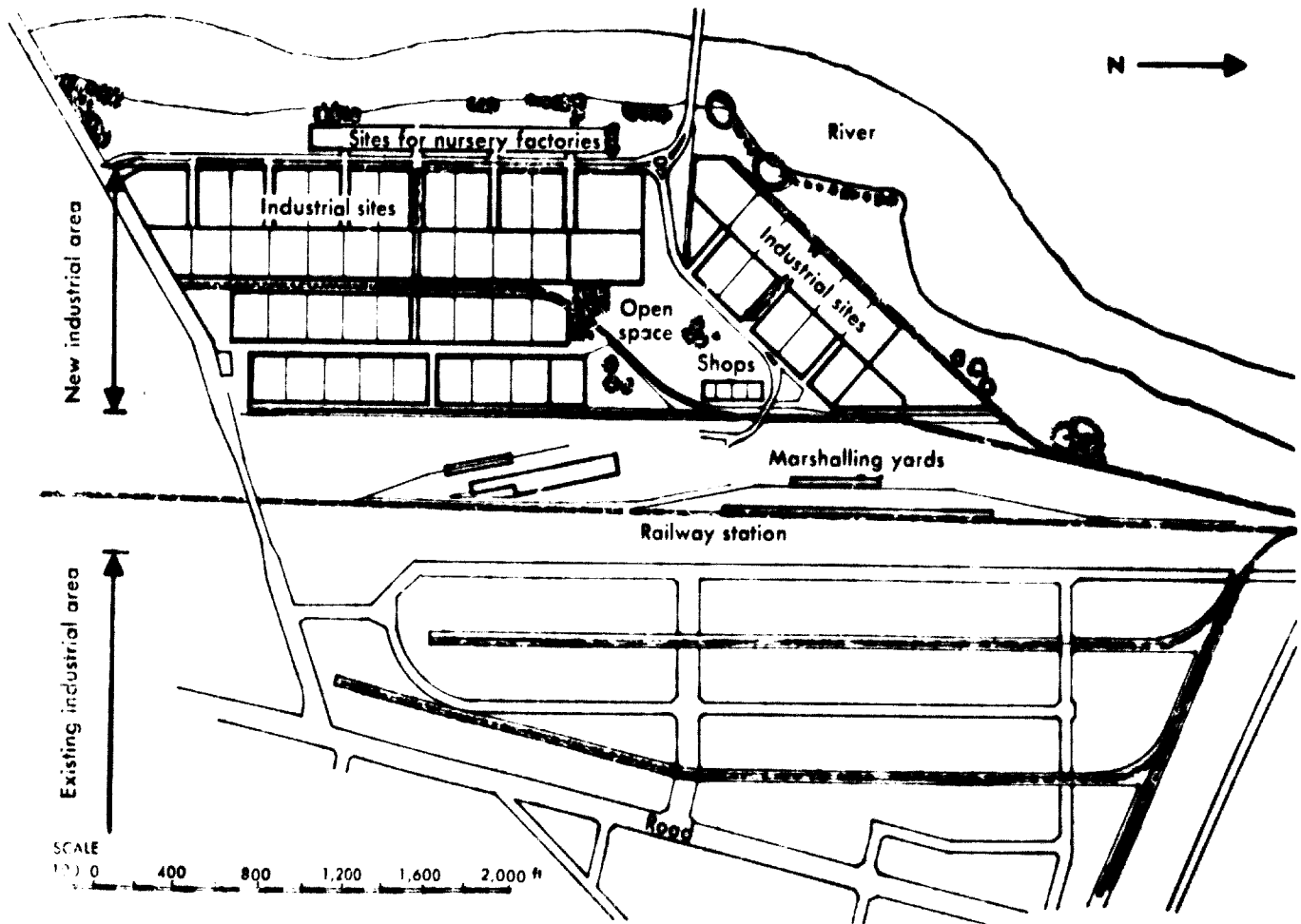


FIGURE 7. CLIMATIC FACTORS INFLUENCING BUILDING DESIGN IN THE TROPICS

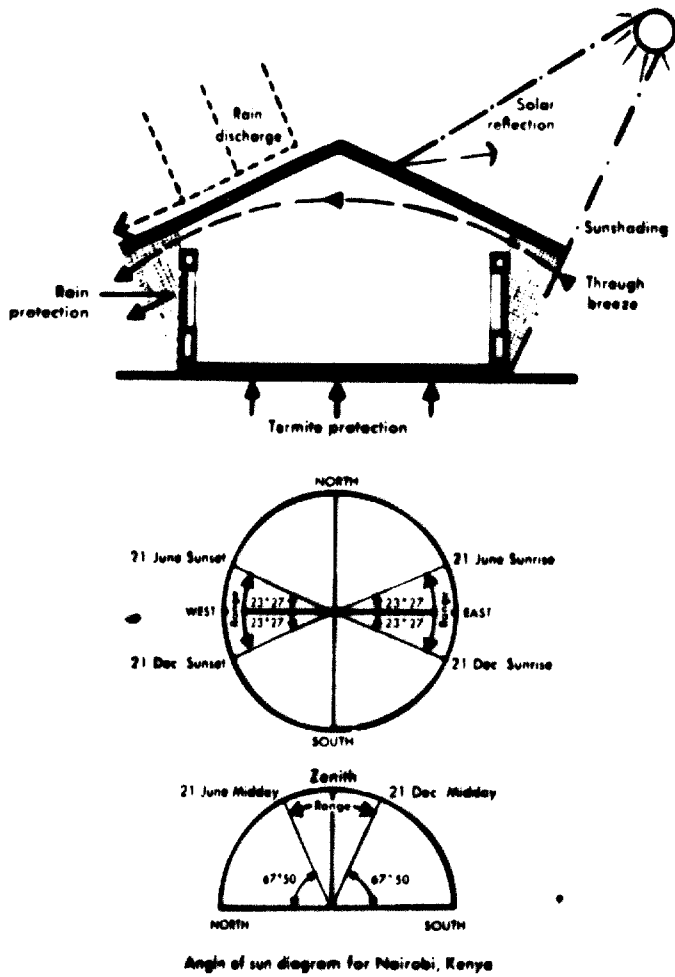
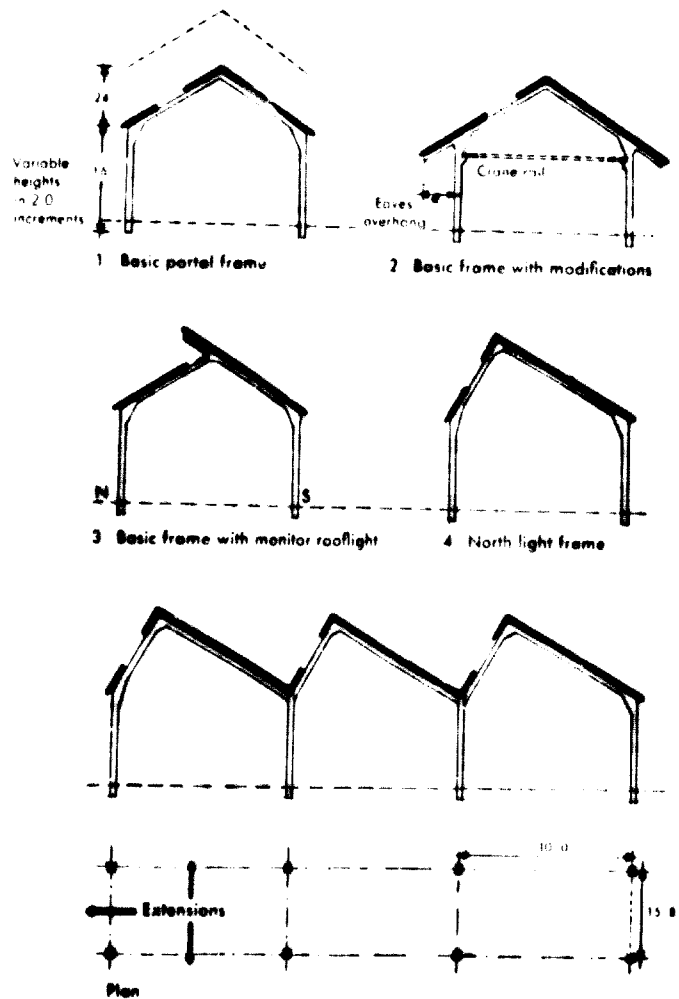


FIGURE 8. ALTERNATIVE SECTIONS FOR PORTAL FRAME TO MODULAR BAY



Annex II

TABLES AND SCHEDULES

TABLE II-1. AREAS OF INDUSTRIAL ESTATES IN VARIOUS COUNTRIES (Acres)

Country	Size of estate		
	Small	Medium	Large
United States	50-100	100-500	500-1,000 and over
Great Britain	up to 50	50-100	100-500 and over
India	2-10	10-30	Over 30

TABLE II-2. COMPARATIVE AVERAGE ROAD DIMENSIONS FOR INDUSTRIAL ESTATES (PAVED WIDTHS) (Feet)

Country	Main roads	Secondary	Service
United States	75-320	80-100	40
United Kingdom	50	36-38	20-22
India *	40	30	22
Singapore	24	16	10
Pakistan	30	22	18
	24	16	10

\* Dimensions recommended by the Central Small Industries Organization (CSIO).



TABLE II-3. COMPARATIVE BUILDING LABOUR RATES IN AFRICA, 1963

(Dollars per month)\*

Country	Skilled	Unskilled	Official rate of exchange to the dollar
Ethiopia	60		Eth \$2.5
Guinea		40-50	CFA fr 250
Ivory Coast			
Kenya	70	20	7 shillings
Morocco	72	36	5 dirhams
Nigeria	36	24	7 shillings
Senegal		40-50	CFA fr 250
Sierra Leone	60	35	7 shillings
Somalia	29	17	7 somalos
South Africa	105	55	0.7 rand
Sudan	40-43	17-20	0.35 Sudanese pounds
Tanganyika	23	17	7 shillings
United Arab Republic	34	18	£E 0.44

Source: United Nations, "Housing in Africa" (mimeographed document E/CN.14/HOU.2).

\* Costs given in dollars to facilitate comparison. £1 sterling = \$2.70.

TABLE II-4. COST ANALYSIS FOR TERRACE OF NINE NURSERY FACTORIES (UNITED KINGDOM)<sup>a</sup>

Element	Percentage
<b>External</b>	
Preliminaries, excavations, foundations, ground slab	17.5
Yards-walls, paving and gates	5.0
Rain-water and soil drainage	7.5
<b>Primary</b>	
Frame, walls, roof structure, doors and windows	35.0
<b>Secondary</b>	
Internal partitions, doors and fittings	10.0
<b>Finishes</b>	
Wall, floor and roof finishings and decoration	15.0
<b>Service installations</b>	
Plumbing, electrical installations, hot and cold water	10.0
<b>TOTAL</b>	<b>100</b>

<sup>a</sup> Single storey, each 32 ft. 6 in. x 92 ft. x 12 ft. to eaves. Construction: Pre-cast concrete frame, asbestos tile roof, brick walls, concrete floor, metal windows. Completion: 1959.

