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Transport, mobility and changing working conditions

Forces behind industry's localization, architecture and production design, 1950-1970

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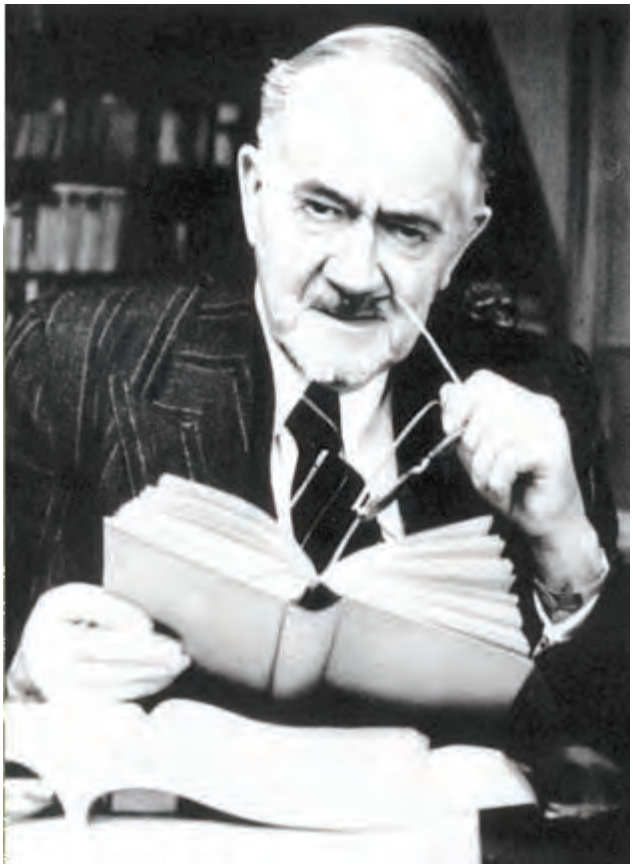
This article is about working conditions and industrial location. Though its examples have been taken from the Danish context, similar trends can be readily found in foreign contexts. In Denmark, and perhaps as well in other countries, local conditions have meant that the evolution of working conditions vis-à-vis industrial location has happened a little earlier or a little later; some areas have had unique processes caused by local



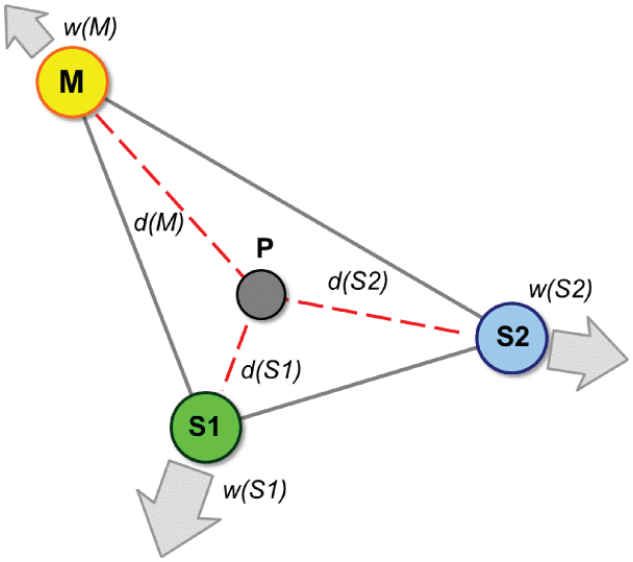
Alfred Weber (1868-1958) is one of the leading theorists of industrial localization.

historical conditions, but, in the big picture, these are all examples of the same development. Changed possibilities for industry localization formed a significant basis for a revised framework for industrial construction, and thus, for working conditions. Therefore, I will start by reviewing the background of industrial location during different periods.

