Transport decisions in an age of uncertainty
Trends in port research

by

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PORT MODELS

Preamble

This contribution is greatly determined by the impressions obtained during visits brought by the author and Drs. H.J. Noortman to a great number of ports of various types all over the world.

Also the preliminary studies made by Noortman and Meeuse, published and presented in recent congresses formed bases for this paper. Because of Noortman's role in this world congress a one man presentation was decided upon.

Introduction

Transport has developed rather spectacularly both in intensity and in scale during the past decades. Only in 1962 Peter Drucker stated in his famous publication "The economies dark continent" with regard to distribution that we know little more about enterprise- or manufacturing levels than Napoleon's contemporaries knew about the interior of Africa. They knew it was there and they knew it was big and that was about all. He proved in that study that almost 50 cents out of every dollar the consumer spends on goods, goes to activities occurring after the goods are made. Furthermore he prescribed physical distribution as the last frontier of cost reduction.

In his often cited book "Le grand espoire du vingtième siècle - Great expectations of the twentieth century - Jean Fourastier characterized in 1947 in a wider scope as Peter Drucker did, transport as a service rendering activity. He distinguished three sectors of production. Agriculture as the primary, industrial activities as the secundary and services as the tertiary sector. Among the immense number of services, transport should be reckoned.

Fourastier was not absolute in incorporating transport and communication in the tertiary group. He states that these activities are of a hybride character and that they may not always stay with the tertiary sector. Though he reckons them now to the service rendering group, he admits that because of the degree of mechanisation and of the analogy to industrial activities, transport can easily escape from the tertiary and be taken up in the secundary industrial sector.

This proves the active character of the transport indus-

Fig. 1

development of transport				
period		past	present	future
dominating		craftmanship	technique	technology
movement	appearance	matter (static)		
	place		matter (dynamic)	matter (cybernatic)
	time		energy	energy
	control			information
characteristics		manual manipulation	transport proces	transport system
transport chain		autonomous links	coördinated links	integrated links in industrial chain
consideration directed on		object	function	function + relationship
field of profession		mech. - handling equipment	mech. - handling technique	transport technology

try. It must however be said that, with due respect to the opinion and to the theories presented by Jean Fourastier, the incorporation of transport activities in the tertiary sector has not done much good towards its development, particulary in the direction of integrated systems.

The developments of transport stayed behind those in industry for a long time and despite an acceleration in this development still the two worlds of transportation and of manufacturing, stayed apart or at least they met insufficiently.

The historical development of transport shows the same three steps as industrial history.

First step

Autonomous activities, characterized by craftmanship and manual manipulations performed by individual workers.

During this past - static - period mechanical handling tools and equipment formed the means to support physical labor.

Second step

Coordinated links of transport and production chains could be formed after energy came available. Production and transport became more and more mechanized. The various activities were no longer considered independent.

This present - dynamic - stage can be best characterized by the concept: technique.

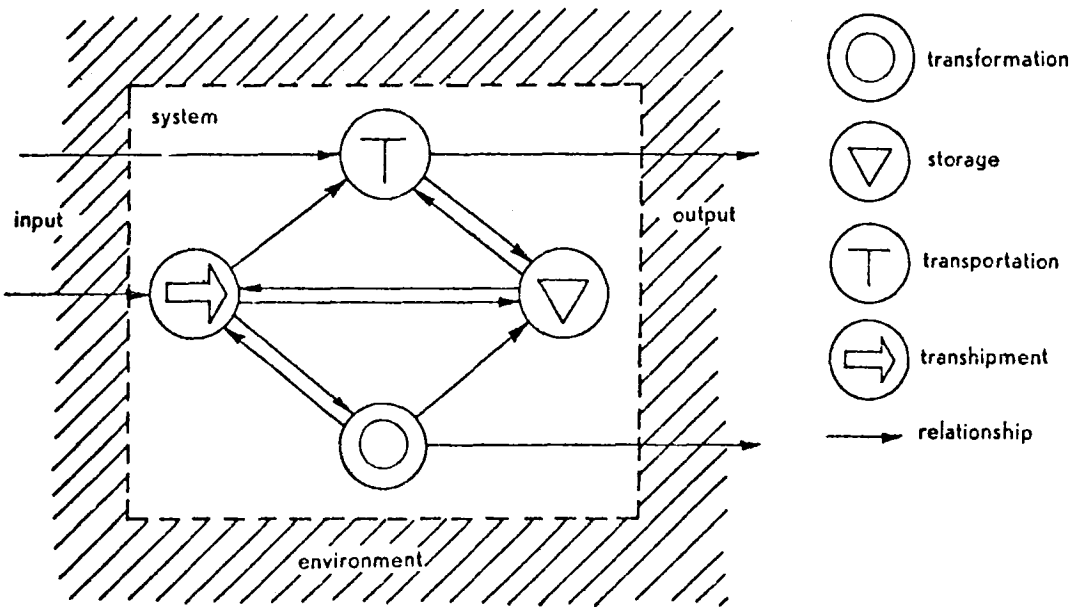
Third step

The introduction of information brings systems into sight.

Technologically speaking: the links of the production and transport chains have to be integrated because of their mutual interdependencies.

In this final and futural stage technology offers a cybernetic control of mass, energy and information. The results are product chains consisting of integrated links.

Fig. 2

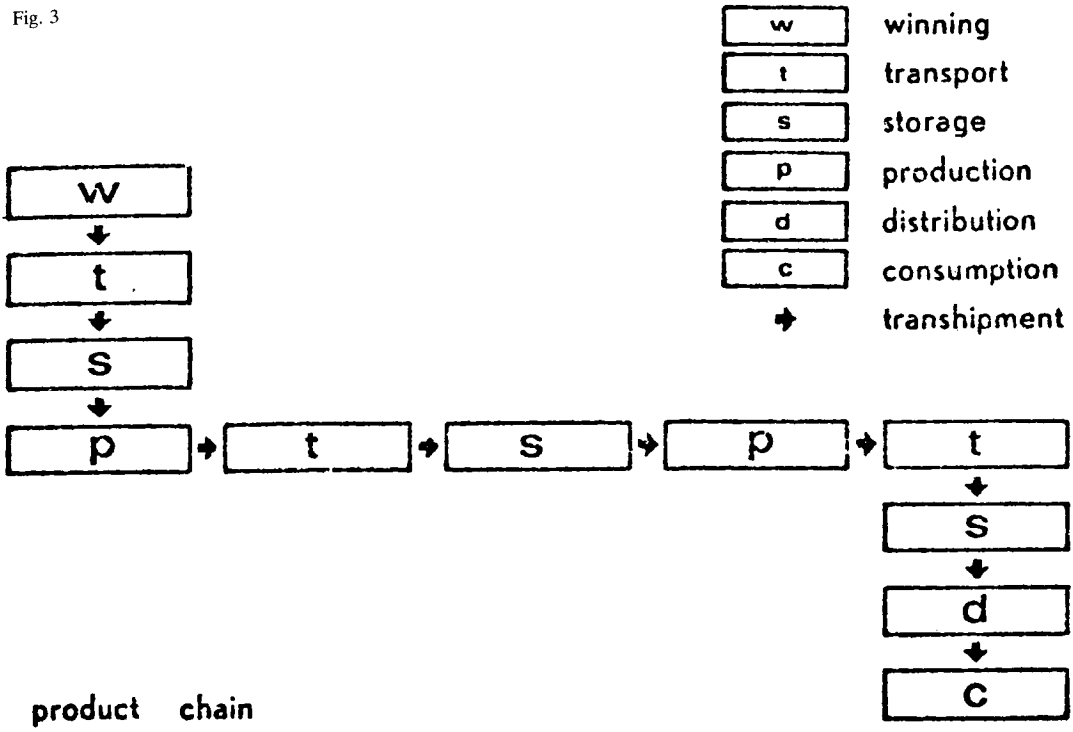


Consequently, technological systems comprise all the activities - both production and transport - necessary to bring products from their origin to their destination; in the right shape, to the demanded place and at the most adapted time.