### Annex III

## SUMMARY OF PARTS OF THE UNITED KINGDOM FACTORIES ACT (1937) HAVING PARTICULAR RELEVANCE TO INDUSTRIAL BUILDINGS

#### PART I. HEALTH (GENERAL PROVISIONS)

1. Cleanliness. 2. Overcrowding. 3. Temperature. 4. Ventilation. 5. Lighting. 6. Drainage of floors. 7. Sanitary convenience. 8. Enforcement by district councils of certain provisions of Part I. 9. Powers of inspector as to sanitary defects remediable by district council. 10. Powers in case of default of a district council. 11. Power to require medical supervision.

#### PART II. SAFETY (GENERAL PROVISIONS)

12. Prime movers. 13. Transmission machinery. 14. Other machinery. 15. Provisions as to unfenced machinery. 16. Construction and maintenance of fencing. 17. Construction and sale of new machinery. 18. Vessels containing dangerous liquids. 19. Self-acting machines. 22. Hoists and lifts. 23. Chains, ropes and lifting tackle. 24. Cranes and other lifting machines. 25. Construction and maintenance of floors, passages and stairs. 26. Safe means of access and safe place of employment. 27. Precautions in places where dangerous fumes are liable to be present. 28. Precautions with respect to explosive or inflammable dust, gas, vapour or substance. 29. Steam boilers. 30. Air receivers. 31. Steam receivers and steam containers. 32. Exceptions as to steam boilers, steam receivers and containers, and air receivers. 33. Precautions as regards water-sealed gasholders. 34. Means of escape in case of fire. 35. Regulations and by-laws as to means of escape in case of fire. 36. Safety provisions in case of fire. 37. Instruction as to use of means of escape in case of fire. 38. Power of Secretary of State to require special safety arrangements for the prevention of accidents. 39. Power of court of summary jurisdiction to make orders as to dangerous conditions and practices. 40. Power of court of summary jurisdictions to make orders as to dangerous factory.

#### PART III. WELFARE (GENERAL PROVISIONS)

41. Supply of drinking water. 42. Washing facilities. 43. Accommodation for clothing. 44. Facilities for sitting. 45. First aid. 46. Welfare regulations.

#### PART IV. HEALTH, SAFETY AND WELFARE

(Special provisions and regulations)

##### Special provisions

47. Removal of dust or fumes. 52. Humid factories. 53. Underground rooms. 54. Basement bakehouses. 55. Laundries.

#### SPECIAL REGULATIONS FOR SAFETY AND HEALTH

##### Supplementary provisions

63. Certificates required before approval of building plans relating to cotton-cloth factories.

#### PART VII. SPECIAL APPLICATIONS AND EXTENSIONS

##### Works of building and engineering construction

107. Building operations. 108. Works of engineering construction.

Note: The numbers quoted above are the section numbers of the original Acts of Parliament.

## Annex IV

### FLATTED FACTORIES

In many large cities in industrialized countries the problem of industry which by tradition has grown up inside the city boundaries has caused considerable confusion. In many cases such industry is badly housed in obsolete premises, but there is often a sufficiently valid reason for the industry remaining within the confines of the built-up area. This occurs in London, Birmingham and other centres in England and the workshops concerned usually house traditional crafts which may have been in the area for centuries such as leather workers, jewellers and garment makers. An example of this is the diamond merchants of Hatton Garden, London.

Because the premises occupied by these firms are often completely inadequate and sometimes unsafe, in many cities of Europe they are being demolished and flatted factories are being built within the town plan for light, clean industries which have a special need to be within the centre of the town. The city of Birmingham in England was one of the pioneers in this matter, and there are now several blocks of this kind in various cities of Great Britain and other parts of the world.

This technique, while it should not be regarded as a wholesale solution to this rehousing of industry dispossessed by a growing city, has some relevance to the developing countries of Africa where certain traditional crafts have always been pursued within the city boundaries.

While every effort should be made to persuade industry in the centre of a town to move out onto new and more spacious industrial estates, there may be in the larger cities of Africa a hard core of industry which would find it difficult to move, as the people it serves are its immediate neighbours within the city boundary.

There is therefore a case for small units of flatted factories in certain carefully selected areas where inoffensive, clean and quiet industries of the handicraft variety or similar can be accommodated. Such industries as jewellers, bespoke tailors, handicraft leather workers, simple printing and others could be housed in this way, providing they do not interfere with the work of either the people with whom they share the building or their immediate neighbours.

The siting of such flatted factories in urban areas needs special

care, especially if they are close to other types of building such as housing and schools. General rules cannot be laid down but noise, smell and traffic are important considerations. This means that adequate space for car parking, delivery and dispatch, storage of materials and local amenities must be considered.

Flatted factories are best built as simple blocks which can be divided into units of which a tenant can rent as many as will meet his space needs. Basic units in Britain vary from 600 to 1,000 square feet. It is essential that the basic unit should not be too large so that a number of multiples can be used to give a wide variety of floor areas.

The plan form of the building should be simple, as free of columns as possible and arranged so that natural lighting is available for the whole floor area. While hoists may be workable up to three storeys, any greater height should be equipped with goods lifts.

The building should have installed basic service mains, that is electricity, water and gas (if available), together with simple toilet accommodation for both sexes. Tenants should be required to provide their partitioning, decoration and services from the mains supply.

If flatted factories are to be an economical proposition it must be possible to keep rents to a minimum. This presupposes an economic building structure, and rigid standardization is a valid contribution to lower building cost. Although the number of examples of such developments is still relatively small, those that do exist suggest that prefabricated modular systems of construction have much to offer. Rationalized building techniques using standardized components can not only produce simpler, quicker buildings but also cheaper ones.

Although the case can be made for a limited provision of flatted factories in built-up areas, careful control must be maintained over such developments, otherwise they lead to a deterioration of the area in which they are built. Whenever an industry begins to grow beyond the size of its small-scale flatted factory, it should be encouraged by all possible means to transfer its activities to more spacious and convenient accommodation in an industrial estate outside the city boundaries.

## Annex V

### BUILDING, TRAINING AND INFORMATION CENTRES IN AFRICA

#### SCHOOLS, FACULTIES AND DEPARTMENTS OF ARCHITECTURE

##### Algeria

Ecole Nationale d'Architecture et de Beaux-Arts,  
Parc Gatliff,  
Algiers.

Institut d'Urbanisme,  
Université d'Alger,  
Algiers.

##### Ghana

Faculty of Architecture, Town Planning and Building,  
Kwame Nkrumah University of Science and Technology,  
Kumasi.

##### Kenya

Faculty of Art and Architecture,  
The Royal College,  
Private Bag,  
Nairobi.

##### Nigeria

Faculty of Architecture,\*  
Ahmadu Bello University  
Zaria,  
Northern Nigeria.

\* Established in 1952. Full five-year course with special studies of tropical architecture and study of the local environment.

### *South Africa*

Faculty of Architecture,  
University of Witwatersrand,  
Johannesburg.

Faculty of Fine Arts and Architecture,  
University of Capetown,  
Capetown.

University of Natal,  
Natal.

### SCHOOLS, FACULTIES AND DEPARTMENTS OF ENGINEERING AND BUILDING SCIENCE

### *Algeria*

Ecole Nationale d'Ingénieurs d'Alger,<sup>b</sup>  
Avenue Pasteur,  
Maison Carrée,  
Algiers 10.

### *Congo (Democratic Republic of)*

School of Engineering,  
Université de Léopoldville,  
B.P. 127,  
Léopoldville XI.

### *Ethiopia*

Building College,  
College of Engineering,  
Haile Selassie University,  
P.O. Box 1176,  
Addis Ababa.

Ethio-Swedish Institute of Building Technology,  
Box 518  
Smuts Street  
Addis Ababa

### *Ghana*

Faculty of Engineering,  
Kwame Nkrumah University of Science and Technology,  
Kumasi.

### *Libya*

College of Advanced Technology,<sup>c</sup>  
P.O. Box 1098  
Tripoli.

### *Morocco*

Faculty of Engineering,  
Université Mohammed V,  
Avenue Moulay Cherif,  
Rabat.

### *Nigeria*

Faculty of Engineering,  
The University of Nigeria,  
Nsukka,  
Eastern Nigeria.

<sup>b</sup> Courses in public works and building, electro-technics, chemical engineering.

<sup>c</sup> Five-year degree courses in mechanical, civil and electrical engineering.

### *Sierra Leone*

Faculty of Engineering  
Fovarah Bay College,  
(The University College of Sierra Leone),  
Freetown.

### *South Africa*

University of Pretoria,  
Brooklyn,  
Pretoria.

Departments of Building and Civil Engineering,  
Pretoria Technical College,  
Church Street,  
Pretoria.

Faculty of Engineering,  
University of Stellenbosch,  
Stellenbosch.

### *Southern Rhodesia*

Salisbury Polytechnic,<sup>d</sup>  
Fifth Street,  
Salisbury.

### *Sudan*

Department of Engineering,  
The University,  
Khartoum.

### *United Arab Republic*

Faculty of Engineering,  
Cairo University,  
Sharia Hadiket El-Ormane,  
Cairo.

Faculty of Engineering,  
Ain Shama University,  
Kaar-el-Zaafam,  
Abbasiyah,  
Cairo.

Faculty of Engineering,  
Alexandria University,  
Bulkeley,  
Ramleh,  
Alexandria.

Faculty of Engineering,  
University of Assuit,  
Assuit.

### *Zambia*

Hodgson Technical College,<sup>e</sup>  
P. O. Box R.W. 133,  
Ridgeway,  
Lusaka.

### STANDARDS INSTITUTES

### *Morocco*

Services de Normalisation Industriels Marocains,  
Sous-Secrétariat d'Etat à l'Industrie,  
Auxamines,  
Rabat.

<sup>d</sup> Courses in building and engineering.

<sup>e</sup> Course in building and engineering.

#### South Africa

South African Bureau of Standards,  
Liesbeeck Park Road,  
Rosebank,  
Capetown.

#### Southern Rhodesia

Standards Association of Central Africa,  
Hatfield Road,  
Salisbury.

#### United Arab Republic

Director-General,  
Egyptian Organization for Standardization,  
Ministry of Industry,  
144 Tahrir Street,  
Dokki,  
Cairo.

#### BUILDING CENTRES AND BUILDING RESEARCH STATIONS

#### Algeria

Belala Amar,  
B.P. 476,  
Algiers.

#### Ethiopia

The Building Centre,  
P.O. Box 518,  
Addis Ababa.

#### Ghana

Building Research Institute,  
P.O. Box 183,  
Accra.

#### Kenya

The Kenya Building Centre,  
P.O. Box 30260,  
Nairobi.

#### South Africa

Building Centre Ltd.,  
129 Commissioner Street,  
Johannesburg.  
MBA Building Centre,  
P.O. Box 1943,  
59-61 St. Andrews Street,  
Durban.  
National Building Research Institute,<sup>1</sup>  
P.O. Box 395,  
Pretoria.

