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05804



Distribution
LIMITED

ID/WG.187/17
24 September 1974

ORIGINAL: English

United Nations Industrial Development Organization

Meeting of Experts/Decision Makers for
Promotion and Development of Machine
Tool Industries in Developing Countries
of Asia and the Far East

Tbilisi, Georgia, USSR
5 - 15 October 1974

TECHNICAL AND INVESTMENT COOPERATION PROGRAMMES . . .
WITH PARTNERS IN OTHER COUNTRIES EITHER WITHIN OR OUTSIDE
THE REGION, FOR COMPONENT OR COMPLETE MACHINE TOOL MANUFACTURE ^{1/}

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I.

In the world of expanding East-West trade and strengthened trade relations between industrialized nations and developing nations, a new form of collaboration is coming about, this generally being referred to by the participants as co-operation.

In this context, co-operation cannot be explained by a simple and straightforward definition. The concept includes many different arrangements and agreements which have been partly tried and successfully tested but are partly still in an early stage of development.

Three fundamental forms of co-operation have so far been established:

1. The transfer of technology by licences and know-how agreements, the licensor frequently receiving licence fees partly in the form of produced goods.
2. Co-operative production in the host countries.
Variants of this form include the supply of factory equipment, availability of technical assistance, training of skilled personnel and specialization in major machine assemblies and parts production. The assembly of the end product takes place at the premises of one of the two partners.
3. In the third fundamental form of co-operation, the accent is on the sale of products, in this case generally in Western markets

and through the sales network of the Western partner.

An infinite number of variations is possible between these three fundamental forms. It is the object of this paper to deal with co-operation between the machine tool builders of Western Germany and the Eastern industrialized nations as well as between Western Germany and the developing nations. This requires a brief investigation of the structure and strategy of the machine building industry in Western Germany.

II.

The machine tool industry of West Germany is highly developed. Its most important feature is its decided medium-size structure. Thus, for example, only few companies employ a staff of more than 2 000. It is not the batch production of standard machines which represents the preferred strategy of West-German entrepreneurs but "custom building" and "tailor-made" equipment.

Many machine tool firms are family-owned and frequently have a patriarchal management structure. This structure has proved its capabilities in middle-size enterprises. The entrepreneur - in many cases simultaneously owner or shareholder - can with this structure ensure better continuity and fulfil his commitments more efficiently than with any other. Moreover, this type of structure makes the middle-size organization unusually adaptable, subject to effective management. The requirements of the capital goods market are thus met in an optimized manner. It is an important feature of capital goods manufacture that this industry does not just supply "machines" but a "return on investment". That is to say, it is not the price of the capital item which is decisive but its profitability. In consequence, the "tailor-made" problem solution, i.e. the special purpose machine offering high productivity, will be preferred wherever the product volume justifies investment in it.

On the other hand, the middle-size company is exposed to special stresses which limit to some extent any co-operation intent and foreign investment.

This is clearly indicated by the cost structure to which an organization producing capital goods is subject:

The cost components involved in capital goods manufacture are as follows:

1. Material costs
2. Direct labour costs
3. Overheads
4. Depreciation
5. Financing
6. Marketing costs
7. Development costs
8. Profit

These cost "packages" are inter-related and depend on company strategy and size.

Basically it is possible to reduce material and labour costs by appropriate efforts in and expenditure on research and development. Similar results can be achieved by amortization and capital utilization, that is to say, by rationalization investments. It will be quite obvious that small and medium-size organizations have to forgo high development and marketing expenses and that they must also keep their capital utilization at a low level so that a medium-size company is subject to limitations as far as capital resources are concerned.

It will readily be understood that the medium-size company has no other choice but to specialize and to go for "custom building", i.e. to practise high level technology and offer solutions to special problems. This is an important feature of the West German machine tool industry. On account of its medium-size structure, capital resources are limited and the facilities for co-operation and investment abroad are therefore restricted to certain forms.

Machine tool building is not structured on a multi-national basis. There are exceptions, one of which is the U.S.A., where the conditions are quite different to those existing in West Germany.

The second important feature of the machine tool industry is its distinct orientation towards exports. In West Germany, this industry exports approximately 50% of its production. The various companies involved are thus aligned to world markets. This factor indeed represents an ideal starting position for co-operation and investment abroad.

I would now like to submit some theories on likely developments in machine building and these may perhaps provide a basis for the treatment of strategy. In this respect please note fig. 1.

Fig. 1.

1. The Federal Republic of West Germany will continue to be an important manufacturer of machinery and equipment involving high-level technology. This can be safely predicted because West Germany has an outstanding core of machine tool experts and continuity in this respect is being

considerably furthered by appropriate training at universities and institutions. On the other hand, the cost structure in West Germany does not favour the production of standard machines. There is no other choice but to produce machines and systems with highly developed technology and sophistication. The reason why "systems" are mentioned at this point lies in the fact that there will be a transition from the special-purpose machine and the transfer line to integrated production systems.

2. The cost problems in the production of standard machines mentioned under item 2 are already manifest in organizations who have hitherto concentrated on standard machines. It has become quite clear in recent years that imported standard machines can - subject to adequate quality - bring cost advantages in comparison with machines built in West Germany.
3. The Federal Republic of Germany will develop into a receptive import nation for standard machine tools because a large market demand will continue to exist for such machines in West Germany. As this demand cannot in the future be covered by our own production, it will have to be satisfied by imports.
4. However, West Germany will in future also become an important importer country for highly developed machine tools and automatics. This applies in particular to major components used in such machines and to auxiliary equipment. This theory is acceptable because highly developed machines are becoming so complex that specialization and a sub-division of effort is unavoidable. Specialization and the sub-division of

work is even now quite noticeable in the component part sector, for example in numerical controls, CNC systems and servo elements. The major part of such equipment is being produced in the U.S.A., or in European production facilities belonging to American manufacturers.