Together the activities form product chains, in which production and transport are combined and almost alternate.

In fact transport and production should be considered equivalent subsystems of these product chains forming together a technological system. None of the two is subordinated to the other; they are however fully interdependent. In so considering the problems, optimisation can be reached, which is much more advantageous than the usual suboptimae. Nevertheless the problems are of introducing the necessary measures to be taken by various interested parties.

Fig. 3



Ports

Ports seem to receive much interest today, when we look to the number of congresses devoted to terminals and ports. Recently in this same town an international conference titled: "Ports of tomorrow" was held. The interesting question "Must ports lead the evolution or follow it" was dealt with by several speakers. As an introduction to an appraisal of port models in the field of transport research I will give first some observations regarding the rôle and the function of ports taken from my contribution to that conference.

The flows of products pass on their ways from origin to destination several ports, either sea-, inland- or airports, railwaystations or trucking centres. Also the accompanying and synchronised data flows - complementary element of transport processes - have their ports, in which they are transferred, stored and handled.

Observing ports in a helicopter view from various altitudes give a series of impressions. Still on earth one smelled the products handled and saw the silhouettes of carriers and of port equipment. These primary sensory perceptions of port activities indicate some important parameters to be taken into account when studying the phenomenon "port".

After take off first the operational aspects become noticeable, telling something about structure and organization of the field of activities.

Regardless of the equipment used and the methods applied the functions performed are of real importance. This aspect can only be observed after gaining more height, that means more distance.

Functionally speaking a port is but a location where conveyance activities are either completed or where they find their starting point - a terminal of conveyance. For the different types of ports even a specific qualification - a name - was derived from the dominant mode of transport they serve. Such a practice is bound up closely with a restricted, one-sided, view, too often found in ports.

When I urged earlier tor an equivalency of activities within technological systems, e.g. production and transport, I now must admit that already in the transport level there is no equilibrium of power. Too often the main mode of transport dominates all others that meet in a particular port.

Consequently the so called "sealag" of a seaport generally is well developed while the "Landleg" still can be improved considerably.

Similar observations can easily be made for airports, railwaystations, etc.

Port Research

The helicopter allows at last, when flying still higher, for a more aggregated picture showing the principles of transport, or better, of technology, on the location under consideration. Such a picture can only be obtained through a system approach of the transport problems.

The description in accordance with such an approach reads: A port is a location in which products are transfered from one stage within a (transport)system to a subsequent one.

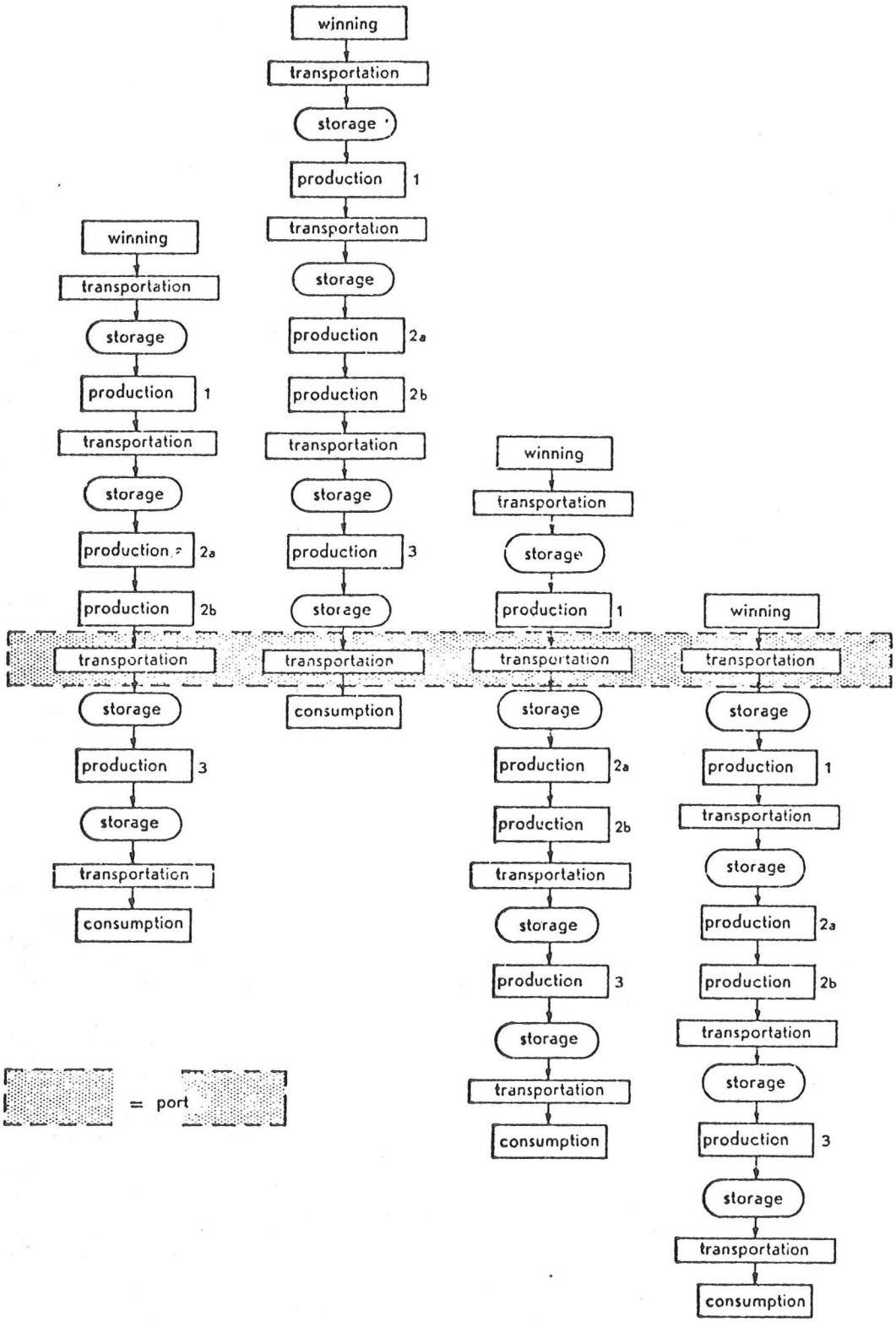
Such a location can be called a terminal and a collection of terminals form together a port. The role of such terminals, whatever type we have in mind, can be visualized as an element of the transport- respectively of the product chains. The ports form the cross sections of the different product chains passing them. This implies that terminals and ports also belong to the basic technological systems and therein form elements.