#### Southern Rhodesia

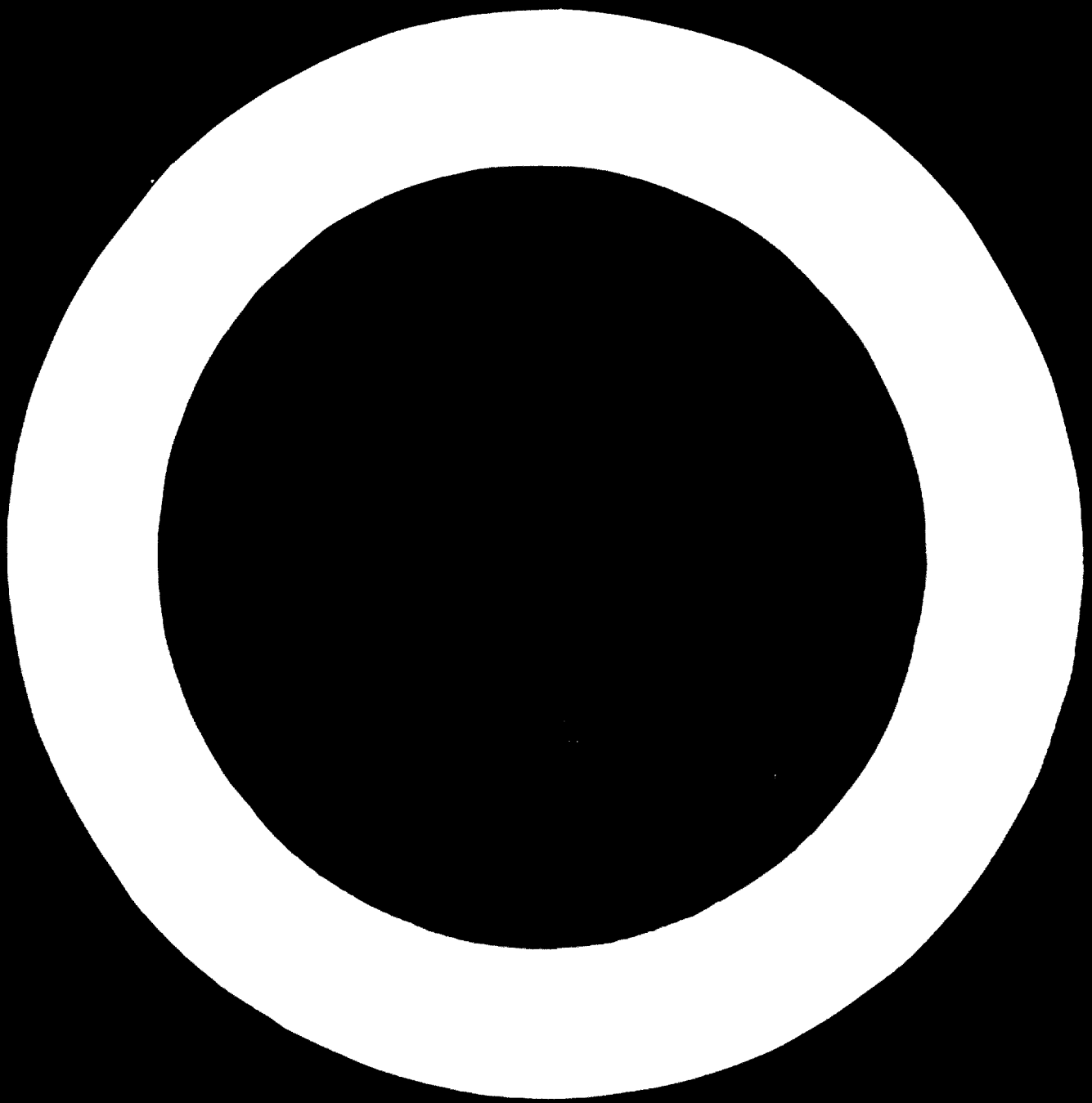
The Building Centre,  
Savoy House,  
Stanley Avenue,  
Salisbury.

<sup>1</sup> Research on national problems of the building and construction industry.

#### Annex VI

#### REFERENCES

- United Nations, *Manual on Stabilized Soil Construction for Housing* (Sales No.: 58.II.H.4).
- United Nations, *Establishment of Industrial Estates in Under-developed Countries* (Sales No.: 60.II.B.4).
- United Nations, *Industrial Estates in Asia and the Far East* (Sales No.: 62.II.B.5).
- United Nations, *The Physical Planning of Industrial Estates* (Sales No.: 62.II.B.4).
- United Nations, "Housing in Africa: Problems and Policies" (mimeographed document E/CN.14/HOU/2, 1953).
- United Nations, "General Survey of the Present Situation and Future Expansion of the Cement Industry in West Africa" (mimeographed document HOU/WP/3, 1953).
- Colour and Lighting in Factories and Offices*, London, British Colour Council, 1946.
- Factory Building Studies Nos. 1 to 3*, London, H.M. Stationery Office.
- Baker, A. L. L., *Reinforced Concrete*, London, Concrete Publications, Ltd., 1949.
- Dunham, C. W., *Planning Industrial Structures*, New York, McGraw-Hill Book Company, Inc., 1948.
- Fry, E. M. and J. B. D., *Tropical Architecture in the Humid Zone*, London, B. T. Batsford, Ltd., 1956.
- Goss, A., *British Industry and Town Planning*, London, The Fountain Press, 1962.
- Hughes, C. B., *Modern Industrial Lighting*, London, Hutchinson and Co., 1934.
- Logie, G., *Industry in Towns*, London, George Allen and Unwin Ltd., 1952.
- Maddock and Bellhouse, eds., *Factories Act, 1937*, London, Eyre and Spottiswoode, 1937.
- Mills, E. D., *The Modern Factory*, London, Architectural Press, Ltd., 1959, second edition.
- *Report on Building Research in Jamaica*, prepared for the Scientific Research Council of Jamaica, 1962.
- Smith, W., *Geography and the Location of Industry*, University Press of Liverpool, 1952.
- Tomlinson, M. J., *Foundation Design and Construction*, London, Pitman.
- White, T., Silberman, L. and Anderson, P. R., *Nairobi Master Plan*, London, H. M. Stationery Office, 1948.
- A large number of useful booklets on subjects related to the design and layout of modern factory buildings are published by the Building Research Station, Garston, Watford, England; the Cement and Concrete Association, 52 Grosvenor Gardens, London, S.W.1., and the Ministry of Public Buildings and Works, London.
- New factory buildings are also illustrated in the weekly and monthly architectural periodicals and in those of most countries of the world, and special issues on factory design and layout are published from time to time, providing valuable reference material.



#### NOTE

Opinions expressed in signed papers and in papers communicated by Governments are those of the authors and do not necessarily reflect the views of the United Nations Secretariat. All material in this publication may be freely quoted or reprinted, but acknowledgment is requested, together with a copy of the publication containing the quotation or reprint.

The designations employed and the presentation of the material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the United Nations concerning the legal status of any country or territory or of its authorities, or concerning the delimitation of its frontiers.

ST/CID/5

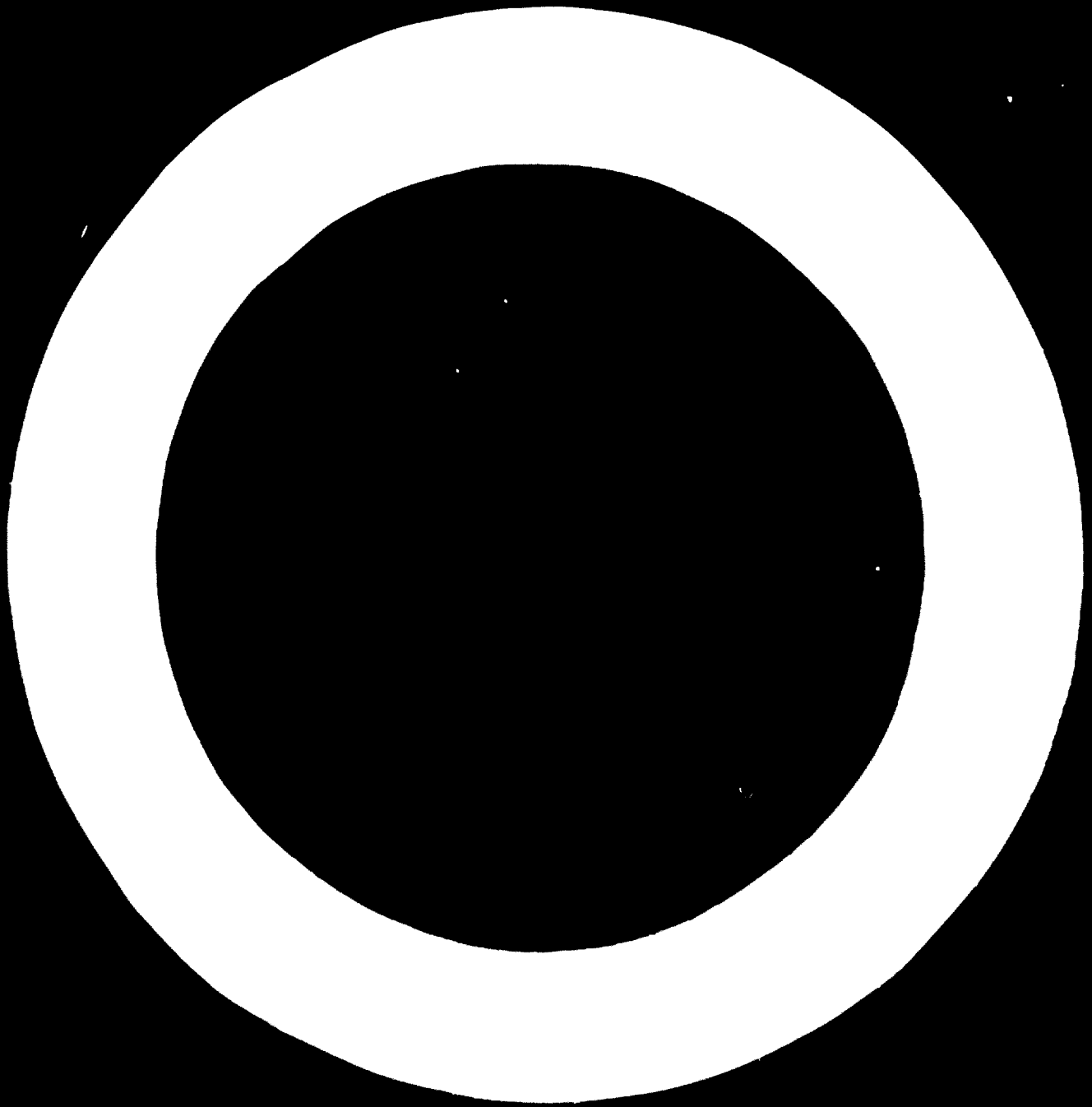
UNITED NATIONS PUBLICATION

Sales No.: 66.H.B.2

Price: \$U.S. 0.75  
(or equivalent in other currencies)

**Part 3**

**INDUSTRIAL ESTATE PLANS AND PROJECTS IN AFRICAN COUNTRIES**





## INDUSTRIAL ESTATE PLANS AND PROJECTS IN AFRICAN COUNTRIES

### GENERAL SURVEY

In most countries of Africa, efforts have been made, principally within the past five to ten years, to induce and facilitate the establishment of industries by providing prospective entrepreneurs with basic facilities — land, roads, utilities and communications — on attractive terms and certain services. Most countries felt that the development of industrial areas offering improved plots in or near the main cities would be a strong locational incentive for both foreign and national industrial enterprises, particularly those of large and medium size. At the same time, the areas would serve as effective instruments for the regulation of land use in urban development or redevelopment schemes.