5. We are counting on it that a large group of nations which are currently among the more important machine tool importers will in future become significant manufacturers and exporters of standard machines. Brazil is among these nations.
6. However, we must also expect that large industrial nations like the U.S.S.R., will in future not only export standard machines but also special-purpose machines, major assemblies and elements of such machines. Later on I intend to report on a co-operation example which justifies this theory.

Within the framework of this paper it is impossible to discuss in detail the overall strategy of the West German machine tool industry but I would like to highlight the more important aspects and then deal with the motives and strategies for co-operation.

It is undoubtedly advisable to look at the structure of the machine tool industry on three planes representing the integration of individual components and major component assemblies via the completed machine and finishing with a "system". This situation is illustrated by Fig. 2.

Fig. 2.

The lowest plane shows the manufacture of individual component parts and major assemblies. The wide range of variants of such assemblies on the one hand and the ever increasing costs for mechanical components parts in West Germany on the other are likely to lead to a reduction of manufacturing "depth" in this area. It is a well-known fact that the machine tool industry has in the past aimed at a high degree of integration and manufacturing "depth" so as to safeguard quality and availability, - factors which are particularly important in "custom building".

It is however likely that specialization will occur in this plane and that, at the same time, assemblies built in house in the past will be supplied by subcontractors and partners.

Activities in this respect started some time ago when it was recognized that it is in most cases not worthwhile to maintain an "in house" foundry. Other constructional elements which have been obtained from sub-contractors are, for example, hydraulic valves and copying controls.

Only few manufacturers are developing their own numerical control systems. At present there is probably no machine tool company in West Germany building its own NC systems. However, it is possible that the larger organizations will decide on account of the increasing part which control engineering plays in their products to make certain controls themselves after all so as to retain adequate influence over their products.

It is regretful that there is comparatively little preparedness for co-operation on this plane. Many organizations cannot thus utilize their resources to the full.

The second plane is the true domain of the machine tool industry. Here, concentration is applied to the development of machines and especially to the development of "building block systems", such building blocks making it possible to produce versatile machines in many variants to solve widely diverging problems. An important aspect is the fact that machine tool development is not now seen as formerly as a concentration on a single machine as a "whole" but as a "building block" and a "machine range". Manufacture must be viewed in this manner to ensure that the integration of major assemblies in machines or machine ranges becomes part of basic development work. Thus, in this context, the machine tool is indeed a "system" and the approach results in very important prerequisites essential for incorporating these machines in integrated production systems.

It is likely that a number of machine tool makers will concentrate on work in this middle plane and will buy component parts and major assemblies "out". Such companies can also function as sub-contractors to "system" manufacturers providing they do not compete with the latter. This is an important role for the medium-size firm intent on using its own resources to the full. This intention makes "buying out" of major assemblies desirable and avoids the risks of involvement in the manufacture of full-scale industrial systems.

In the third plane, machine tools are interlinked into integrated production systems. Here, the "system" is the keynote and the machine tool is simply a building block within the system. Added to the machine

tool technology as such must be interlinking, process control, software, monitoring, sizing and adaptive control. Work in this plane must become the preserve of organizations with adequate resources, i.e. organizations capable of sustaining the risks and problems of "system" manufacture. It is impossible for an organization to operate on a full integrated basis in this plane, that is to say, the organization has to collaborate with many subcontractors supplying constructional elements and machines, interlinking facilities and controls. However, the organization has to be capable of providing all essential prerequisites for sophisticated projects of this type.

Naturally, there are companies concentrating on individual planes and other companies who make all three planes their field of activity. However, extensive integration of this kind must not be considered as particularly favourable because it is certain that conflicts with competitors will arise.

Co-operation is possible in any plane. However, it will be shown later that certain sectors offer special attractions for co-operation.

What then are the motives of partners to enter into co-operation agreements and to make investments abroad?

Fig. 3. In this context please note Fig. 3. We differentiate between aggressive and defensive strategies. Among aggressive strategies are the following:

1. Unused resources.

There are many examples of this. The most important is probably the transfer of a production line, which, although mature and tested is incapable of generating adequate profitability. Where a market demand exists in developing countries, this would be a strong motive for entering into a co-operation agreement or installing production facilities. Indeed, starting any kind of co-operation with tested and successful products offers the best possible conditions for such a transfer.

2. A further strategy is the utilization of structure and auxiliary programs in developing countries.

The machine tool industry is among the most important expansion areas of young industrial nations. This is the very reason why governments are creating promotion programs with the object of building up a structure for machine tool production. This is a very strong motive for West German companies to invest in such countries. At present this applies, for example, to Brazil. I shall report in more detail on this case later on, a case where this strategy is being followed by building an entire industrial complex.

3. The third motive is a global multi-nationally orientated growth strategy. Organizations who follow this strategy see their business policy in forming production facilities and companies abroad to provide, on the one hand, insurance against general business risks and, on the other hand, to compensate for cyclic trade fluctuations and crises. This motive is less important for machine tool building.

The medium-size structure does not really allow a multi-national approach.

The second group of motives deals with defensive strategies which include the following:

1. Securing markets, products and rights. Such a strategy is frequently initiated by restrictions raised in the host countries, for example by customs barriers and import restrictions. In such cases, the machine tool maker has no other choice but to enter into a co-operation agreement or to install production facilities unless he decides to forgo the markets in question. This motive is important and has undoubtedly led to a number of co-operation set-ups. The fact that such a strategy can indeed achieve advantages for both partners is discussed in more detail later by way of an example.
2. A further strategy is the balancing of business risks by counteracting cyclic trade fluctuations. In common with all other capital goods, the machine tool industry depends to a large extent on boom and crisis situations. What decides investments is not an existing boom but the assessment of such boom by the investors. It is therefore desirable to attempt to balance the cycles which repeat with a frequency of several years. This can be achieved by production facilities in countries where the boom situation occurs in a different phase position. This again is

a strong motive for co-operation and investment by the machine tool industry.