At their inception, industries were located in cities near key transport facilities and manpower, which, as we shall hear, was also the case with newer industries. However, the most mechanized and energy-intensive production had such a huge need for artificial energy that these industries had to be situated near hydropower. Hence, we see that mills, paper mills, textile factories, and many other industries were established at major rivers. In Denmark, there is a coherent industrial area north of Copenhagen around a mill stream, as well as other similar industrial plants in streams. Often, there was no labor near industries, but local labor could be attracted by the industry, then by the developing city, and eventually born from the initial manpower. There could thus arise entirely new urban communities around the plant, as was the case at the Silkeborg paper mill, the Frederikværk metal industry, and the Brede and Hellebæks textile factories.[1]

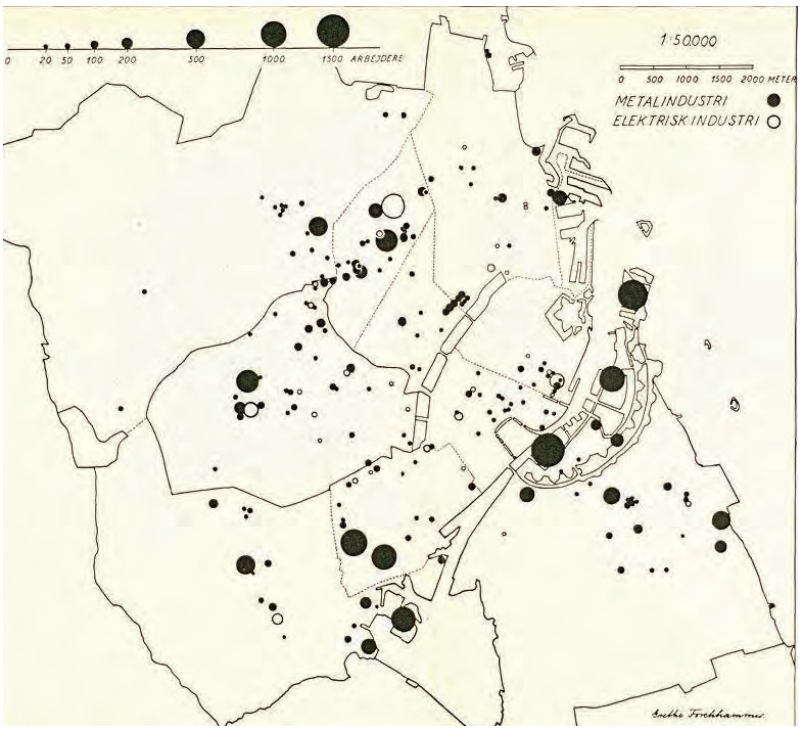
Many of Denmark's major cities have arisen at water-rich streams, and industry has had a particularly strong incentive to use water power in these cities because they also benefitted from the city's population as labor and its disposition for traffic with easy transportation via ships. Thus, for example, big cities, such as Vejle and Odense, already had major grain mills near harbors.

As a factor for localization, hydropower engines disappeared as the steam engine gained ground and eventually became widespread. If an industry had no particular need for large



According to Alfred Weber's theories the optimal location of an industry could be calculated mathematically from the location of the raw materials, the factory, and the market.

Substantial industries were originally located near a port or rail. The picture shows the center of Copenhagen in 1935 and highlights the metal and electrical industry (from Forchhammer 1948).