The industrial area is today the most prevalent form of planned group location of industry in African countries. Industrial areas exist in the Gambia, Ghana, Kenya, Mauritius, Nigeria, Rhodesia, South Africa, Uganda and the United Republic of Tanzania. They have been set up not only in or near large urban centres but sometimes also in smaller towns. They range in size from a few to several thousand acres. The extent of improvement of the plots varies considerably. Sometimes all utility connexions, sewers, internal and access roads and railway sidings are installed in advance by the sponsoring authority. In other cases provision of these facilities has to be negotiated by each entrepreneur with a variety of companies and contractors. The scope of services provided by the sponsoring authority or related agencies also varies: in some cases assistance is available for the financing and construction of factory buildings, related public works and other infrastructure facilities, the hiring and training of labour and the like; in other cases few if any services are made available.

Large-scale and medium-sized industries have been established on some of the industrial areas, as well as small-scale industries, repair shops and other service industries, commercial establishments and warehouses.

According to the replies of Governments to a questionnaire on industrial estates sent by the United Nations in February 1964 and May 1965, the success of the industrial areas in African countries, in terms of number of industrial enterprises located on the sites and rapidity of occupancy, has been very unequal. While certain causes of success or failure are mentioned, the assessment of the role played respectively by the availability of a site and other facilities and by other measures of promotion of industrial development cannot readily be made. In a general way it would seem that the most successful industrial areas were

those whose location and siting were based on thorough techno-economic surveys of prospects of industrial development. In some cases the absence of such surveys resulted in the establishment of areas in localities with inadequate resources, infrastructure facilities and other prerequisites, and no sites were taken up by industry. In other cases errors in the estimates of demand led to excessive and costly advance development of the area, provision of unnecessary facilities such as railway sidings and other wasteful operations.

Success appears also to be closely related to the integration of industrial area projects with comprehensive programmes of industrial development at the national or regional level, including such measures as fiscal and financial incentives, development of related power, transport and other infrastructure facilities and special promotion measures for attracting foreign capital and guaranteeing its investments.

Even more recently plans have been made and carried out in a few African countries for the establishment of industrial estates for small-scale industries, featuring standard factory buildings for rent, common service facilities and advisory and training centres. Estates of this type are functioning in Ghana, Nigeria and the United Arab Republic. In many other countries plans for their establishment are at various stages of implementation.

A certain number of the more recent programmes have been drawn up with the assistance of United Nations experts, and some industrial estate projects are to be undertaken with assistance from the United Nations Special Fund. These industrial estate programmes are closely integrated with other programmes for the promotion of small-scale industries.

Information on country plans and projects, based to a large extent on replies of Governments to the United Nations questionnaire on industrial estates, will be found in the following section ("Country Data").

In all newly independent countries of Africa, the primary objective of industrial estate programmes is to stimulate the participation of indigenous entrepreneurs in the development of industry. It is realized that the industrial estate is one of the most effective means of promoting small-scale industry, and that the latter offers immediate prospects for investment, ownership and operation by African entrepreneurs, provided financial, technical and managerial assistance are made available.

In all cases the sponsorship, financing and management of industrial estates is assumed by the Government, often the Ministry of Commerce and Industry or one of its departments, or by an autonomous or

semi-autonomous agency set up by the Government, such as an industrial development corporation, a development bank or an organization for the promotion of and assistance to small-scale industries.

While most of the plans now being made are for industrial estates admitting all types of small-scale industries with the exception of "obnoxious" industries, some of the few existing estates are specialized. The Yaba industrial estate in Nigeria has been devised as a demonstration "nursery" scheme to facilitate the growth of small establishments expected to relocate outside of the estate after they have reached a certain size. In the United Arab Republic an estate for leather industries has recently been created.

The sizes of some existing and planned industrial estates in Africa are: 2 3/4 acres at Yaba (Nigeria), about ten acres in each proposed estate in the United Arab Republic, twenty-three acres in the proposed estate in Uganda and about one hundred acres in each proposed estate in Somalia. In the Nigerian estate there are forty-two standard factories of four different sizes; in the United Arab Republic a typical estate contains forty-five factory sheds of four different sizes; in Uganda thirty standard factories of two different sizes, and in Somalia one hundred to one hundred and fifty factories of four different sizes.

Sizes of standard factories in industrial estates are as follows:

*Nigeria:* 450, 600, 750 and 1,200 square feet (41.8, 55.8, 69.7 and 111.6 square metres).

*Somalia:* 1,989, 4,500, 8,874 and 14,850 square feet (185, 418, 825 and 1,381 square metres).

*Uganda:* 2,000 and 5,000 square feet (186 and 465 square metres).

*United Arab Republic:* 4,301 square feet (400 square metres).

*United Republic of Tanzania:* 800 square feet (74.4 square metres).

In Nigeria and the United Arab Republic factory sheds are let out to small-scale industrialists on rent, which is subsidized over an initial period of three to five years. In the United Arab Republic it is also proposed to let out factories on an instalment-purchase basis.

Facilities for training, repair and maintenance and other common services are planned in several countries.

The establishment of industrial estates in African countries is too recent and too limited in scope to permit a thorough evaluation of experience. Some "caveats", however, are suggested by some developments reported in the replies to the questionnaire and other sources. There are indications that, in some countries, industrial estates are being operated or planned as self-contained projects unrelated to or unco-ordinated with broader programmes of development of small-scale industry. In some cases no programme of financial assistance is being worked out; in other cases no

industrial extension services are planned or provided; training centres for workers do not always exist in the vicinity of the estate or are not adapted to serve the needs of the newly created industries; above all, the lack of agencies for the promotion of entrepreneurship through techno-economic surveys, feasibility and pre-investment studies, orientation of prospective new industrialists, facilitation of credit and advice on the administrative, legal and other problems related to the creation of an industry may slow down the rate of occupancy of some of the estates.

In some cases this lack of integration is likely to be more the result of time lags in the planning and implementation of related projects and of shortcomings in co-ordination than of inadequate over-all programming of small-industry development. The fact that an industrial estate project is not simply a real estate operation but one of several complementary measures for the promotion of small-scale industries appears to be increasingly realized, especially in the more recent projects formulated in countries of the region.

## COUNTRY DATA

### *Angola and Mozambique*

Industrial zones have been established in the urban areas of Luanda, Lobito and Sa da Bandeira in Angola and Lourenço Marques and Beira in Mozambique. Transport facilities, sewers, water, electricity and communications are available in the zones and land may be acquired at reasonable prices.

The establishment of industrial estates jointly managed by municipal councils and proposed industrial development companies is envisaged in the future. The industrial estates will feature standard factory buildings for small-scale and medium-sized industries to be leased or acquired on hire-purchase, as well as developed sites. Technical assistance centres and social facilities, such as canteens and clinics, will be provided as required. Some land will be kept in reserve for further expansion. Priority of admission will be given to new industrial establishments, but the possibility of admitting existing enterprises is not excluded.

### *Cameroon*

In 1963 a United Nations technical adviser recommended the establishment in certain urban centres of Cameroon of a certain number of industrial estates offering standard factories, improved plots and common service facilities, and, in smaller towns, of workshop blocks for artisans offering a more limited range of services and facilities. Further to these recommendations, the Government requested from the United Nations, under its Technical Assistance Programme, the services of an expert who will carry out surveys of prospects of industrial development in various localities of the country and, in the light of these surveys, will select the location and site of a certain number of industrial estates and workshop blocks. The expert

will draw up plans for construction and development of the estates, estimate their costs and make recommendations on their financing. He will also make recommendations on the organization of training facilities for the workers and foremen and on the number and type of fellowships necessary to carry out the project, for example, for the government officials in charge of industrial estate development or for the future managers of the industrial estates. He will also make recommendations on further assistance which might be requested from the United Nations to carry out the project. The expert will see to it that the industrial estate programme is integrated in a broader programme of development of small-scale industry and may present recommendations for such a programme, if required. Recruitment of the expert is currently under way.

#### *Chad*

In Chad a certain number of zones have been reserved for industrial use in some urban centres. The zones are located near electric transformers and water supply. Plots in the zones are made available by the State, in some cases free of charge, in particular to enterprises, set up with Government participation, or are sold by the Lands Department.

#### *Congo (Democratic Republic of)*

The Government of the Congo is not considering, at this stage, the establishment of industrial estates for small-scale industries. The main reason for this is that, as a result of the recent economic and social upheavals, the capacity of production in industry, especially in small-scale and medium-sized industry, was considerably reduced, and the country's efforts are directed first towards industrial recovery, that is, the return to full use of capacity, and then to the modernization and expansion of existing enterprises. These are located in three major areas well supplied with raw materials, energy, water, communications and land for industrial use: Leopoldville and its suburbs, Stanleyville and Elisabethville-Kolwezi.

When the economic plan now in preparation is completed, a programme for the establishment of industrial estates will be drawn up. The main objectives of the programme will be to stimulate the establishment of small-scale and medium-sized industries around new large-scale industries still to be created, to facilitate industrial decentralization and decongestion of large urban centres and to foster industrial development in areas where new resources, in particular raw materials and sources of energy, are made available.

#### *Equatorial Guinea*

The advisability of establishing industrial estates was considered in connexion with the preparation of the first economic development plan for Equatorial Guinea, covering the period 1964 to 1967.

With regard to Fernando Poo, it was considered that Santa Isabel, the only important town and port

in this small island (2,000 square kilometres) was, owing to the availability of better communications and better economic resources than in other areas, a natural focus for industry, and it was decided not to make provision in the plan for an industrial estate.

In Rio Muni studies are in progress for the building of a harbour and the development of power supply and communications in the hinterland. Because of the large capital investment required and the need to carry out preliminary studies, the construction of this complex was not included in the first plan. After the infra-structure facilities are completed, consideration may be given to the establishment of an industrial estate.

#### *Gambia*

There are no manufacturing undertakings in the Gambia other than factories processing ground-nuts for export. In 1964 an area of crown land at Kanifing-Serekunda, a suburb of Bathurst, was zoned for industrial use with a view to encouraging the growth and diversification of industry. The area, which adjoins the main road, is being laid out in plots, and water, electricity and telephone service are being provided as occasion demands. It is not proposed to erect standard factory buildings. Preference in admission will be given to industries qualifying under the Development Act of 1964 for fiscal concessions, but admission of existing industries is not ruled out. All sites will be available on long lease at economic rent. The Government would in many cases be prepared to accept payment for the capitalized value of the land and of utilities in the form of shares at par in the enterprise.

#### *Ghana*

In Ghana an industrial estate has been set up at Nyanibah on the outskirts of Accra by the Ghana Estate Investment Company, a subsidiary of the Industrial Development Corporation. After the dissolution of the Corporation, the management of the estate was taken over by the Housing Corporation. The buildings contain eighty-two bays, a certain number of which are not individually partitioned. While a few small-scale industries occupy premises on the estate, most of the bays have been let out for warehousing. No common service facilities are provided.