What then are the most important motives of partner nations for entering into co-operation agreements and for accepting investments?

This can be brought down to a simple formula:

Our partners desire technology, know-how and assistance with the training of experts and skilled personnel for the production of machine tools. In general they demand assistance which enables them to start at the outset at the highest level of development. They are also frequently interested in paying for at least part of the licence fees as well as for machines, equipment and systems with goods produced within the co-operation framework. Moreover, they expect the partner's assistance in the sale of goods.

It will be obvious that the aims of the West German machine tool industry and those of its partners do not coincide and that indeed seriously conflicting interests may exist. The Western countries are hardly likely to be interested in handing to the co-operation set-up their latest developments if this brings the risk of unemployment in their own plants at home.

It can be said in conclusion, however, that even taking the aims of both partners into consideration many possibilities for co-operation and investment exist and that new co-operation examples will undoubtedly develop while existing co-operatives are being improved. This applies where the main interest is not purely commercial and where the salient point is "partnership". Such co-operatives can look forward to a bright future.

III.

I would now like to report on a number of co-operation set-ups which have proved successful so far:

To begin with, let me deal with collaboration through licencing and know-how agreements.

Licencing and know-how agreements of the type with which we are all acquainted are a one-way street. The licensor allows the licensee manufacturing and sales rights for certain limited areas. In most cases, this example does not coincide with the interests of the co-operating partners. They desire compensation by selling back the goods produced within the co-operative framework.

I would like to report on a case which has proved rather successful for my company and its co-operative partner. This involved a licencing agreement combined with a specialization and sales contract. Within the framework of these agreements, our partner - in an Eastern industrialized country - receives the right to manufacture certain models from our product range and to sell these exclusively in his own country. In addition, our partner has the sales rights for our full range in his territory. In so far as our partner's resources permit, he is thus able to fulfil specific user needs and to supply tooling. We assist him by advice and by the supply of special tools.

For models built in the plant of our partner we supply special constructional elements to reduce the problems arising during the starting phase. We

intend to supply certain special components in the future also. The need for co-operation in the area of special assemblies has already been covered by me in the first part of this paper. On the other hand, we shall in future receive component parts from our partner also, that is to say, parts on which he has specialized. As soon as the learning process has progressed further we shall cement still better co-operation by allowing the partner to ship additional assemblies to us. It is even possible that we shall import complete basic machines. In this case we would have to restrict the manufacture of basic machines in our own plants. This is an undesirable consequence which we may nevertheless have to face. However, the co-operative offers facilities for specialization and thus for still more rationalized utilization of production equipment.

This co-operative has been in existence for some years and is a long-term project. Further years will elapse before it is fully mature. At this stage, communal further development of models produced by our partner may follow.

This co-operation set-up is successful both for our partner and for ourselves but a flow of knowledge and experience in both directions has not yet been achieved. This cannot be different in co-operative based on licences. I would therefore like to report on a second case where we have entered into a partnership. In this case, co-operation starts at the product development level. This achieves that patents and experience is brought to the new product by both sides. Here again, the co-operation arrangements are on a long-term basis because the development of a product in the machine tool industry must be envisaged over a period of at least ten years. The first

results, that is to say, the first new machines normally only reach the market after approximately three years.

The development and production aim is a complete machine tool building-block set. As this project extends over the third integration plane shown in fig. 2, it is very extensive. It demands very high preliminary expenditure and effort and these aspects can be covered in an optimized manner by forming a partnership.

Our partners are particularly interested in product experience gathered by us because it is intended to sell the machines both in Eastern and Western markets. As far as development is concerned, experts of both partners work together as a team. During later production, our partner will specialize in certain major assemblies with the accent on basic machine assemblies such as beds, headstocks, carriages etc. The accent in our own production will in this case be in the area of auxiliary assemblies such as control systems, tools etc.

During later sale of the products the markets will be appropriately limited, our partner will supply the Eastern markets and we shall serve the Western markets.

As far as we are aware this is a new co-operation example. Many basic problems still have to be solved. However, we are convinced that our involvement will meet the needs of the type of international co-operation unavoidable in the future and that we are thus making an important contribution towards the development of efficient two-way traffic.

A medium-size company has limited resources for foreign investment at its disposal. To limit the risk of foreign investment, capital utilization must be kept down. It is therefore essential to start with a small production unit. As far as the host nation is concerned individual investments of this kind are of little interest. For this reason, a medium-size company is at a disadvantage with regard to choice of site and availability of finance. Another problem lies in the fact that the manufacture of high-value capital goods - in particular the manufacture of machine tools - demands the availability of machines and systems which cannot be fully loaded during the starting phase. Any investment is therefore subject to capital and depreciation costs during the initial phase. Moreover, a medium-size company will only to a limited extent be able to convince subcontractors that they have to make arrangements in terms of quality and quantity for a new need. These are fundamental problems for machine tool builders because the quality of the final product is largely decided by the quality of steel, castings, tools, work-holding equipment, control systems etc.

Finally, an organization starting with a small production unit is confronted with considerable problems arising in building up the necessary "in depth" know-how of the personnel in the new plant.

Basically, the parent company can provide "supplied items" during the early

phases. However, such supplies are made more difficult by transportation costs, customs duties and limited availability.