The position of the cross section within a product chain indicates the degree of completion of the technological series of activities a product has to undergo.

Roughly speaking this can be expressed in terms like: raw material stage, semi-manufactured stage, finished stage.

A more accurate way of expressing this could be found in a technological percentage.

Fig. 4


winning
transportation
storage
production 1
transportation
storage
production 2a
production 2b
transportation
storage
production 3
storage
transportation
consumption
winning
transportation
storage
production 1
transportation
storage
production 2a
production 2b
transportation
storage
transportation
consumption
winning
transportation
storage
production 1
transportation
storage
production 2a
production 2b
transportation
storage
production 3
storage
transportation
consumption
winning
transportation
storage
production 1
transportation
storage
production 2a
production 2b
transportation
storage
production 3
storage
transportation
consumption
= port

Anyway this position should be determined, and particularly changes in that position should be watched carefully.

In the flow of products from less developed areas such shifts, which can occur for a not well prepared observer as a surprise, can be expected.

In a contribution titled "Trends in port development" to the biennial congress of the International Cargo Handling Co-ordination Association held last week in Melbourne, Noortman en Meeuse elaborated this theme much further. In this paper based on the principles of system approach it was strongly emphasized to consider port activities to be part of transport - and finally of technological systems.

The technological completion percentage was there introduced as a magnitude to characterize a port. An other parameter was found in the appearance of the goods, while of course the volumes of the transport flows through the transport chains were given full consideration.

Attention was also paid to the homogeneity of the flows per product and to the geographic location of port activities.

Finally clusters of product chains, for which the ports form a "get togehther" were described.

Similar consideration lead CEPAL - the Economic Commission for Latin America - of the United Nations ECONOMIC and SOCIAL COUNCIL - in February 1977 to a publication titled "The distribution chain as a methodological tool". With the aim "to improve marketing, distribution and transport systems for commodity exports of developing countries, including an increase in their participation in those activities and their earnings from them", some most valuable observations and recommendations have been made.

One of them is the consideration of "transport as part of a broader distribution function, forming a chain in time and space between producer and consumer being an important advance in the methodology of product distribution analysis, because it provides for a comprehensive treatment of all aspects of the process, including physical movement, storage, transformation, brokerage, insurance, banking, regulation and documentation".

A good description of the distribution chain, which I prefer to call a product chain, is useful in a number of ways to aid in achieving the goals.

CEPAL presents a conceptualization of the distribution chain as a methodological tool. Certainly the proposed procedure can serve as "an information organizing scheme which might facilitate the collection and the retrieval of data. As an analytical model it serves as a checklist to assure that important elements, especially those concerning transport and associated services have not been overlooked".

"The model itself is structured in the form of a matrix with eight rows and an undetermined number of columns. Each of the rows - termed "planes" - corresponds to a group of related activities or information in the distribution process between the producer and consumer of a particular product. In turn, each plane is made up of elements, which in the model are called "modules", that form the columns of the matrix".

The eight planes deal subsequently with operations, technology, ownership insurance, credit and payment, regulation and control, documentation and finally process information.

I like on this occasion to complement CEPAL on this important proposition. Further I like to invite interested parties to prove the validity of this proposal through application. Noortman and I will certainly give it full attention and we will record and comment on it in due time.

Systems and models

The three approaches through operations, functions and systems give an increasing level of abstraction.

Speaking on systems and consequently on transport-systems is "in". System-thinking however is more than a common sense approach of every day problems in a modern and rather sophisticated jargon, it is a way of thinking! By applying it a conscious and systematic handling of complex problems it becomes possible, which would present many difficulties if handled by feeling.

In fact system approach is not a recipe, but if offers an expedient to those who acquire it as an attitude. It can be very well trained through application on actual problems derived from industrial circumstances.

In its turn every system taken into consideration is part (=sub) of a bigger whole from which it can be distinguished and separated. The principle keeps off from the earlier mentioned partial treatments, in which relevant qualities are kept invariable.

Quite often it has occurred that technical and technological parameters were in a qualitative sense, kept invariable. The number of tools and implements were thereby taken into account while new methods were neglected. This could result in crooked growth trends in forecastings.

Forecasting and extrapolation are not similar activities. Only to some extent are they connected. Extrapolation forms only an aspect of forecasting but is on its own a rather hazardous activity. Particularly in periods of restricted economical growth, the margin in which corrections can be made are proportionally narrow. Flexibility and being quick at repartee do not help under these circumstances.

To study a system under real conditions and making experiments is mostly impossible. Therefore we have to build models, in which we simplify the complex reality according to our views and aims. Models therefore form an abstraction of the life systems but at the same time through deletion of certain aspects are of a lower level. Consequently modelling includes both profits and losses. This property of models should therefore always be taken into consideration.

The quality of a model is the effectiveness, that is the degree in which the model suits its purpose.

If a model in itself is a system serving to study other more complex systems, it generally will be an aggregation of those systems and therefore will be of a higher level of abstraction.

Prof. in 't Veld gives a survey of models both qualitative and quantitative which can be used, in the circumstances. His ideas are applied on a large scale in the Netherlands and have been published in his book "Analyse van organisatieproblemen". (Analysis of organisational problems). (Figure 5)

The generally expressed preference for dis-aggregated models for decision making purposes - e.g. for real life systems - can only be met if first the coherence of the various elements, their interactions and interdependencies, are considered on a more aggregated level, and from there come down to a zoomed picture through zeroing.