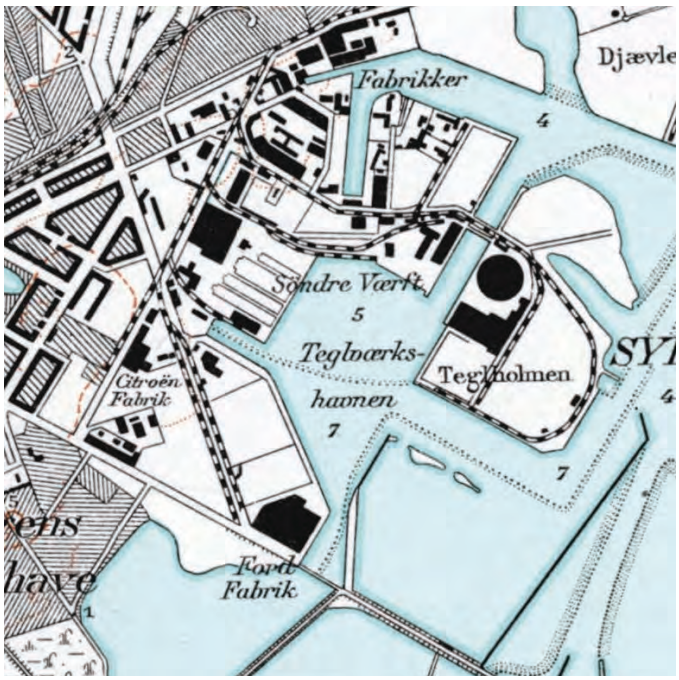


quantities of water or to be near raw materials, it could theoretically be placed freely. However, industrialization was often practiced in preexisting cities where there were both labor and the required transport—mainly shipping.

But soon placement tended to prefer good rail connections. Ships could provide the necessary coal for steam engines, but when power plants began to appear, needing to be near coal transport became outmoded. Industries could then be positioned freely within a larger radius of the power supply. As Weber wrote, energy had become ubiquitous, and was thus discontinued as a localization factor.

I'd better introduce Alfred Weber (1868-1958), brother of the famous sociologist Max Weber, who in his works deals with a basic theory of industrial location. Alfred Weber was one of the theorists in a German tradition rich with ideas about localization, and in his masterpiece from 1909[2], he establishes a theory of industrial location in which transport is one of the main economic elements for placement, along with cheap, skilled labor and agglomeration (that is, approximate to today's business clustering). By analyzing a given industry in these three dimensions, it is possible to calculate an economically optimal location within a geometric triangle, for which the three points represent the location of raw materials, the factory, and the market. If raw-material weight decreased substantially during the manufacturing process, a location close to a mine site would be the natural choice, while the opposite—an increased weight—would prompt a location close to the market, as has happened, for example, with the manufacture of soft drinks. The transport economy, however, would have little bearing on localization if both there were a need for specialized labor and the transportation cost per unit was low.

If we look at what's happened, we see that companies have largely followed these laws. For example, we can look at the capital of Denmark, Copenhagen, which in 1935 contained more than half of the country's industry.[3] That same year—1935—there was a cataloguing of all businesses, so when we look at all manufacturing companies with more than 20 employees, the picture is clear; businesses are located at good transport links. They are often located near a port or railroad; the best are situated both with port and rail nearby, from where their raw materials were delivered by ship, their manufactured goods driven forward by rail. All examples have good road connections, but very few are located without a port or railway nearby.



One of Copenhagen's industrial estates, which provided access to port and railways. "Ford Fabrik" is the Ford car assembly plant. Map from 1945.

In the Copenhagen area in 1935, there were 22,300 industrial enterprises with 43% of the country's industrial workers. Only smaller companies do not have to prioritize taking advantage of a nearby port or rail. Let's look at the few exceptions among the major industries.

In the food and beverage industries, there are a few large companies close to the actual center. They are chocolate factories, which see an advantage in being near the approximately 2,000 retailers in the capital. In the textile industry, there are relatively many companies outside the said location. There are knitting and hosiery factories close to residential areas with a rich female labor source, and there are older industries originally established far outside the city limits but which later had neighborhoods built around them. The same location near the female workforce was also part of the footwear industry and partly of the capital's porcelain industry.

The clothing industry, with their large workrooms, were condensed together with the graphics industry, often located in the city center close to customers as well as shops with rapidly changing fashions respective to printing tasks for administration and business enterprises. Similarly, there were also some great furniture stores, which had a market orientation close to the main street outlets. Two older phone factories were still down in the city center, but they somehow had similar locations due to proximity to customers. Plus, their longstanding position on the ground or moving into former industrial buildings gave a kind of historical "path dependency"; however, they soon moved. These were the exceptions to the major business units, which were mainly transport-oriented.

It is interesting to see that industry outside of metropolitan Copenhagen in 1935 was largely absent, with the exception of industry located at the ports of Copenhagen and Hellerup and the old industries located at the Mølleåen (i.e., 'the Mill Stream'). Even through good rail connections outside the metropolitan Copenhagen there had not yet been established industrial areas near railway stations. This was opposed to the areas established inside Copenhagen at Valby Station, at the Central Station, at Frederiksberg Station, and near the former freight rail station in Nørrebro. There were only a few companies in the suburban municipalities of Glostrup and Gladsaxe, while all other cities with rail connection in the region show a complete absence of industry.