To avoid these problems we have drafted a new "model" for foreign investments. This particularly takes into consideration the medium-structure of the machine tool industry as mentioned in the first part of this paper. Again, I would like to describe this model by way of a typical example:

At Porto Alegre, Brazil in the State of Rio Grande de Sul we are building an industrial complex on an area of approx. 60 ha. The site was chosen and developed with the generous assistance of the State of Rio Grande de Sul because this industrial complex is considered as an important structural

Fig. 4 project. Climate and transport connections are optimal (fig. 4).

It is intended to build over an area of approx. 200 000 m². This means that 6 000 to 7 000 people can work in this complex. During the planning stage it was duly taken into consideration that unusually favourable conditions should be created for the people working in the area. These plans include ideal design and planning of working areas, shopping facilities, medical centre etc. Companies of widely varying structure will be settled on the site so that a sound mixture will be present. The sub-contractors of the producing companies will also be settled in the area, for example a foundry, a steel merchant, a heat treatment and plating firm and at a later date a computer centre.

Fig. 5 The company structure is illustrated in fig. 5. The interests of the

industrial complex as a whole are represented by the holding company (industrial complex company). The shareholders are the partner companies. This ensures continuity and ready adaptation of the industrial complex to changes.

It is not the holding company which has purchased the land but each partner buys his own land on which he then erects his plant. However, land utilization is subject to certain conditions which will ensure the continuing existence of the complex. Thus, the partners may not change their business purpose because it is intended to exclude competition in all areas, i.e. sales, personnel and purchasing. (Fig. 6.)

Fig. 6

The industrial complex company (holding company) undertakes the following functions:

1. Management functions:

- site management
- public relations for industrial complex
- representation of the interests of the complex with official bodies and governmental departments

2. Service functions

- canteen, cafeteria
- medical centre
- shopping centre
- banking service
- staff transport

Fig.7

However, the most important feature of this industrial complex is the formation of manufacturing centres shown diagrammatically in fig. 7. Within the industrial complex, every partner specializes on a manufacturing centre, that is to say, he accepts the responsibility for building up mechanical production in a certain area for his own use and that of the partners. In practice this looks something like this: Gildemeister builds up a capable turned parts centre from which the other partners are also supplied. However, as far as large component manufacture is concerned we shall co-operate with one of the partners, namely the partner who has specialized on this centre. In this way it became possible to reduce investments drastically and to improve profitability while reducing risk. Moreover, this model does not restrict autonomy and competitiveness, because, should one of the partners wish to build up an autonomous plant he can do so within the framework of the agreements and guidelines. Similar comments apply to sub-contractors (jobbing shops) who have settled in the industrial complex. They too arrange their capacity to suit the industrial complex. However, it is intended that part of their production is to be sold outside the industrial complex as this will ensure that these firms operate on a market-orientated basis.

The industrial complex of Porto Alegre is being built in an area which in accordance with national plans is intended to become an industrialized structure. Skilled operatives are not yet available. On the other hand, motivation and willingness are high. The problems of industrially concentrated areas such as lack of loyalty to a particular plant and fluctuation do not yet exist and are not expected for some considerable time.

A training program has been started up at technical schools in conjunction with the authorities and this program will provide skilled operatives

and engineers for the industrial complex. The training program covers several years.

The initiative for this project came from one of the future partners, i.e. Gildemeister. This has meant much idealism and pioneering work.

Future projects of this type are intended to start with the formation of an industrial complex holding company. This company can be a co-operative foundation consisting of a German partner and a partner in the host country. Initial development work is then taken on by the holding company. We have gathered such experience in planning the industrial complex at Porto Alegre and this experience will again be utilized in new projects.

It is very important that development is on a long-term basis, say, 5 to 10 years so that the community can develop by undergoing a healthy growth process.

Figure 1.

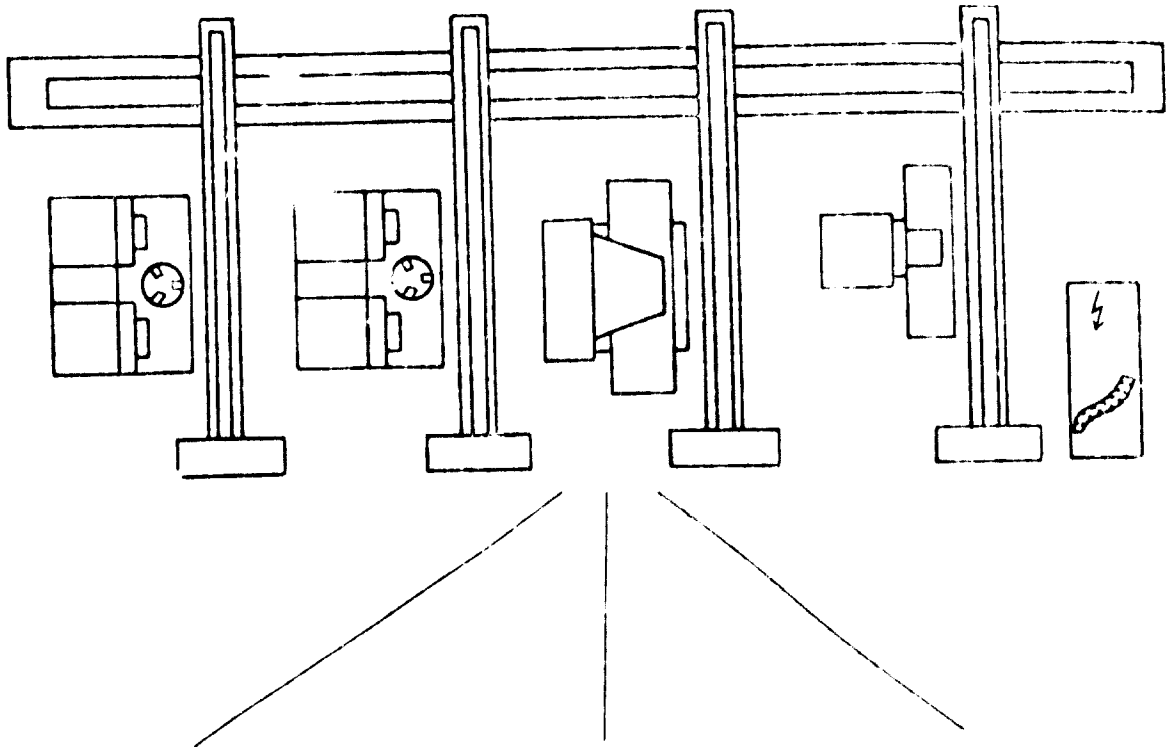
Theories on the development of machine tool manufacture in the Federal Republic of Germany.