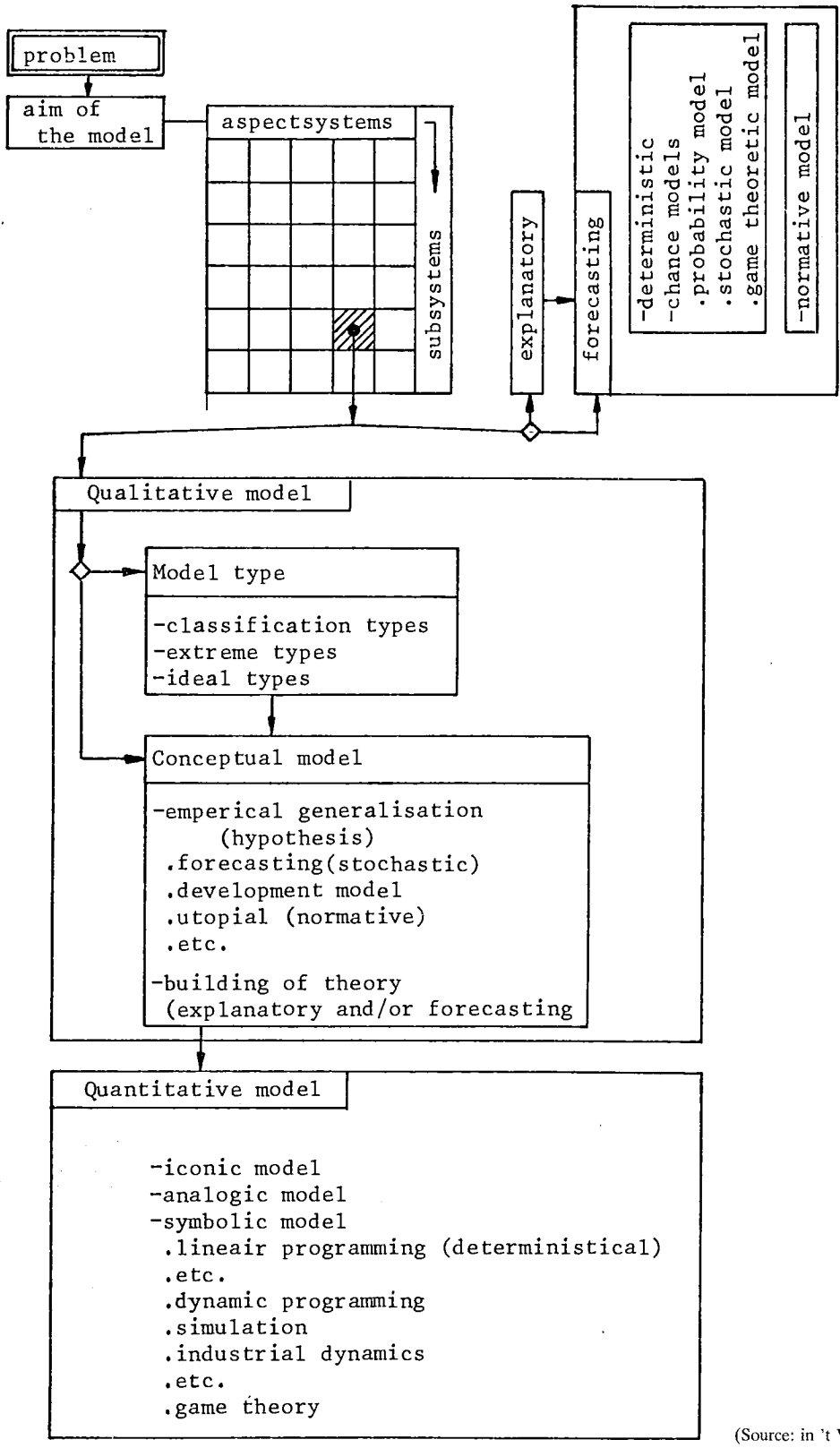
In summing up we must be careful not to take the results of model research too absolutely. Models are but a tool for decision making and too many models have been built already for the sake of modelbuilding only!

Port models

In the congress report of the first international research congress a series of methods are described how to approach port problems.

In my Institution some publicated models have been thoroughly studied. A brief report is presented in annex

Figure 5 - Typology of models



(Source: in 't Veld)

A in terms of goals, structures, methods and fields of application.

When examining these port models it appeared that they reached from static single enterprise models up to dynamic simulation models of regional ports. The level of aggregation is generally low and most models are even of a dis-aggregate type. Only the Dynamo model is of a high aggregation level.

The examined models are not only of differing levels, but are designed for various applications as well. One could put the questions whether still more models have to be built for specific applications or that overall models can be expected to be suitable for most situations.

More and more voices can be heard against the use of large scale models, among those even "A requiem of Large Scale Models". (Mr. Douglas B. Lee Jr., in A.I.P. Journal, May 1975).

Worth mentioning are the ideas of the Netherlands Bureau of Transport presented by Noortman and the author in the earlier mentioned ICHCA-conference (See for schedules Annex B).

These models are discussed at length by Mr. van Es and Mr. van der Wouden in this congress.

Requirements for further modelbuilding for ports

When we consider the trends in port research, it seems that modelbuilders try to broaden the applicability of their models in two ways:

a. by increasing the number of port functions that are taken into consideration, and

b. by enlarging the number of relevant aspects: Technology - economy - ecology.

This form of widening the scopes is of course of great value to the decision-makers that have responsibility for more than one port function and/or aspect.

This way of broadening of the port models leaves however a number of weak points, when evaluating their applicability for policy-making and their properties as policy-orientated models.

In the following these weak points will be considered.

The increase of the number of port functions

Although the relevancy of other functions than the transport function perhaps is understood by modelbuilders, the broadening of the port models in this connection has more the character of parallel running than of integrated efforts. For instance transport and production are considered types of economic activities, that both have significance for the further development of the port areas, but can at the same time be considered competitive with regard to land use. In other words, they are treated in a given geographical port area according their appearance and their characteristics.

A real integrated approach of these two port functions however, asks for a system-approach in which transport and production are seen as equivalent elements of a technological system. Within these technological systems the two mentioned activities add value to the products namely:

- production adds value of shape, whereas
- transport adds values of place and time.

In such an approach for a given port area, transport and production are no longer competitive in asking for land and investment resources. In this approach the port is in the first place a "get together" of a number of product flows, each of which can be depicted as a product-chain. At the moment that these product flows pass a given port, the chains are cross-sectioned at different levels as shown in figure 4.

The integrated approach of transport and production in the first place asks attention for the factors taken into consideration, in the decisionmaking process falling under the heading "business logistics".

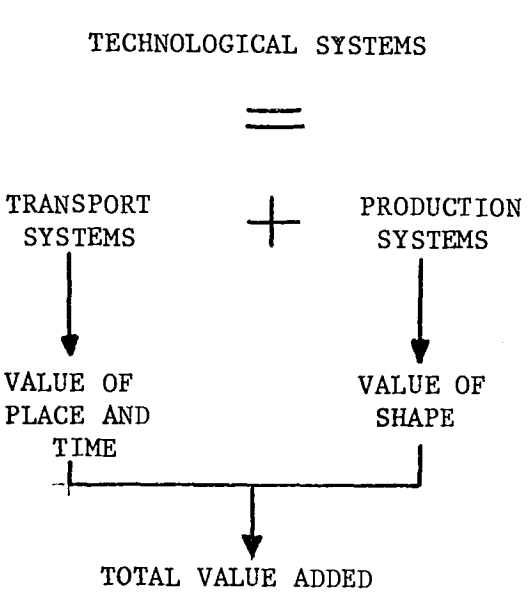


Figure 6

In this system all decisions are comprised that deal with the transportation process. It starts with the extraction of raw materials and it ends up in the consumption of finished products.

What priority or emphasis has to be given to specific production or transport activities at a certain moment in a special port, can only be answered - in that context - when transport and production are evaluated phases of product chains. In their actual appearance these links are often much more influenced by exogene variables of the port than by internal variables.

In the total decisionmaking process for product chains, the decision of the port authorities and of port industries are indeed of strategic importance, they form however only one set of decisions, within a much broader scope.

The enlargement of the number of relevant aspects

The earlier port models were in essence orientated at:

- the transport function and
- the handling aspects as such.

By and by the modelbuilding widened towards aspects like economy and later on also ecology.

Here again it appears however that this approach still is confined and focussed on local circumstances. The trade-off between is technological, economic and ecological variables is primarily port-orientated. What relevance do they have however for any particular port?