The Roads' Excess Capacity

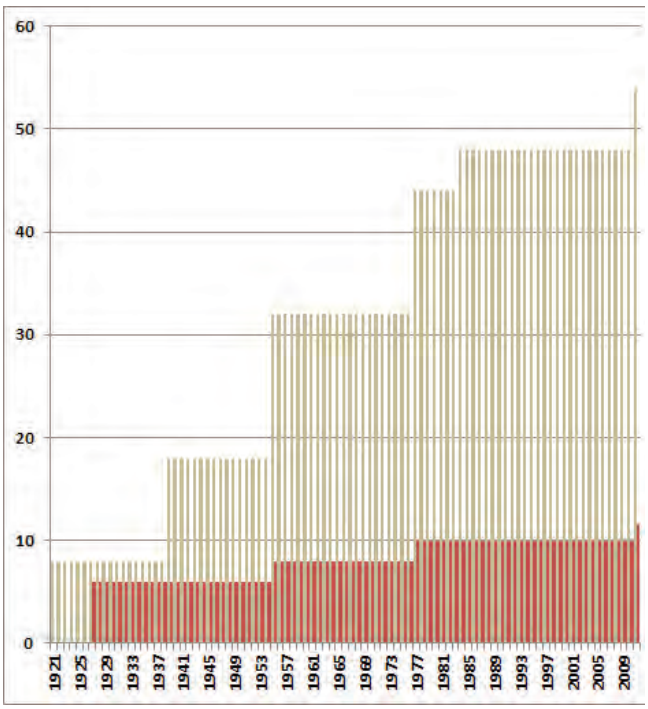
When roads had been repaired after World War II, they could handle a very high level of traffic. Actually, the roads offered, at least for some years following the war, a capacity that exceeded the amount of vehicles that could use them. Roads were slowly but steadily expanded into a higher-quality network. With each year, a smaller proportion of the country's roads were refurbished or newly built, and their quality was slowly raised through the use of asphalt. Asphalt had already been used in the years before the war, but the amount of asphalt was minimal compared to the large quantities being increasingly used. By 1946, more asphalt by far was already being used than in 1939; by 1955, asphalt consumption was more than 1946's figures by six-fold; and by 1960, almost tenfold.[4]

Asphalt meant much more pleasant roads, and to a certain extent, also meant increased carrying capacity since frost damage was minimized because the dense asphalt surface prevented water from seeping into its underlying layers. However, the big increase in road capacity happened not until after 1960. This increase is of particular interest to industry transport relying on heavy vehicles, which cause abrasion on the roads equal to the fourth power of their weight. (That is, in principle, the wear of just one heavy lorry weighing 12 tons causes the same wear from 160,000 small cars). Great theoretical insight was harvested thanks to the scientific results from large-scale trials of the impact of lorry influence on the roads: for example, the large AASHO study in USA for which heavy trucks drove around the clock on some road segments from 1958 to 1960. In time, new roads were constructed in a completely different way, where gravel and sand created a stable base for the top layer being driven upon.

Maximum-weight limits were increased during the same period in several stages. In 1955, the maximum permissible load was increased from 6 to 8 tons. Though the increase does not seem like much, the difference is linked to a strong increase in the overall weight limit for a truck with a hanger. While great revolutions have not occurred in the field of road construction in relation to the maximum permissible weight, there have been changes in truck technology, which caused major revisions of the weight limits. One of the major new structures for trucks emerged due to the use of a new type of tire—so-called 'low-pressure tires' and popularly called 'balloon tires' after their resemblance in shape to Zeppelin balloons. This tire type had appeared as early as 1923 and within a few years became the standard for all passenger vehicles. It was not until the 1930s, however, that tires could be built to carry heavier trucks.

Most trucks in Denmark were smaller, such as this Bedford from DSB, the Danish State Railways. Notice the double wheels that distributed the truck's weight on the road.