West Germany:

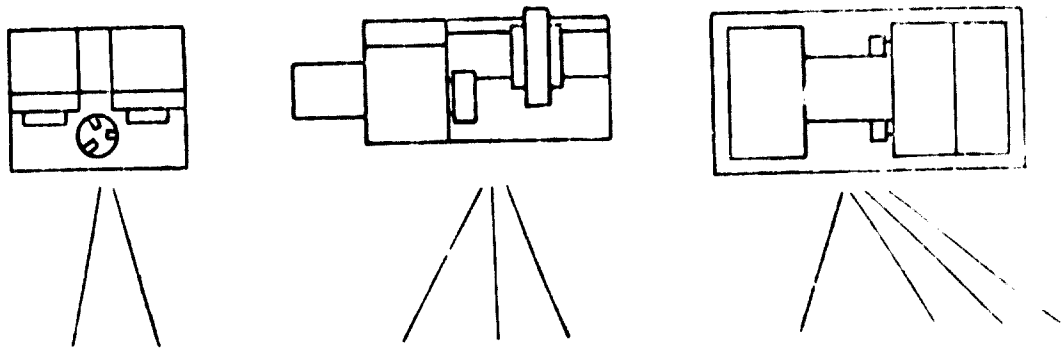
- remains an important manufacturer of machines and systems with highly developed technology
- is likely to be confronted with serious cost problems in the production of standard machines
- will become a receptive importation country for standard machine tools
- will become a consumer country for machines offering highly developed technology and especially for the constructional elements and equipment of such machines (control systems, servo elements, tools)

Figure 2.

1. Industrial and production systems



2. Machines



3. Major assemblies

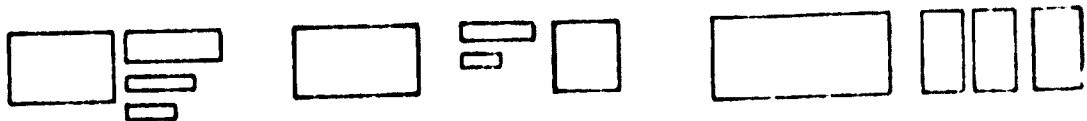


Figure 3.

The more important

motives for co-operative arrangements and foreign investments

1. Aggressive strategies

- unused resources
- structure and aid programs for developing countries
- global multi-national growth strategy

2. Defensive strategies

- securing of markets, products, rights
- overcoming of customs and import barriers
- risk compensation for entrepreneurs by balancing of boom cycles