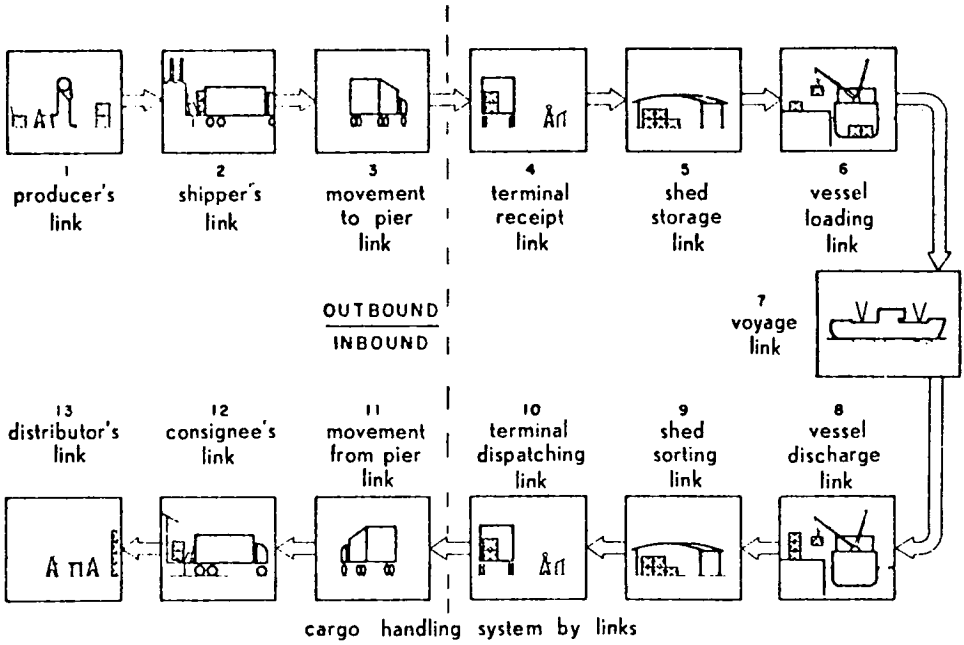
When we see the ports once again as a "get together" of product flows, the dimensions of the model increase considerably.

The relevance of each of the aspects rather than their weight has to be evaluated for each phase in the total dimensionmaking process; this was earlier condensed in the term "business logistics". In doing so, it becomes clear that an approach via the product chains asks for the introduction of even more aspects than technology, economy and ecology.

Decisionmaking for the main ports of the world asks at least for the additional introduction of the political objective to share the welfare between more and less developed countries.

Given the number of employed people in more developed areas, the structure of the economic pattern in such an area is highly influenced by the stage reached in the distribution of economic activities over developed and developing regions. Each shift in that distribution has consequences for the volume of the product, flows passing the ports as well as for the appearance of the goods within these flows.

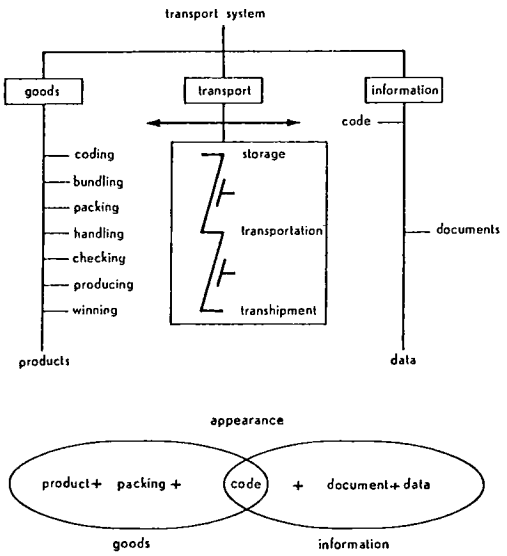
Figure 7



The widening of port models towards (integrated) transportchain models

Port activities generally form a part of transportation clusters. Such clusters consist of several transport activities-storage, conveyance, and transhipment - together comprising transport chains.

Figure 8



The implementation of policy-orientated port models

In the foregoing a further broadening of the port models was suggested. Such a widening has to be realized step by step. From a systematic point of view therefore it seems to make sense to distinguish the main "barriers" that have to be taken:

The widening of transportchain models towards transportsystem models

Transport activities as such are not standing alone. They form part of transport systems in which also other elements than transport have to be taken into consideration. Besides the products themselves, the data that accompany their transport should be mentioned.

The widening of transport system models towards technological systems

This step in the widening process of port models is necessary, when we keep in mind that decisionmaking cannot be optimal when it is limited to transport only. This should be only sub-optimization, because the equivalent production activity should not receive the necessary emphasize. The implementation of the results of simulationstechniques on port models can best be achieved via process planning instead of via target (= final stage) planning.

Technological prospects

Technologically speaking the future is hardly uncertain. Todays designs will be realized and applied within a few years. What is on the drawing boards today will be in practice in the eighties. Depending on the complexity and the magnitude of a project it takes a number of years, from two to seven, to build a future.

Consequently, speaking on short terms, the future is already destined today. Though the speed of development is high sometimes, this need not necessarily be dramatised. Even explosions can be kept under control! Combustion engines and explosion suppressions systems

prove that. If one uses a time scale of the same order as the scale of the processes to be governed, solutions are available. One only has to tune in on the existing process speeds. To run after the facts, to be flexible and quick at repartee, used to be good practice but it becomes more and more a stressing and fatigueing attitude.

Following the developments is no longer a lazy man's practice but can easily turn into a loser's fate. These ideas brought me to answer the question whether ports must follow or lead the evolutions. Because, to my way of thinking, ports which follow the evolutions are asking for trouble.

Next to the rather passive way of following, which suits very well the conventional principles of service rendering, there is the more active form of anticipation. Such a disposition asks for an opinion of trends in development based on extrapolations - or at best - on forecasts.

Along such courses quite some ports were developed more or less successfully. Better and in particular more reliable results may be expected from the participation of ports activities in the technological developments.

I prefer the substitution of "anticipation on" by "participation in" technological processes, so expressing the degree of control and of uncertainties.

How can this be done and what are the consequences? For all naïve observers technological changes appear sudden. Still there are signals from which such surprises can be foreseen. It must be granted that such signals are not always obvious because they are often not readily available, and are not lying upon the surface. Still it is worthwhile to trace them because substitution or shifts may, as has been said earlier, have unpleasant effects particularly when they take place unexpectedly.

Such technological accidents can be avoided if one is not frightened by them. Once again: explosions are only swift processes which can be controlled if feedback and steering can be made faster.

As an example of such a surprise the changes in the appearance of cargo is worth mentioning. This "goods-explosion model" shows the trend from "manloads" into unitloads en bulk-products. The historical growth of cargo flows through the port of Rotterdam proves this trend.