A large area was improved at Bubuashie to accommodate more than 800 repair shops and other small establishments operated on an artisan basis, many of which were transferred from Kokomshe. A similar project, which will feature a central workshop, is to be undertaken at Kumasi.

An estate for light industry is planned as part of the new port of Tema. It will accommodate thirty to forty workshops for service industries such as motor-car repair, fitting, welding, carpentry and so on. The construction of the buildings will be financed by the Government and will be carried out under the supervision of the Tema Development Corporation. The buildings will be offered for rent at an economic rate

based on depreciation over twenty years, plus a ground charge. There will also be provision for outright purchase based on a sixty-year lease (with an option for additional thirty years), 20 per cent of the value being payable in cash and the balance over ten to fifteen years.

#### *Guinea*

The establishment in Guinea of industrial estates and workshop blocks for small-scale industries was recommended in 1963 by a United Nations technical adviser as part of an over-all programme of industrial development. Further to these recommendations, the Government requested the United Nations to provide, under its Technical Assistance Programme, the services of a small-scale industry expert to draw up a programme of promotion of small-scale industry and of establishment of industrial estates. The expert will carry out feasibility and pre-investment studies for small-scale industries of different types in various locations, select the location and site of the estates, organize training and apprenticeship programmes and make recommendations on the institutions required to carry out the programme and further technical assistance which might be requested from the United Nations. Recruitment of the expert is currently under way. The Government has earmarked about 1,000 acres in Conakry to be developed as an industrial area.

#### *Kenya*

A major objective of Kenya's development policy, as laid out in the Government's 1964 to 1970 Development Plan is the promotion of increased African participation in every sphere of the nation's economy and, in particular, in small-scale industry and commerce. The main Government agencies for stimulation of small industrial and commercial enterprises under African ownership and management are the Industrial and Commercial Development Corporation, which provides loans and advisory services to the borrowers, and a Small-Industry Research and Training Centre at Nakuru.

No industrial estates with standard factories and common service facilities have been set up in Kenya. The Government considered that adequate facilities for development existed in eleven industrial areas set up in Nairobi, Mombasa, Changanwe, Nakuru, Kisumu, Eldoret, Kitale, Naivaska, Thika, Thomson's Falls and Nayuki, all of which except Changanwe are administered by East-African Railways and Harbours.

In these areas plots are provided with roads, railway sidings, water supply, sewers and storm-water drainage. Electricity and telephone arrangements are worked out with the relevant authorities. Detailed building plans need the approval of the administering authority. "Offensive" industries are usually grouped separately.

Plots are provided on leasehold terms (up to ninety-nine years in the case of the larger towns and up to thirty years in the case of the smaller towns), and are made available only to those who intend to use them

at an early date. The purchaser of the plot has to pay a premium calculated at one-fifth of the capital value of the land and an annual rental at 5 per cent of the balance of the capital value. Development charges are payable by the plot-holder, who is also required to pay legal and survey fees as well as stamp duty.

As a special project to stimulate small-industry development, the Ministry of Commerce and Industry, acting through the African Industrial Estates Development Fund, set up two industrial areas reserved for small-scale industries. One of these, located at Karatina in a highly populated rural area of the central region, offers plots, roads, drainage and a railway siding. The other area, at Shauri Moyo, a predominantly African sector of Nairobi, features improved plots, roads and drainage. No funds were available for the construction of standard factories or financial assistance to entrepreneurs willing to put up their own buildings. No plots have yet been taken up in either scheme.

In 1964 a United Nations team recommended that the Industrial and Commercial Development Corporation assume the functions of a national promotion and assistance agency for small-scale industries, including, besides financial assistance, promotion of indigenous entrepreneurship, industrial extension and training services and, as a major activity, establishment of industrial estates. The proposal is under consideration by the Government. The planning of an industrial estate near Nairobi has recently been initiated.

#### *Mauritius*

The Government of Mauritius proposes to sponsor industrial estate projects, which will be under the control and management of the Development Bank. A first estate will be set up in the industrial area of Bell Village/Plaine Lauzun, an area of crown land within the boundaries of the Municipality of Port Louis. The amount of crown land in this area tentatively reserved for industry is approximately 120 acres. About half of it is already developed by such concerns as the Central Electricity Board Power Station, the Tobacco Marketing Board, the Ministry of Works Mechanical Workshops, workshops of several building companies and assembly workshops for motor vehicles and agricultural equipment, a paint factory and the like. A certain number of factories are built with financial assistance from the Development Bank. One of these, a plant for a foreign investor concerned with the production of jewel-bearing units for watch manufacturing, is being constructed by the Bank. An area of fourteen acres has been earmarked at Plaine Lauzun for the pilot industrial estate, the organization and features of which are now under discussion.

#### *Nigeria*

Planned industrial communities in Nigeria include an industrial estate for small-scale industries featuring standard factory buildings, common service facilities and advisory services, and twelve industrial areas offer-

ing improved and unimproved plots for medium-sized and large-scale industries.

The industrial estate was established in 1958 at Yaba, near Lagos, by the Federal Government. Its main purpose was to serve as a "nursery" for small-scale industries which, as they grew, could occupy additional units or sub-units, with a maximum of three units per enterprise. Thereafter the industries would be encouraged to undertake construction of their own factories outside the estate.

The Yaba estate occupies an area of 2 34 acres and consists of forty-two standard factory units. The units are situated in seven blocks, the standard size unit being 40 by 30 feet. Some of the units are divided into sub-units of 40 by 15, 25 by 30 and 15 by 30 feet. The forty-two units are occupied by twenty-eight tenants with a total employment of 300 workers. The tenants include light industries manufacturing plastic products, tarpaulins, furniture, wood carvings, garments, hosiery and gymnasium equipment, and service industries, namely, printing presses, commercial sign writing, rewinding of electric motors and shoe repairing. Obnoxious industries are not admitted.

Factory sheds are offered for rent. Subsidies permit the payment of rent to be graduated so as to approach market cost after the fifth year of lease.

The general services provided on the Yaba estate include power, water, watchmen, medical care, fire protection, canteen, parking spaces for bicycles and cars, lavatories and baths, telephones and so on. Special common facilities include a maintenance and repair workshop and disposal of waste. Some training is provided to the managers of the industrial enterprises.

The industrial areas are sponsored, financed and managed by the regional governments — the Ministry of Land and Housing in the western region, the Ministry of Town Planning in the eastern region and the Ministry of Works and Surveys in the northern region. Their primary objective is to attract foreign enterprises.

The industrial areas range in size from 60 acres at Gusau to 2,500 acres at Trans-Amadi near Port Harcourt. At Kano, in the northern region, an industrial area was established as early as 1955 on about 110 acres and a second area was set up on 170 acres in 1958; both areas were fully improved from the start. The Ikeja industrial area near Lagos has 290 acres, fully improved in 1961. At Kaduna an industrial area opened in 1962 occupies 570 acres. On the Trans-Amadi industrial area 717 acres were developed as a first stage in 1962. All areas offer improved plots with utility connexions and access roads; many feature railway sidings. The average plot size in the Ikeja industrial area is 6.2 acres for commercial and service industries and 8 acres for manufacturing industries. In Trans-Amadi the average is 15 acres for manufacturing establishments and between 1.3 and 4 acres for commercial and service establishments.

The sale of Government land being forbidden by Federal law, plots are leased to the occupants. The maximum rental period is of ninety-nine years, provided

certain minimum improvements are made by the tenant during the period of occupancy. Rents are set at a level permitting return of capital over a period of ten to fifteen years. On the Ikeja industrial area the average cost of development has been £N 2,500 (about \$7,000) per acre. In the northern region, because of better load-bearing qualities of the soil and the availability of flat, well-drained land at a lower price, the development charges have been considerably less, averaging between £500 and £550 per acre. This is reflected in the rents, and a system of differential rates operates in practice.

Although many industries and commercial and service establishments were attracted to the industrial areas total employment in the twelve areas is 20,000. The demand for sites was somewhat overestimated and in the 1962 to 1968 Development Plan the amounts set aside for land acquisition and development were drastically scaled down. Future development will be done with a close eye to actual or prospective demand.

In its reply to the United Nations questionnaire on industrial estates, the Nigerian Government evaluated as follows the experience gained in the Yaba estate:

"The scheme does fulfill a long-felt need and larger estates of this type with more complete facilities should be set up both in Lagos and other parts of the Federation.

The period of five years that was estimated as necessary for a firm to have developed to the state where it can build its own factory outside the nursery estate is optimistic. Only two tenants since the estate began operations in November 1958 are expected to have moved out of the estate into new factory buildings.

The rent differential designed to discourage tenants from remaining in the estate for over five years by increasing the rent after prolonged occupancy has failed to effect the desired result. In some cases, in fact, tenants have left the estate for other premises before their businesses were fully developed to avoid incurring debt from the obligations to pay their leases. An appreciable number of small tenants remaining on the estate are accumulating debt as a result of arrears in rental payments. Finally, new tenants on the estate and a large proportion of prospective tenants are proprietors of fairly developed industries capable of occupying three or more units. The estate was not designed for operations of this scope. Such tenants tend to regard the estate as a permanent location for their operations. As a result, unless the original policy is strictly enforced, this estate will tend to be occupied permanently by a few fairly developed firms. It will thereby no longer perform the nursery estate function.