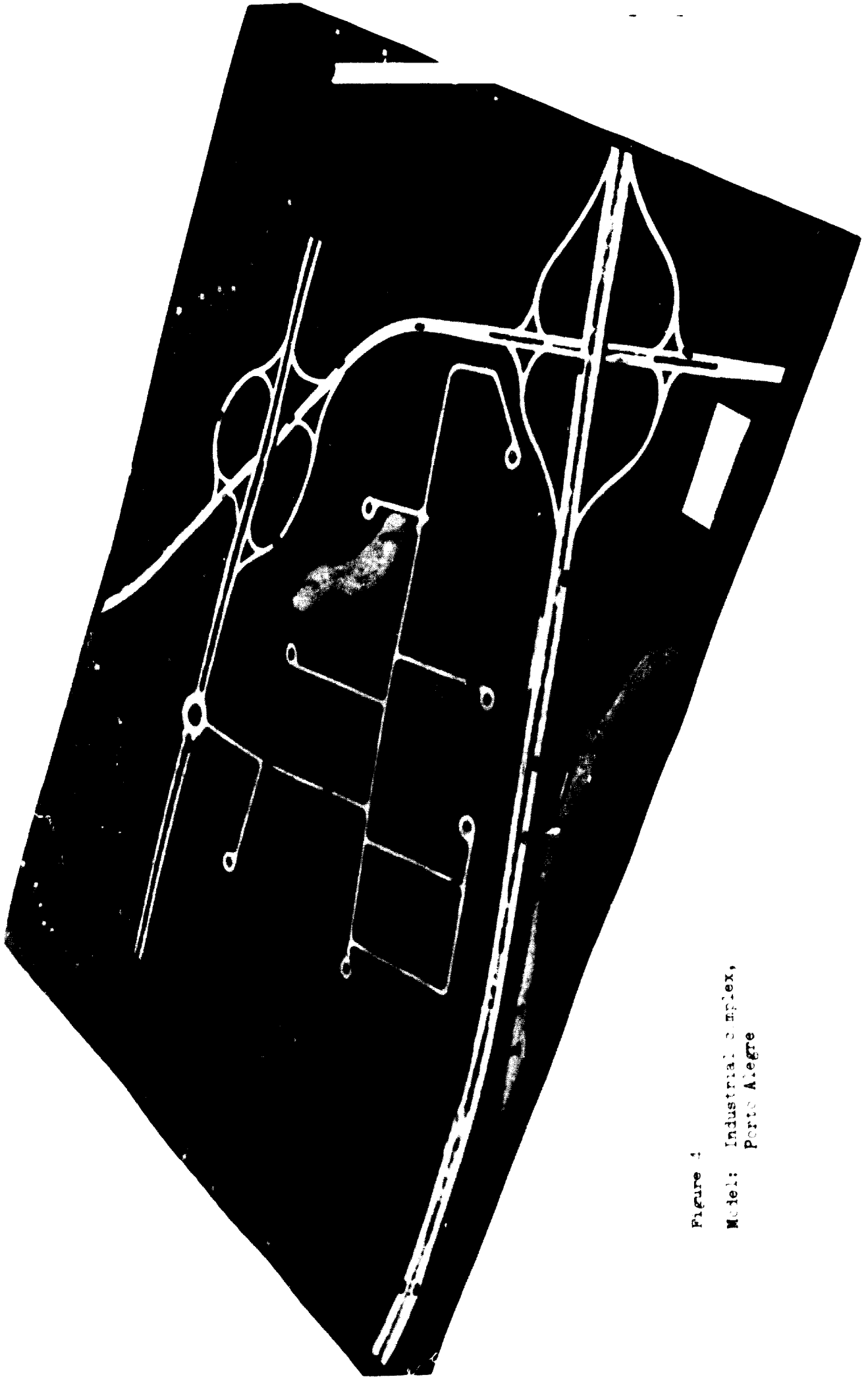
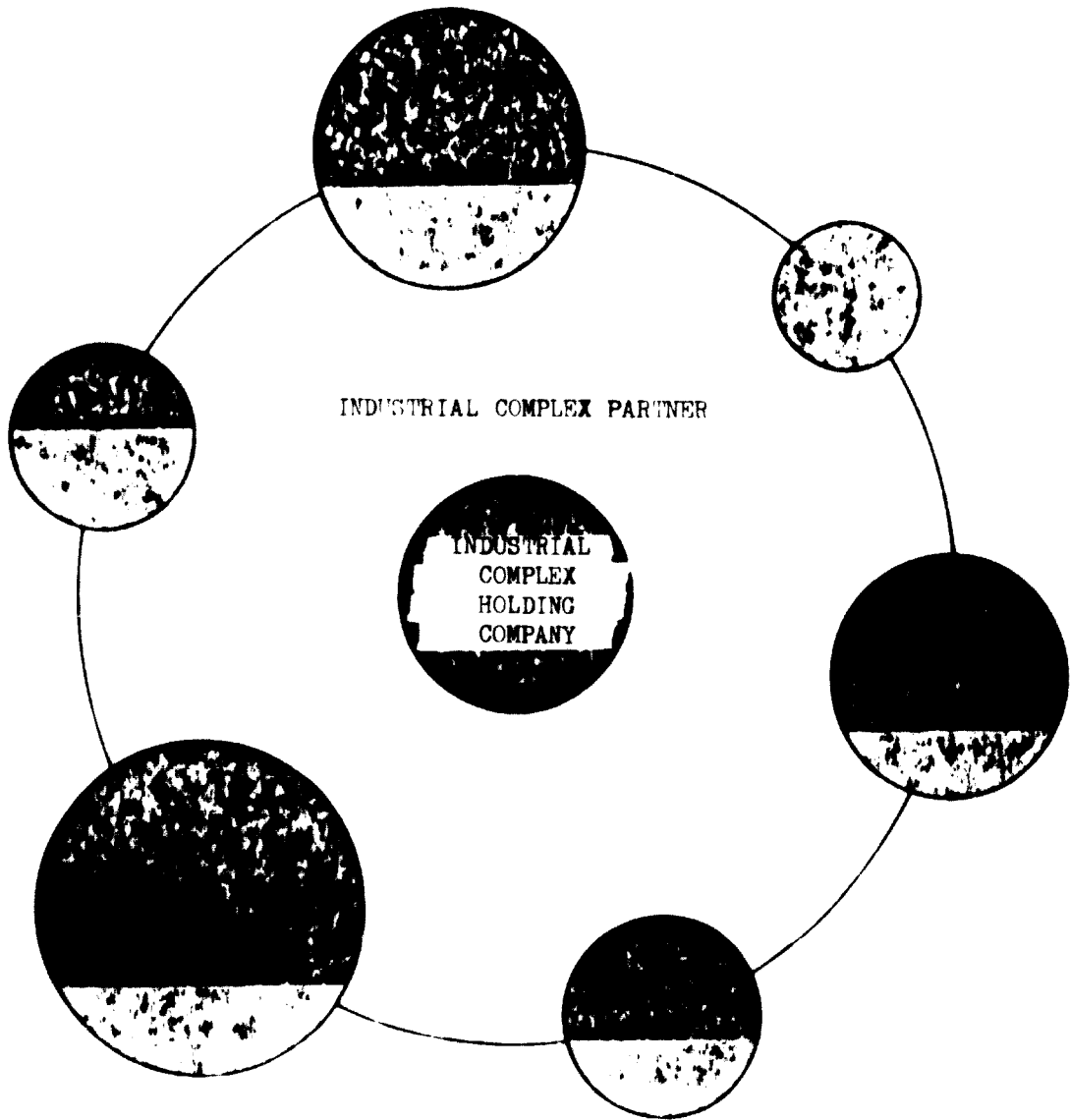