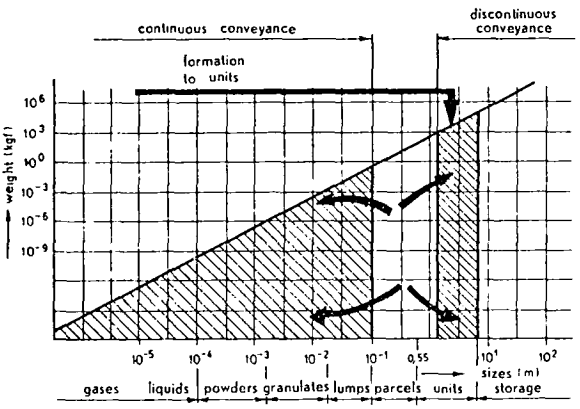


Fig. 9

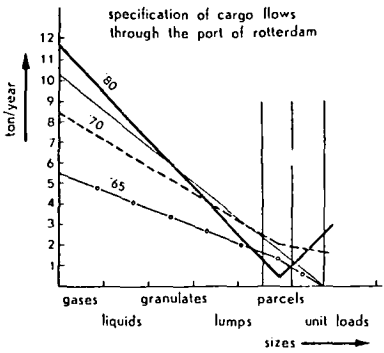


Fig. 10

Ports set up in accordance to the principle of participation have properties deviating from conventional ports.

The application of function analyses and of the principle of disconnection of different functions e.g. transhipment, conveyance and storage, open ways for advanced lay outs. Particularly the location of storage with respect to the quays can change drastically. I do know of some rather exceptional cases, in which ports really gave lead to the evolution. In those cases ports have chosen for some business logistic activities.

Business logistics can be defined as: the process of managing all activities required to strategically move raw materials, parts and finished inventories from vendors, to enterprise facilities and to customers.

Ports keeping stock of certain products chains really can lead the evolution!

The margins of uncertainties

If there are some remaining uncertainties the question arises if these can be quantified and kept between certain known limits. Therefore the transport properties relevant of these factors must be determined and particularly the role they can play in decisionmaking must be known. If one considers the control of transportation activities as an optimizing process, transport forms an element of a technological system. Therein transportation and transformation are of the same order.

On the level of the management of enterprises one enters then the domain of business logistics. Then not only the place of certain functions and ports within an overall technological system is determined.

In the process of decisionmaking this includes the number of variables to be taken into account dependent on the time-span, the time-horizon, that one has to take into consideration at a certain moment. Even the importance of the role of a port depends on the time-horizon.

The longer the period we take into account the greater the number of relevant variables and the more complex will be the model. The closer the time-horizon the more limited the number of degrees of freedom. The more we zero in in terms of time, the more options will be left out and the more the number of relevant variables of decisionmaking is reduced. This does not mean that the decisionmaking process on short term is easier than that for long term.

It is true that for long terms the number of variables to be taken into account is relative large, however most of the variables are very well quantifiable with respect to their relevancy. In preparing decisionmaking on short terms the number of variables to be taken into account might be smaller but they are less quantifiable. This can be caused by the fact that reactions on changed external circumstances can not be sufficiently predicted. This introduces uncertanties-the responses on certain changes-

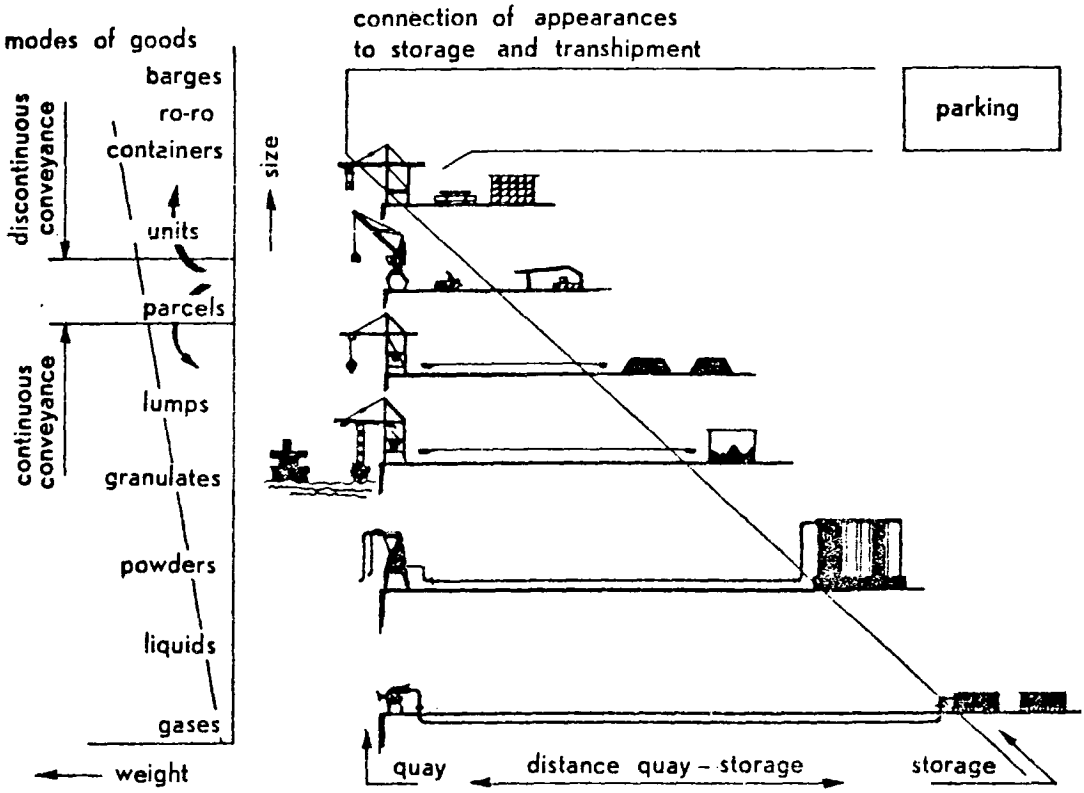

modes of goods
barges
ro-ro
containers
units
parcels
lumps
granulates
powders
liquids
gases
weight
discontinuous conveyance
continuous conveyance
size
connection of appearances
to storage and transhipment
parking
quay
distance quay – storage
storage