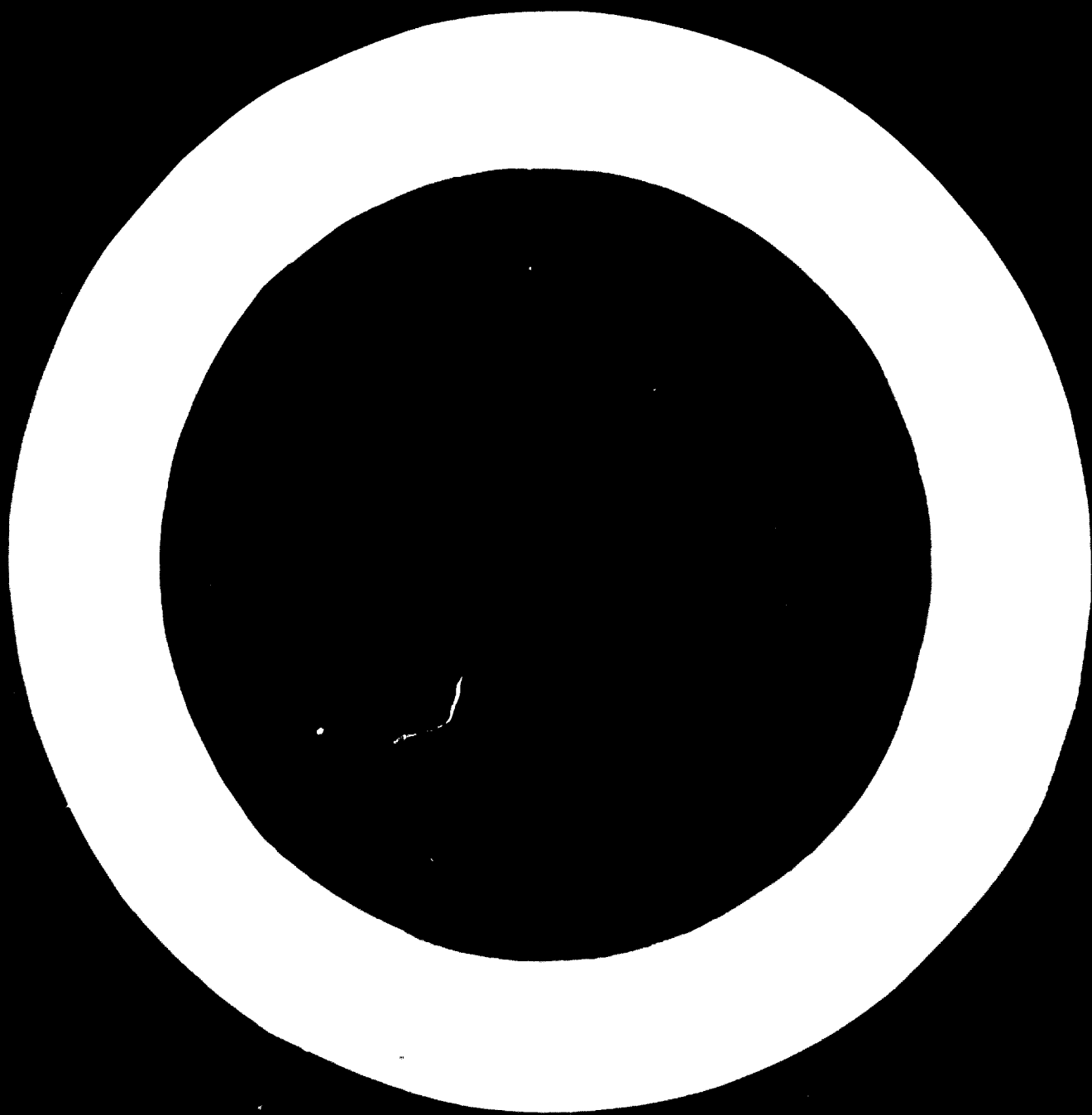
Before an estate is planned in the future the rate of development in that area of the country should be carefully assessed in order to plan adequately for roads, parking space for cars, area for loading and unloading of goods and so on; also the type of industries to be accepted on the estate and the character and behavior of the tenants will have to be more carefully examined. Because needs in these regards were not clearly envisaged when the original planning was done, there is conges-



**15.7.74**

## TABLE OF CONTENTS

	<i>Page</i>
<b>PREFACE</b> .....	1
<b>PART 1. REPORT OF THE UNITED NATIONS SEMINAR ON INDUSTRIAL ESTATES IN THE REGION OF THE ECONOMIC COMMISSION FOR AFRICA</b> .....	5
Annex I. List of participants .....	13
Annex II. Agenda .....	15
Annex III. Address by Mr. F. A. N'Liba-N'Gumbous, Deputy Executive Secretary, on 14 December 1964 .....	15
Annex IV. List of documents .....	16
<b>PART 2. PLANNING, DESIGN AND CONSTRUCTION OF INDUSTRIAL ESTATES WITH PARTICULAR REFERENCE TO AFRICA</b> .....	19
Annex I. Drawings and diagrams .....	34
Annex II. Tables and schedules .....	37
Annex III. Summary of United Kingdom Factories Act (1937) having particular relevance to industrial buildings .....	38
Annex IV. Flatted factories .....	39
Annex V. Building, training and information centres in Africa .....	39
Annex VI. References .....	41
<b>PART 3. INDUSTRIAL ESTATE PLANS AND PROJECTS IN AFRICAN COUNTRIES</b> .....	45
General survey .....	45
Country data .....	46





## PREFACE

The present publication is the fourth in a series of studies and reports on problems relating to industrial estates to be published by the United Nations. In this series, it is the second which discusses these problems from a regional standpoint.

Two of these publications are concerned with general aspects of the subject. The report entitled *Establishment of Industrial Estates in Under-developed Countries* (Sales No.: 60.II.B.4) deals principally with the role of industrial estates in policies of industrialization and of industrial location in a number of countries, developed and developing, special attention being paid to their role in the promotion of small-scale industry. The other report, *The Physical Planning of Industrial Estates* (Sales No.: 62.II.B.4), discusses problems of location, planning, layout and building of industrial estates, and provides data on the norms for plots, factories, roads and land use adopted or recommended in various countries.

In November 1961, the first in a series of regional seminars on industrial estates, covering the region of the Economic Commission for Asia and the Far East (ECAFE), was held in Madras, India, under the joint sponsorship of the United Nations and the Government of India. The report of the Seminar, and large excerpts from the information and discussion papers submitted to it were published in *Industrial Estates in Asia and the Far East* (Sales No.: 62.II.B.5).

In December 1964, a second regional seminar, covering the region of the Economic Commission for Africa (ECA) was held in Addis Ababa, Ethiopia. The Seminar was jointly sponsored by the Economic Commission for Africa, the Centre for Industrial Development and the Bureau of Technical Assistance Operations of the United Nations Department of Economic and Social Affairs.

The Seminar had before it a certain number of papers relating to the various items on the agenda. Some of these papers were concerned with general problems in the field of industrial estates and, in particular, with their role in the development of small-scale industries. In other papers, industrial estates were discussed within the context of plans, achievements and requirements in African countries.

The present publication contains the report of the Seminar on industrial Estates in the ECA region and other material relating to industrial estates in Africa, namely, a study of planning, design and construction of industrial estates with particular reference to Africa and a survey of industrial estate plans and projects in countries of the region. The seminar papers of more general scope — "The Role of Industrial Estates in Policies and Programmes for the Development of Small-

scale Industries", "Types of Industrial Estates", "The Definition of Small-scale Industry" and "United Nations Activities in the Field of Industrial Estates" will be published in 1966, together with other studies, in a volume to be entitled *Promotion of Small-scale Industry*.

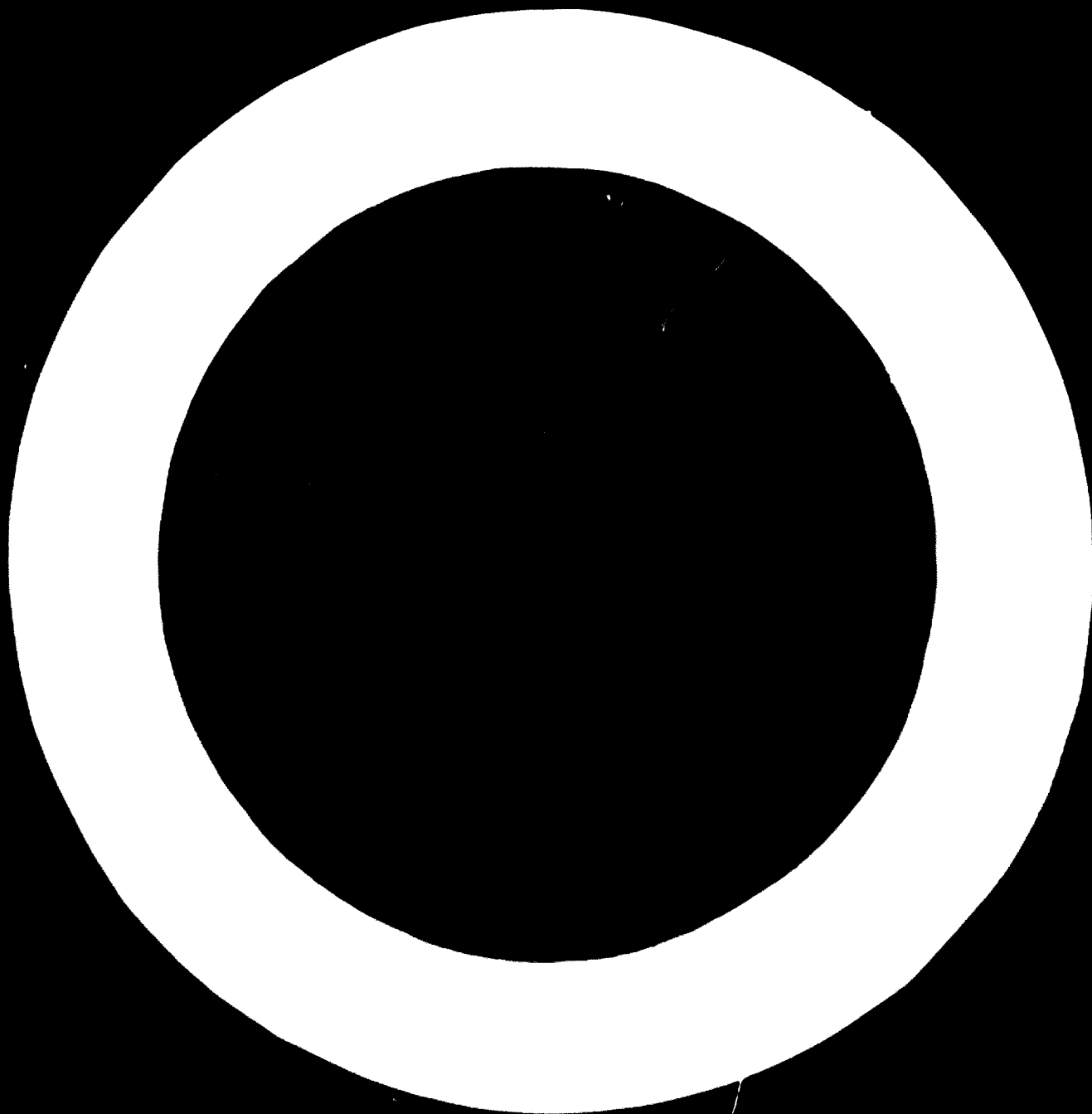
The report of the Seminar on Industrial Estates in Africa (Part 1) contains findings and recommendations on policy aspects, economic and physical planning, organization, management and financing, and regional and international co-operation in the development of industrial estates in countries of the region. An important conclusion of the Seminar is that, in view of their role in the promotion of small-scale industries, industrial estates may facilitate a breakthrough of the indigenous entrepreneur into industrial activities and his participation in the industrialization of his country, a major policy objective in the newly independent nations of the region. Many recommendations on the planning, establishment and operation of industrial estates are affected by this consideration.

The paper on "Planning, Design and Construction of Industrial Estates with Particular Reference to Africa", prepared by Mr. Edward D. Mills (Part 2), deals with various aspects of over-all planning, design and layout, buildings and other facilities, building materials and construction, costs, programming and legislation.

The survey of "Industrial Estates Plans and Projects in African Countries" (Part 3) has been prepared by the Secretariat on the basis of a number of papers submitted to the Seminar — "Industrial Estate Developments in the UAR", "The Yaba Industrial Estate in Lagos, Nigeria", "A Review of Industrial Estate Developments in Africa" and "The Potential Importance of Industrial Estates for African Countries". It is also based on the replies of Governments of African countries to a questionnaire on industrial estates sent by the Centre for Industrial Development in 1964 and early in 1965. Thus, the survey presents a picture of industrial estate plans and projects in the region as of the beginning of 1965.

A comprehensive analysis of all replies to the questionnaire received from Governments throughout the world and of other relevant material will be published in 1966 under the title *Industrial Estates: Policies, Plans and Progress — A Comparative Analysis of International Experience*.