Figure 4
Model: Industrial complex,
Porto Alegre

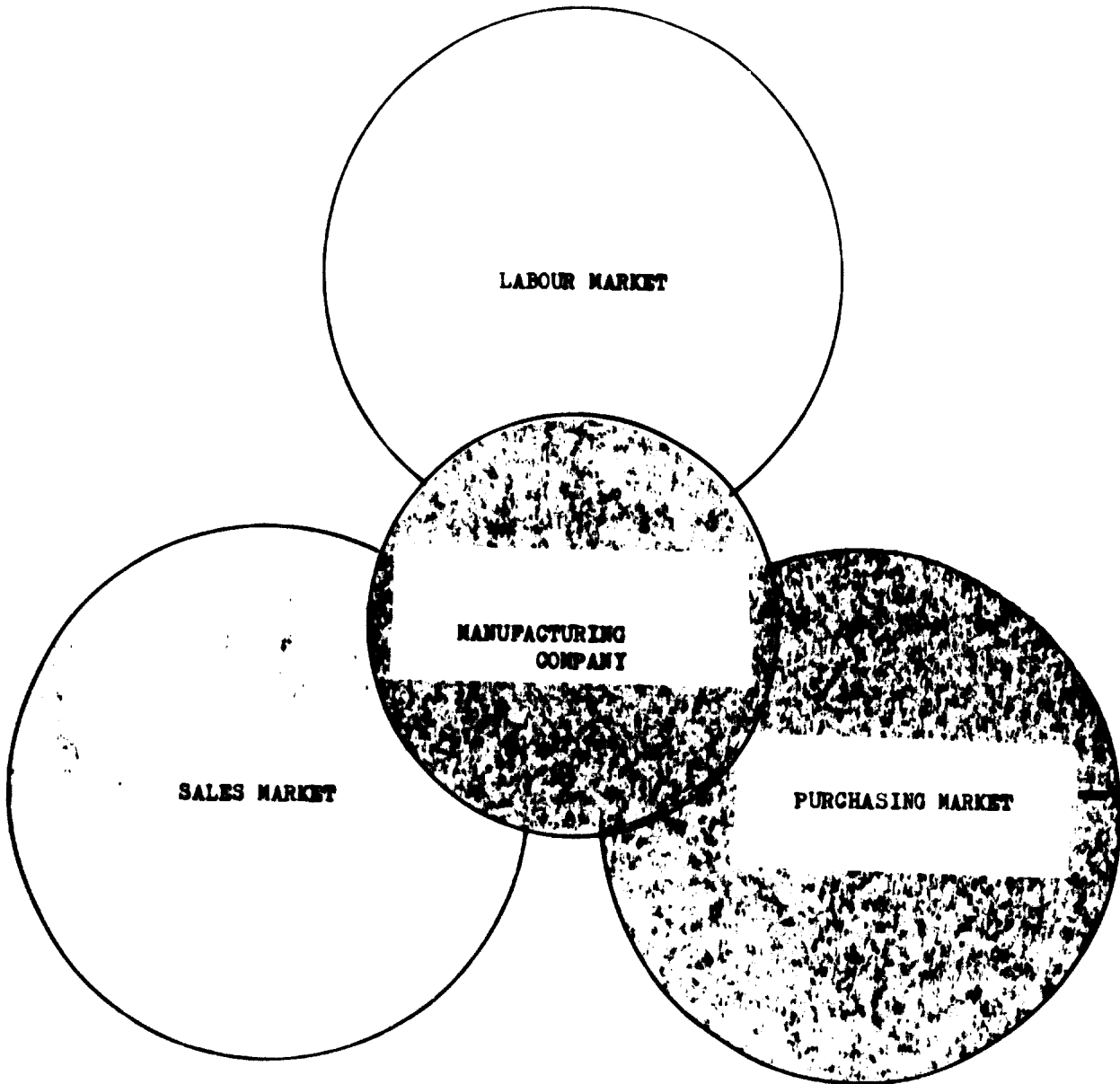
Figure 5.