Fig. 11

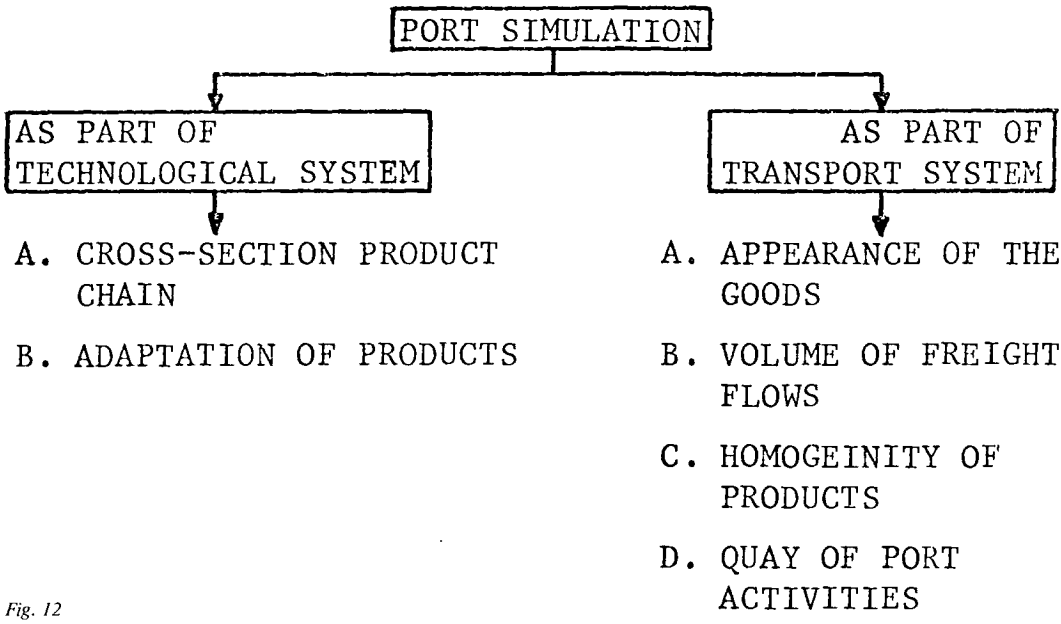

PORT SIMULATION
AS PART OF TECHNOLOGICAL SYSTEM
A. CROSS-SECTION PRODUCT CHAIN
B. ADAPTATION OF PRODUCTS
AS PART OF TRANSPORT SYSTEM
A. APPEARANCE OF THE GOODS
B. VOLUME OF FREIGHT FLOWS
C. HOMOGEINITY OF PRODUCTS
D. QUAY OF PORT ACTIVITIES

Fig. 12

and an element of "gamble" in the decision process. Here the engineer and the economist, preparing transport decision within the scope of wider technological processes, are beginning to feel their uncertainties. They principally based their approach on expected patterns of conduct, which were more or less rational. This supposition appears to be realistic when it concerns a hypothesis for conducts on long terms; on mid-range and short terms such a clinical approach can lead to fully unrealistic results. No matter what the exactness of the calculations, if they are based on a supposed rational pattern of conduct, their results do form an insufficient base for decisionmaking in problems for short- and mid-range planning. For these planning horizons the change in the pattern of conduct between now and the moment on which the rational factors for decisionmaking are dominant again must be taken into account.

This means that for short and mid-range effects important deviations from long range effect must be expected. In this respect time lags should be introduced. We start on the expectation that on long terms the pattern of conduct will adapt itself to the expectations, which can be derived from the calculation based on hard data. The actual conduct shows a deceleration caused by hemming factors with regard to the final expected conduct. These factors are determined by vested interest and these are pure human.

One can speak of psychological resistence to break away from the familiar conducts. Such situations can be elucidated by many examples. An example in the field of transportation, worth mentioning, could be the figure of the loads to be containerized given by the introduction of containerization.

In literature and in discussions two figures were mentioned: the potential containerisable loads and the expected containerized loads in a certain year. Differences between those figures indicate the time lag to be taken into account in the process of decisionmaking, which was dependent on the time horizon under consideration.

Besides the fact that habit and conduct are a second nature to men, the mentioned time lag is caused by the presence of interests, which in turn are a function of our society. These interests are mostly of a financial, economic nature. The decisionmakers in the transportation field may not have the illusion that the corrections to be made on the long term in order to come to short and mid-range decisions can be easily derived through the simple introduction of factors of resistance. In the sphere of transportation we not only have to take into consideration hemming forces, but depending on the geographic relation, also accelerating forces. The latter occurs in transportchains between the developed and the developing countries. The span of time, that can be derived from a simulation model, in which the input is exclusively originating from experiences in developed countries mostly needs corrections. This wil not lead always to decelerations, but on the contrary can easily lead to accelerations in the process of changing over. If vested economic interests work retardingly on the effectuation of change in the pattern of conduct and on changing economic and social relations, considerations of prestige can on the contrary accelerate this process.

It will be clear that a too early start of a new concept is equally dangerous for an enterprise as a late response on exogene changes. Consequently preparation of decisionmaking in the domain of business logistics is certainly more than clinical simulation based on the pattern of conduct of a homo economicus.

It should be studied what the retarding and the acceleration causes are, which act on the reaction pattern depending on the span of time to be taken into consideration and depending on the relevant geographic relations.

I hope that in the above mentioned thoughts it is made sufficiently clear that simulation as a support for decisionmaking cannot be put on a par to the application of a number of calculation rules. The fascinating facts of simulating models might be that we try to predict the pattern of response of human beings behind and against technological processes in a stylised form. In this respect it is important to consider the place of integrated transportsystems within the wider scope of decisionmaking, that is to say transportation being an element of a total technological system.

In the earlier mentioned conference of ICHCA held in Melbourne last week the author and Noortman gave their thoughts on a transport simulation model which suits within the frame of reference just being sketched.

Appraisal

It is the author's firm belief that for the sake of "anticipation on" or better for "participation in" future evolutions, transport systems must be considered an integral part of larger technological systems.

An appraisal of what has been achieved until now can be best given as the report of our helicopter pilot. His views allow for wider horizons and for more neutral evaluation of port research depending on his altitude.

He observed ports as the links in social and economic relations between people with different backgrounds and in differing stages of development.

Though it might not or hardly be possible to change things overnight it certainly is not unrealistic to direct todays decisions towards the presented visions and goals.

Port models tend to be either operationally oriented, e.g. applicable in todays jobs, or they are focussed on vague futureal situations as the crystal ball shows for the year 2000. These two extremes make port planning easily trivial.

What are needed are port simulation models in which feedbacks are supplied between decisions of today without the dollars-budgets that can be spent there, and the long term objectives, based on long term planning without limits set by actual financial barriers.

Thereby we must not pretend to substitute existing procedures drastically but to supplement and to modify them.

New is the train of thoughts leading from autonomy via coordination to integration on as wide a level as possible.

Systems approach does not longer allow for reactive policy but includes new ways towards anticipating policy or better, decisionmaking on the equal basis of participation between transport and all other activities.

This includes a change over from link-to-link decisions towards a worldwide social and economic integration process.

In the outlines of the conference under topic I, four questions have been put. My answers to these questions can be short and I hope clear.

1. What key decision will transport decisionmakers face in the near future?

Answer: Integration through system thinking.

2. What key decisions were faced in the past?

Answer: Coordination through process study.

3. How has research influenced these decisions?

Answer: By the detraction from autonomous activities.

4. How has it failed?

Answer: By the simple extrapolation of trends.

ANNEX A

Survey of four transportmodels

In preparation for this contribution a study was made in my institution of published transport models. In this annex four models are briefly described in terms of goals, structures, methods and fields of application.

1. The deepsea-containerport model

Goal:

the aim of this simulation model is to estimate the dimensions of an import container stack based on a number of suppositions concerning throughput, and custom operation times. It is assumed that there are no interactions with the export containers. Because a changing throughput is applied, and consequently a changing demand for facilities, this model can be best qualified as a pseudo dynamic optimization model.

The model structure:

the model is of a low complexity level which can be seen by the number of its components. This is the result of a limitation of the transportation functions taken into consideration. The reduced number of elements is not caused by the aggregation level of the model but more by the fact that a number of parameters have been neglected.

The methods:

the method used is that of a static simulation model for a single purpose port. Though not explicitly mentioned it is clear that the container traffic between two continents formed the basis of this model. For a certain terminal-capacity the operational costs are determined for a series of throughputs.