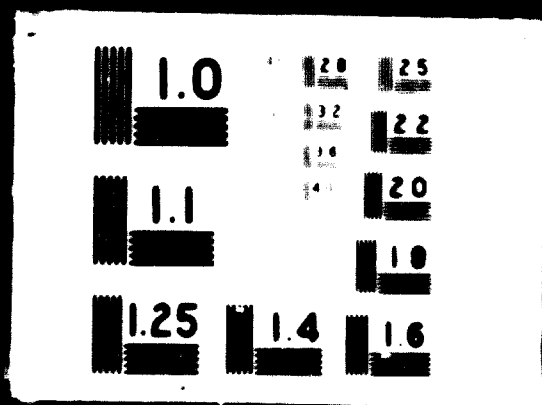
Problems relating to industrial estates and industrial areas will be further considered in 1966 at a third seminar organized by the United Nations. The meeting will bring together participants from developing countries in two regions — Southern Europe and the Middle East. The report and papers of this seminar will be published in due course.



2 OF 2

DO

3 7 9 1



tion from the use both of personal cars and company-owned delivery vans, and easy access to individual units has been made difficult."

The Government's evaluation of experience in the industrial areas is as follows:

"From a planning point of view, the industrial areas in the regions have been a success. They have tended to focus industrial growth in certain locations and thereby have enabled more harmonious over-all development of metropolitan areas. These areas, too, have undoubtedly expedited new investment by removing what had been a worrisome stumbling block, the inability to obtain developed land with clear legal title.

There has been some disappointment in the effectiveness of industrial areas in dispersing industry away from the more desirable economic centres such as Port Harcourt, Lagos and Kaduna. This is in part due to the fact that no single Government has control over site location. A given region cannot easily force a firm to locate where it would not choose to go because potential investors usually have the option of locating in a different region or in the Federal territory. Thus, control over the siting of new plants has been by persuasion rather than regulation. The strongest economic incentive (other than the possibility of obtaining regional financial assistance) to locate in a particular industrial area has been limited to rent differential, an incentive that in most cases has not been of sufficient importance to affect many locational decisions."

#### *Senegal*

An industrial area has been developed in Dakar for large-scale and medium-sized industries. The establishment of industrial estates for small-scale industries was recommended in 1965 by a United Nations expert, a part of an overall programme of development of small-scale industries. The expert recommended that the first demonstration industrial estate be located in the Cap Vert region, near Dakar. Following these recommendations, the Government requested the United Nations to provide, under the Technical Assistance Programme, the services of a small-scale industry expert to assist in the formulation of policies and programmes for the promotion of small-scale industries, including establishment of industrial estates, in the period of the second four-year plan. Recruitment of the expert is currently under way.

#### *Somalia*

The first Five-year Plan (1963 to 1967) of the Somali Republic envisages the establishment of industrial estates providing developed plots, and, in some cases, standard factory buildings for small-scale industries, with facilities of power, water, roads and communications.

During 1963 a firm of consulting engineers undertook industrial surveys and site investigations in Mogadiscio, Chisimayo, Hargeisa and Berbera under contract with the Government of the country. The firm recom-

mended the establishment of industrial estates in the first three towns — each estate forty hectares (about 98.8 acres) in size, of which twenty hectares would be developed during the first phase. On the basis of market surveys, the firm recommended the admission into the estates of twenty-eight small-scale and medium-sized industries and sixteen handicraft and cottage industries initially, and thirty-seven other small and medium industries at a later stage. The first occupants would be industries producing flour, beverages, jute bags, oil, matches, buckets and pans, razor blades, knitted ware, soap, buttons, glass beads, shoes, sports goods, locks and the like. At a later stage somewhat more advanced industries producing bicycles, sewing machines, radio receivers, surgical instruments, agricultural implements, hand tools, automobile parts, plastics, boot polish and so on would be set up on the estates.

Each of the three industrial estates would have developed plots of three different sizes: 1,381 square metres (about 1,650 square yards), 825 square metres (about 986 square yards) and 418 square metres (about 500 square yards) of initial covered area, provision being made for doubling this area at a later stage. There would also be factory sheds of 185 square metres (about 221 square yards) each for "nursery" units. Eventually each estate will be occupied by one hundred to one hundred and fifty small and medium-scale enterprises. Each estate will have a service centre to train and teach the proper use of machines and tools by the workers.

#### *South Africa*

In the early nineteen thirties, several industrial areas providing plots equipped with water, power, roads and railway sidings, were set up in South Africa. The areas were established principally by private developers with the object of selling land at a profit; this was possible only in places offering locational advantage, such as a major city, a harbour or an existing industrial centre. In some cases major industries such as steelworks, refineries and mines developed adjoining land to facilitate the establishment of industries depending upon or serving them.

Since the nineteen forties local authorities motivated by the desire to rehabilitate old mining areas, attract foreign enterprises, increase their tax base and increase local employment have also established industrial areas with loans provided by the Government. The establishment of such areas is co-ordinated with zoning regulations under town planning legislation.

During the last decade the central government has financed the development of a few industrial areas in less developed regions which were not sufficiently attractive to private developers and local authorities.

There is no co-ordination of the planning, construction and operation of the different types of industrial areas.

Standard factory buildings and special services are not usually provided. The occupier of an industrial

plot or the developer of the industrial area arranges for loans from banks and insurance companies and from the South African Industrial Development Corporation for construction of factory buildings and erection of plants. Developed plots are usually sold to the occupiers for cash.

The areas vary in size from 10 to 500 acres, plot sizes range from 1/2 acre to 50 acres and factory sizes range from 2,000 square feet to several acres. Excluding buildings, investment varies from 2,000 to over 10,000 rands per acre.

Special inducements are provided to industries locating themselves in certain under-developed regions; these include concessional railway rates to urban centres, tax concessions and the provision of cheap water and power.

### *Southern Rhodesia*

A certain number of industrial areas have been established in the larger towns of Southern Rhodesia — Salisbury, the capital, and Bulawayo, under the sponsorship of councils. Only in two cases have private landowners set up industrial areas as commercial projects; such development was carried out in accordance with requirements of the town planning legislation. The main objective of all these areas has been to attract industries from abroad. They offer fully serviced sites with access roads, storm-water drains, water mains, electricity and sewers. Rail-siding facilities to industrial sites have been recently provided.

The average size of industrial sites in Bulawayo and Salisbury is 1 1/2 to 2 acres (0.6 to 0.8 hectares) with an average employment of forty-six persons per acre. The size of the industrial area is 444 acres in Bulawayo and 589 acres in Salisbury.

Sites are available on lease with option to purchase as soon as development to minimum value has been carried out in the site. No common service facilities or special inducements are offered. Finance for developing the sites has been provided by the local or central government as the case may be.

An important project sponsored by the central government is the Norton industrial township, a satellite city 25 miles from Salisbury. Norton was created around 1950 for the purpose of decentralizing industry and decongesting the capital. Sites, electricity, water, housing and other facilities are available at low rates. Some difficulties were experienced in attracting industry, partly because the salaried staff was reluctant to live in a small community with limited social amenities.

### *Uganda*

With the assistance of two United Nations officials, an integrated programme for the promotion of small-scale industries, including the establishment of a pilot industrial estate near Kampala, was formulated in 1964 by the Government of Uganda and is expected to be implemented in the course of the second Five-year Development Plan, 1966/67 to 1970/71, with

assistance from the United Nations Special Fund. The Kampala industrial estate would serve as a demonstration project showing how indigenous entrepreneurship can be concretely stimulated and assisted, providing guidance for further projects of this type and eventually inducing local governments and private groups to follow suit. Part of the tract of land on which the industrial estate will be set up will be developed as an industrial area for medium-sized and large-scale industries.

An area of 150 acres (60.75 hectares) will be acquired for the industrial estate and the industrial area. The estate will be built in an area of 23 acres (9.3 hectares), and 104 acres (42.12 hectares) will be developed as the industrial area. In the industrial estate thirty standard factories — 15 of 2,000 square feet covered area (186 square metres) each and 15 of 5,000 square feet covered area (465 square metres) each — will be built to accommodate small-scale enterprises. Apart from utilities, power, water, sewers and roads, facilities of fire station, post office, bank, dispensary, canteen, show-room, warehousing and club room will be provided. Common service facilities will include a tool room and mechanical workshop and a testing laboratory.

The standard factories in the estate will be leased on rent for the first five years and thereafter offered on outright sale or instalment-purchase terms. Developed plots in the industrial area will be offered either on long-term lease or on outright sale.

The project in Uganda will be co-ordinated on the one hand with town planning requirements and on the other hand with broader programmes of feasibility studies, industry and marketing surveys, financing, training, management assistance and fiscal incentives.

Besides the proposed industrial estates, five rail-served industrial areas exist in Kampala, Jinja, Mbale, Tororo and Kasese.

### *United Arab Republic*

Since 1960, when the second five-year industrial programme started and the General Organization for Small Industries and Co-operative Production (C.P.O.) was established, the United Arab Republic has been executing a programme for the planned establishment of industrial estates in conjunction with programmes of financial and technical assistance, training, marketing and fiscal incentives. The small-industry development programmes are aimed at overcoming the handicaps of inadequate capital resources, lack of modern means of production, marketing facilities and trained personnel from which small industries suffer.

Three industrial estates are being established under the second five-year programme (1960 to 65). The first estate, which is nearing completion, is a special-purpose industrial estate for the leather tanning industry, located at Bassatin, on the outskirts of Cairo, on a 130-acre site. This estate, managed by the Cairo Industrial Tanning Co-operative (CITC) will consist of seven modern tanneries which will eventually replace the existing eighty-five very small tanneries of traditional

type in the city. The tanneries will be owned by the CITC and will have modernized machinery and equipment for tanning. While one of the tanneries will be for general purpose, the other six will carry out specialized work — two will specialize in the manufacture of uppers, two in sole leather and two in light leathers. Facilities to be provided in the industrial estate on a common basis include electricity, water, streets, chemical stores, purification of effluents, central stores for hides and skins, chemical analysis laboratory, foundry, mechanical engineering workshop and carpentry workshop. Arrangements for other facilities, such as banking, post office, police station, cafeteria and first aid centre, will also be made. In addition, a hide market will be established and sites will be provided for the manufacture of allied products, such as glue, gelatine and imitation leather. The output per man-hour in the modern tanneries established in the industrial estate is expected to be 24 square feet as compared to the existing rate of 4 to 5 square feet. Employment of workers will decline from 2,800 to 985, but additional employment of 400 persons other than workers is envisaged. The total investment in the estate is expected to be £E 8 million (about \$18.4 million).

Besides the special purpose industrial estate for the leather tanning industry, two general purpose industrial estates are being established, one at Mansoura, 130 kilometres north of Cairo, and the other at Beni Suif, 124 kilometres to the south of Cairo. A comprehensive survey and feasibility study for the Mansoura estate has been carried out jointly by the CPO, the Five-year Plan Organization and the Institute of Small Industries (set up with assistance from the United Nations Special Fund as a training and research project). The survey for Beni Suif is under way.

The existing manufacturing industries in the Mansoura region include food products, textiles and clothing, metal products, machinery and equipment and non-metallic minerals. The proposed industrial estate will initially have ten factory sheds with 400 square metres of floor space each, which could accommodate up to forty workshops. Provision will be made for a further twenty sheds, to be erected on demand. The selection of tenants will be based on the growth record of existing enterprises and the over-all development plan of the country for various industries.