THE COMPANIES OF THE INDUSTRIAL COMPLEX

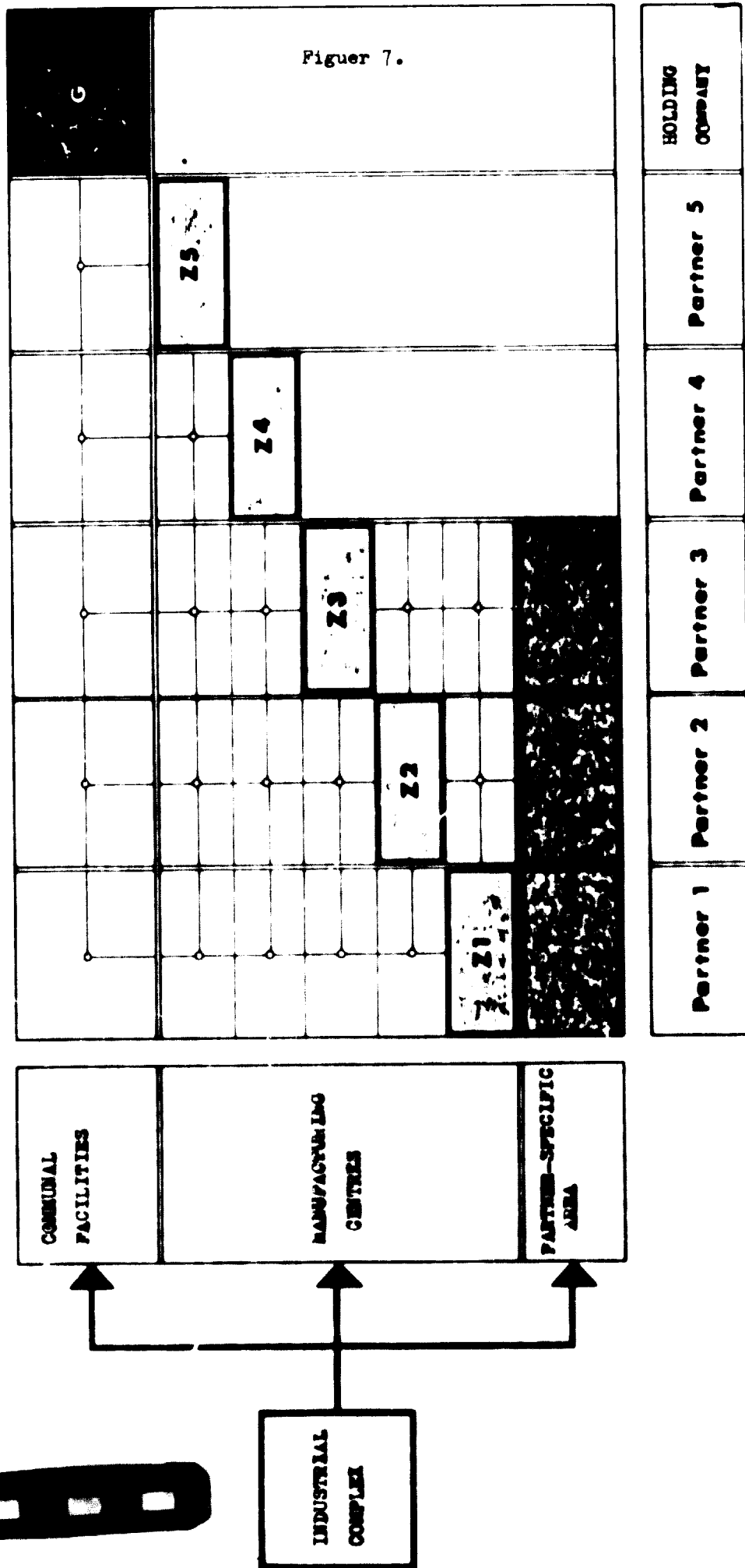


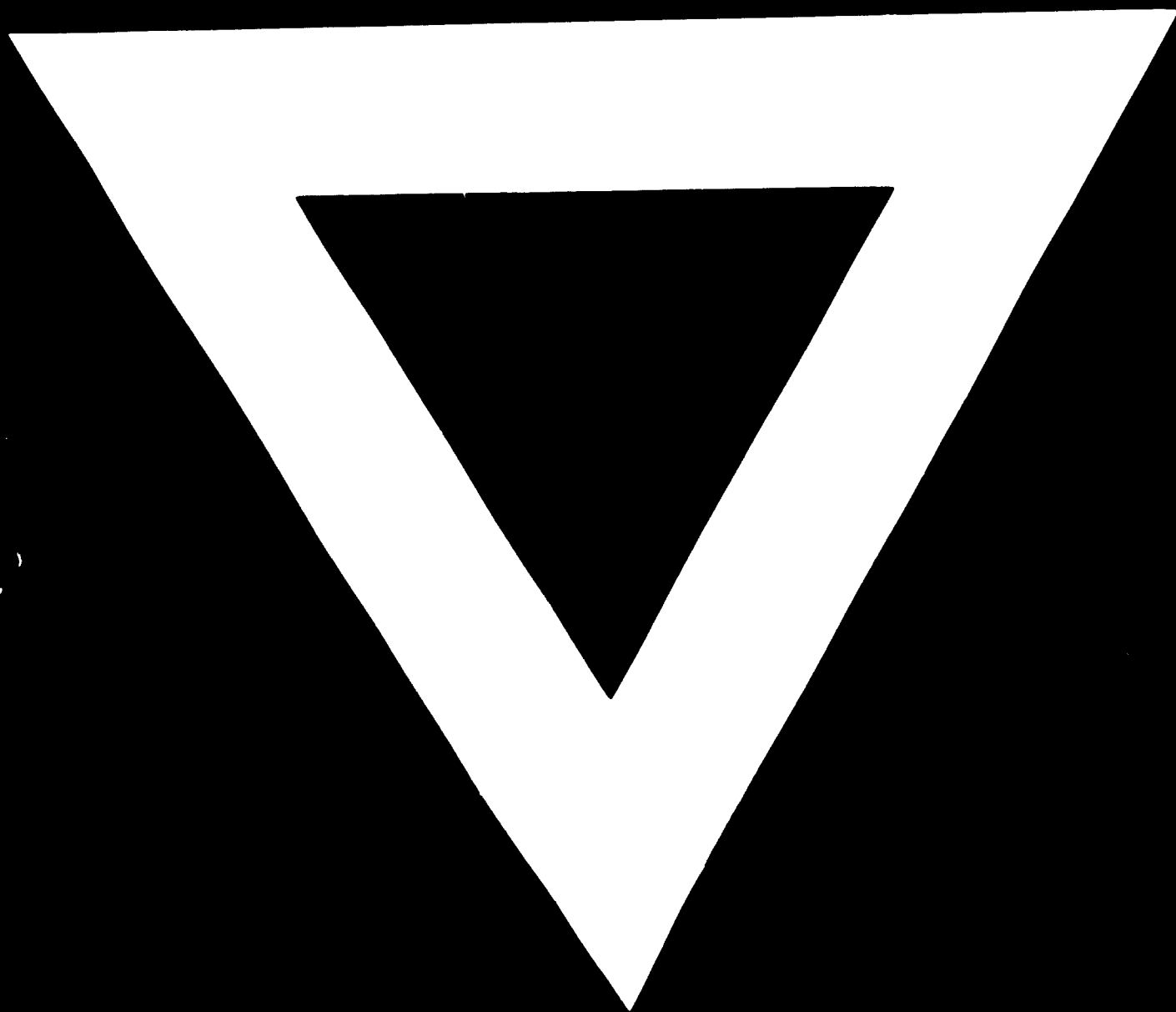
- = INDUSTRIAL COMPLEX HOLDING COMPANY
- ◐ = PARTNER SPECIFIC AREAS
- = MANUFACTURING CENTRE

Figure 6



INDUSTRIAL COMPLEX MODEL
WITH MANUFACTURING CENTRES AND COMMUNAL FACILITIES





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