The field of application:

this model has a rather limited field of application. The model deals only partly with the transport function of a port, viz. the transport of containers. The advantages of this simplification are that the model is rather tangible and that it can lead to applicable conclusions for a container terminal operator.

2. The port simulation model: PORT-SIM

The aim:

the model aims to get hold of the staying, waiting and working times of the various port components in order to describe the port functions. The model is based on a given capacity of goods handled.

The structure:

the model contains a relatively low number of elements. The level of aggregation is low because no efforts are made to cluster the elements. Nevertheless it can not be qualified of a disaggregate level. For that, the model is kept too global and quite a number of details are even not being dealt with.

The methods:

The model can be best typified as a static simulation model of a multipurpose port.

The field of application:

the model is in the first place mentioned to be an expedient to indicate the appropriate port configuration for a given offer of commodities and ships. The model is not suitable for "fine tuning", because too many details of the port operations have been deleted.

3. The UNCTAD-model

The aim:

a. the optimization of methods for transport and commodity handling in ports and hinterlands, in order to obtain the maximum contribution in terms of costs to the growth of the national economy.

b. The elaboration of a research program for the determination of the problems of ports and their hinterland based on a set of statistical data.

c. The elaboration of a set of programs to correct imbalance in the concerning transport system.

The Unctad model consists of a simulation model dealing with the technical aspects and of an optimization model dealing with the economical aspects of a port.

The simulation model aims to specify the handling times for commodities and ships. The optimum to be determined by the optimization model does not necessarily co-indicate with the technical optimums. The optimum achieved can be best qualified as a dynamic optimum.

The structure:

the Unctad model is a rather complex model, that can be derived not only from the magnitude of the program but also from the number of subsystems to be applied. The activities pilotage and towage, the activities day and shifts, the activities high and season indicate already this complexity. The structure of the Unctad model is quite open, while a number of qualities and properties are determined outside the model. The level of aggregation is that of a dis-aggregate model, because the totality of the port operations is as detailed as possible and no clusters are considered at all.

The methods:

the Unctad model can be best qualified to be a dynamic simulation model of a multipurpose port.

The field of application:

the Unctad model has a wide field of application and can be applied for several situations. One has to keep in mind however when one wishes to take decisions for investments based on this model that the model is restricted to technical and economical aspects only.

The pro and cons of the various other functions such as the living conditions, industrial interaction and quality of life aspects have to be evaluated seperately.

4. The dynamo model

The aim:

a. to simulate and to forecast the developments with respect to three aspect systems (viz. the technological, the economical, and the quality of life system). With regard to four functions of a port (viz. transport, living, service rendering and industry).

b. to consider the relevant interdependencies between the aspect systems and the functions.

c. the influence of the decisions and the supposition on forecast.

Basically this system can be focussed on any goal one wishes.

The structure:

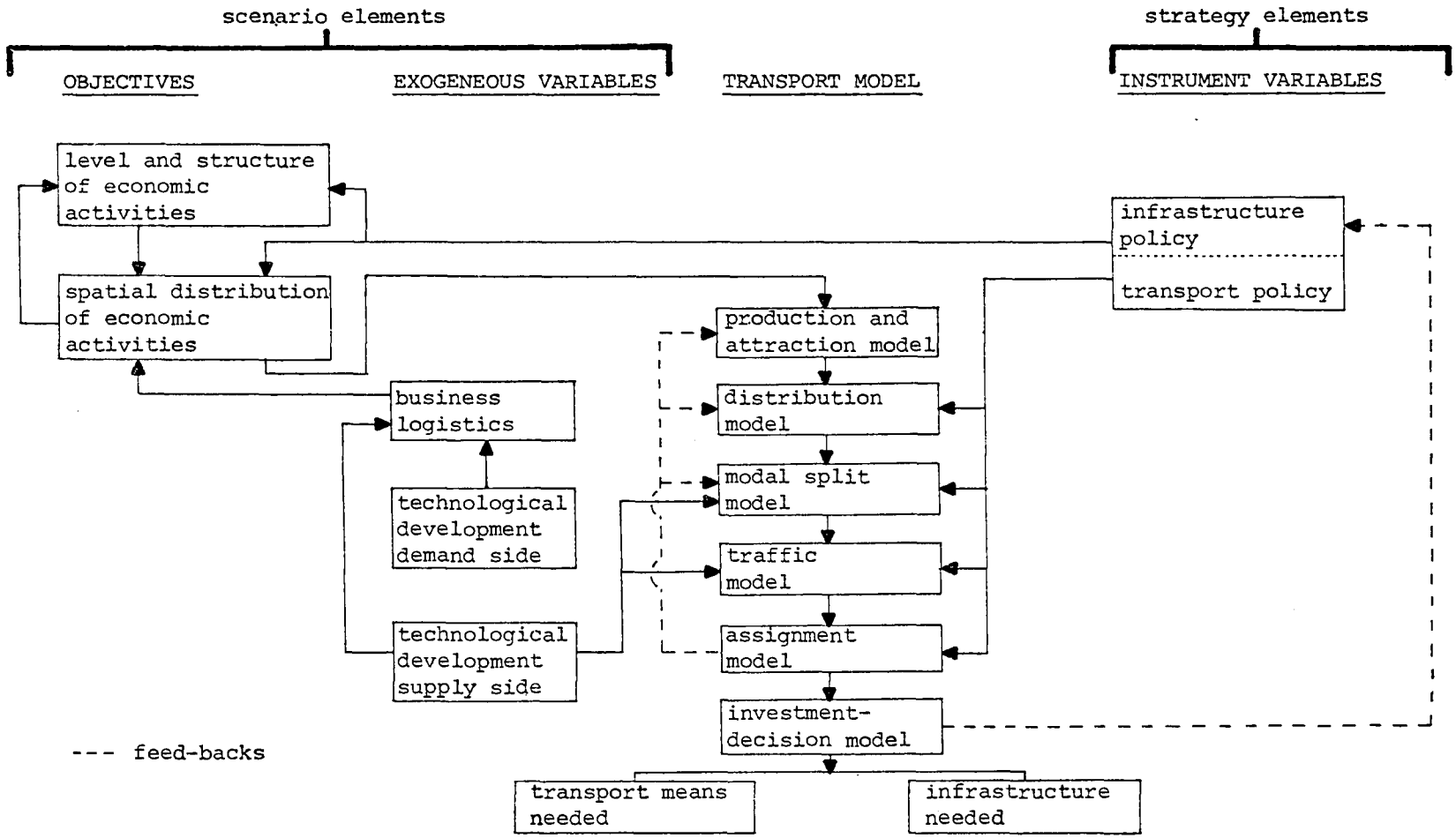
the dynamo model is a very complex model with an open structure. Because of the comprehensiveness this model is highly aggregated.

The methods:

only this model can be best qualified as a dynamic simulation model, because a connection is made between the industrial growth and the port configuration and because the industrial dynamic methods are applied.

The field of application:

in principle this model applies for regions, which are depending on a port and consequently one has to be careful in introducing the necessary restrictions. There are already a number of restrictions and premisses from which the model has been derived of which a number are less realistic under circumstances.



Source: Netherlands Institute of Transport