Under the third industrialization programme (1965 to 1970) the Government of the United Arab Republic proposes to establish eight industrial estates. The general policy is to establish industrial estates in or near the capital cities of the Governorates (provinces) after detailed surveys and feasibility studies. The objectives of the estate, the size of the estate, the number, type and size of sheds, the types of industries to be accommodated, the common facilities and services to be provided are determined on the basis of the survey. However, it is envisaged that a model industrial estate should have an area of 21,000 square metres, with

provision of an additional 21,000 square metres for the later expansion. There will be forty-five factory sheds of four different sizes, which could be subdivided to provide for more workshops. A common maintenance shop, testing laboratories, a canteen and all necessary municipal facilities will be provided. It is estimated that the cost of such a model industrial estate will be £310,000 (about \$712,971).

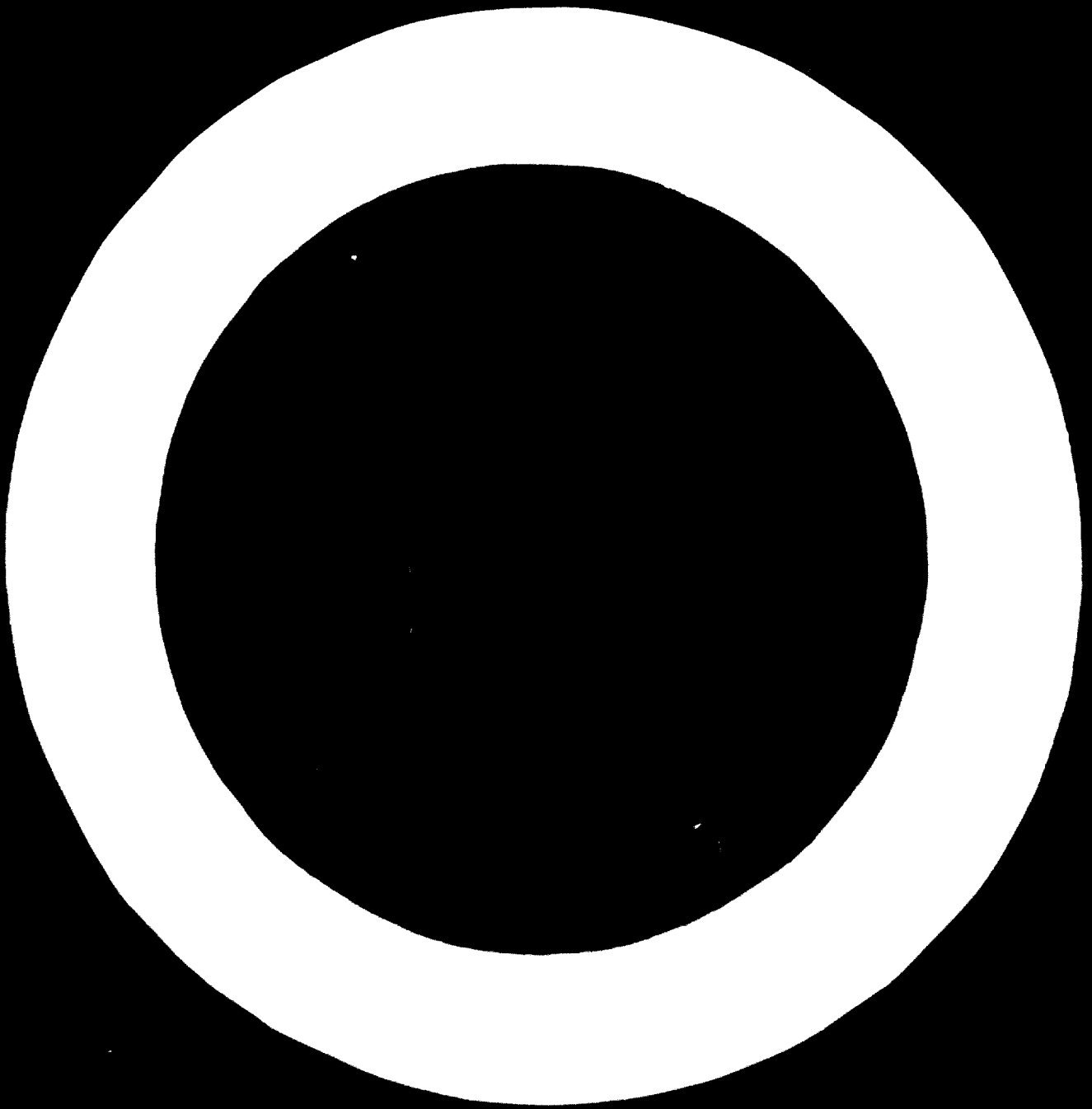
Factory sheds will be leased either on a rental basis (rent being calculated on an amortization period of thirty years) or on a hire-purchase basis (instalments calculated over a period of twenty years). As an inducement to occupancy, it is proposed that the Government will subsidize 75 per cent of the rent or hire-purchase instalments in the first year, 50 per cent in the second year and 25 per cent in the third year, the full value being charged from the fourth year.

Each estate will be managed by a director appointed by the CPO. A technical and administrative group of specialists will be employed by the CPO to provide technical and management consulting services; these services will be made available also to enterprises outside the estate. Similarly, facilities of working capital loans, supply of machinery on hire-purchase, training, marketing and the like will be available to all small-scale enterprises in the area, and not just to estate tenants.

After several estates are established, it is proposed to set up a board to manage all of them.

#### *United Republic of Tanzania*

In 1957 the Government of Tanganyika set up a certain number of improved industrial plots with access roads and, in some cases, railway sidings at Dar-es-Salaam, Morogoro, Mwanza, Moshi and Tanga. In Arusha an industrial area was established on the initiative of the town council, which acquired a large area of land known as the Themti estate and provided plots of land on a freehold basis to industrial enterprises with a minimum of formalities. The Arusha industrial area has been the most successful project of this type. In the Three-year Development Plan, 1961 to 1964, provision was made for developing industrial estates with standard factories for rent; advisory services were also to be made available. The objective of the programme was to promote as rapidly as possible a breakthrough of indigenous entrepreneurship in industrial activity. Two types of plans were worked out; one providing individual buildings with a working area of 800 square feet (74.4 square metres), storage space, small office and show-room; another providing for a co-operative block of 12 self-contained units in one wing and a series of administrative units (secretarial services, accounting and general management advice) in the other wing. The project could not be carried through owing to shortage of funds. The Government intends to resuscitate the project.



#### HOW TO OBTAIN UNITED NATIONS PUBLICATIONS

United Nations publications may be obtained from bookstores and distributors throughout the world. Consult your bookstore or write to: United Nations, Sales Section, New York or Geneva.

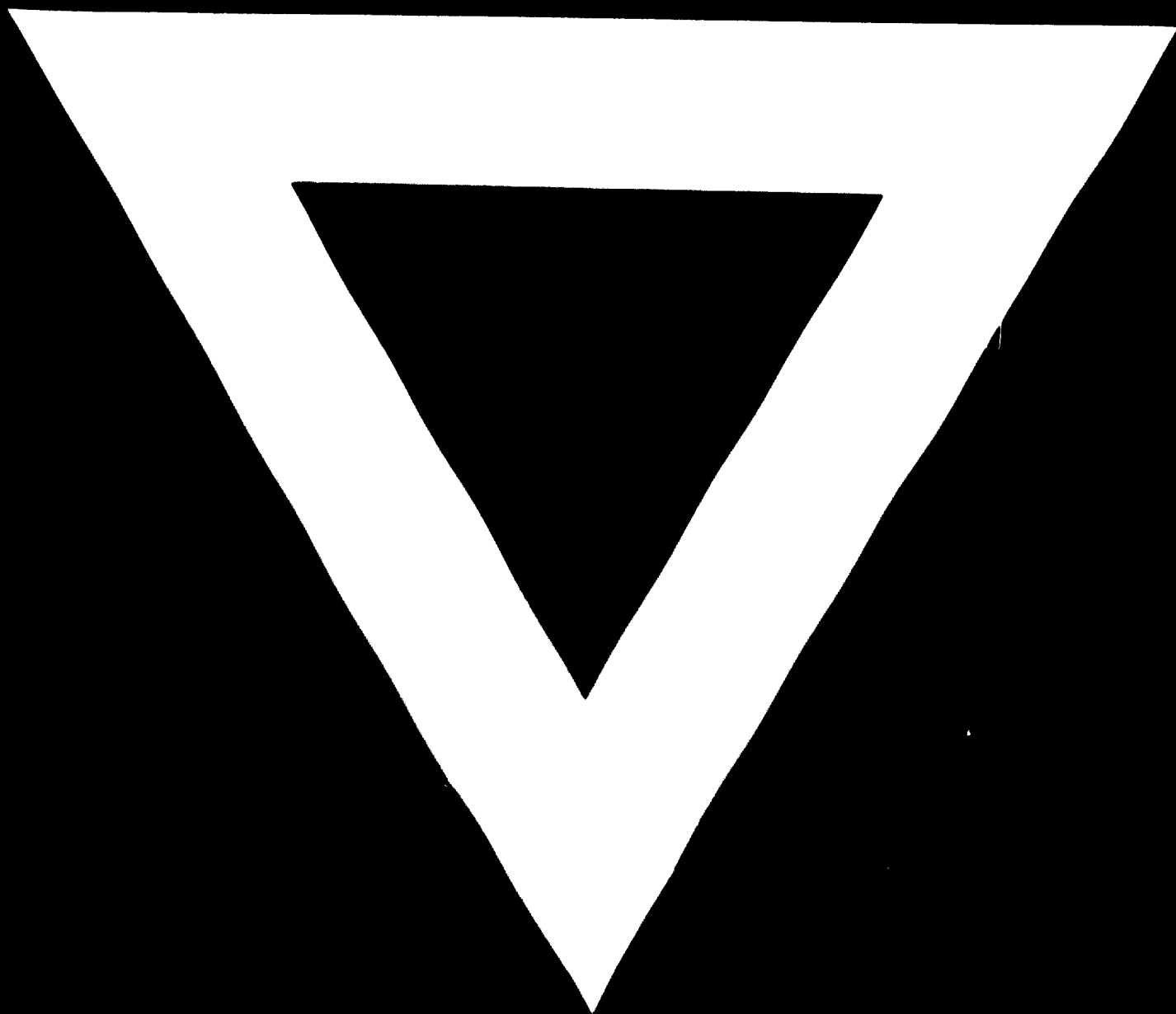
#### COMMENT SE PROCURER LES PUBLICATIONS DES NATIONS UNIES

Les publications des Nations Unies sont en vente dans les librairies et les agences dépositaires du monde entier. Informez-vous auprès de votre librairie ou adressez-vous à: Nations Unies, Section des ventes, New York ou Genève.

#### COMO CONSEGUIR PUBLICACIONES DE LAS NACIONES UNIDAS

Las publicaciones de las Naciones Unidas están en venta en librerías y casas distribuidoras en todas partes del mundo. Consulte a su librero o diríjase a: Naciones Unidas, Sección de Ventas, Nueva York o Ginebra.





**15.7.74**