The use of balloon tires meant that the weight limits for the wagon's laden weight could be significantly increased by 1939, when a car train's maximum weight was increased from 8 to as much as 18 tons. Low-pressure tires were not the only new technology, however. Equally important was the development of trucks built



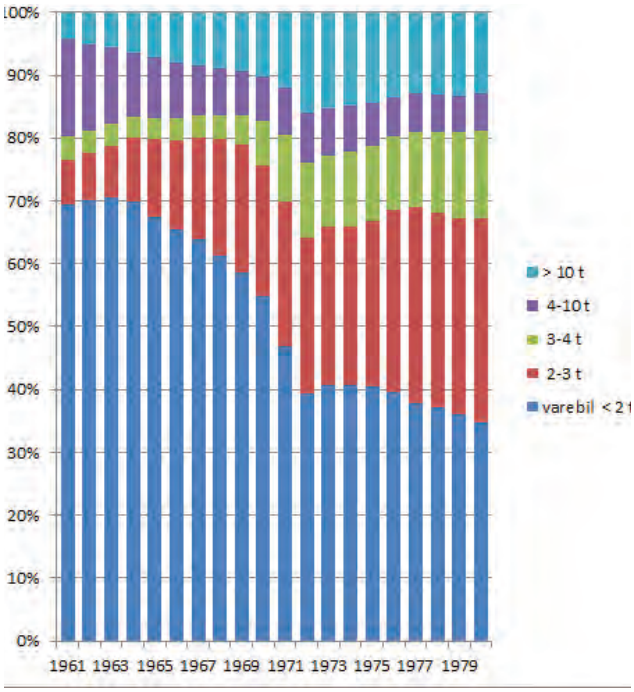
Weight limits in Denmark.
Dark brown indicates the maximum allowable pressure for a shaft. Light gray indicates the total weight of all axles. The increase from 8 to 18 tons in 1939 lasted through the war, became 32 tons gross vehicle weight in 1955, and finally 44 tons in 1977.

Chief industrial routes were not highways, but small, ordinary roads such as this. Since the 1930s, trucks were equipped with low-pressure tires (i.e., balloon tires), which were relatively gentle on the roads.

with their weight better distributed on the road. This development could be achieved by increasing the number of wheels, hence trucks with rear axles of four wheels to distribute the weight became standard. At the same time, the number of corresponding axles broadened and could similarly be fitted with four wheels per shaft. Later, more powerful engines made truck trailers possible, and new brake systems were simultaneously introduced to allow stopping the trailer without deteriorating the safety.

In only a minor part of Denmark could trucks exploit the rules to the maximum. In 1951, only about 5% of the actual trucks over 2 tons could theoretically run with a combination of the permitted total weight of 18 tons. When the total weight maximum was raised in 1955, there was still only a small proportion of vehicles that could handle a weight near the limits. Thus, the proportion of vehicles able to fully exploit the new limit of 32 tons was still at 5% in 1962. Capacity was, however, greatly increased by the addition of new trucks with moderate load capacities. The only growth from 1951 to 1962 was the number of main vehicles by 50%. If trailers and the growth in the average size of wagons are included, the capacity increase at the 10-year anniversary had probably more than doubled. In 1964, another strong increase in capacity occurred, because the motorway speed limit for trucks was increased dramatically—to 70 kilometers per hour. This meant that vehicles could travel even further and thereby increase transport capacity without it costing more than marginally, given a slightly reduced fuel economy.

There was also a great deal of transport innovation regarding efficiency in many areas. Wasting time with loading and unloading cargo was sharply reduced by the use of new devices, which will be elaborated later. There was also much rationalization regarding a better organization of transport. A return load could theoretically halve the cost of transportation if the trucks were full loaded on the trip home as well. Many manufacturing and trading firms reduced or completely abolished their own fleets and instead let professional road haulers take over transport. Plus, transportation could be further improved if vehicles were loaded up to the optimum.



The truck's importance has increased in proportion to the growth of the maximum weight limits.

Labor Came to Move

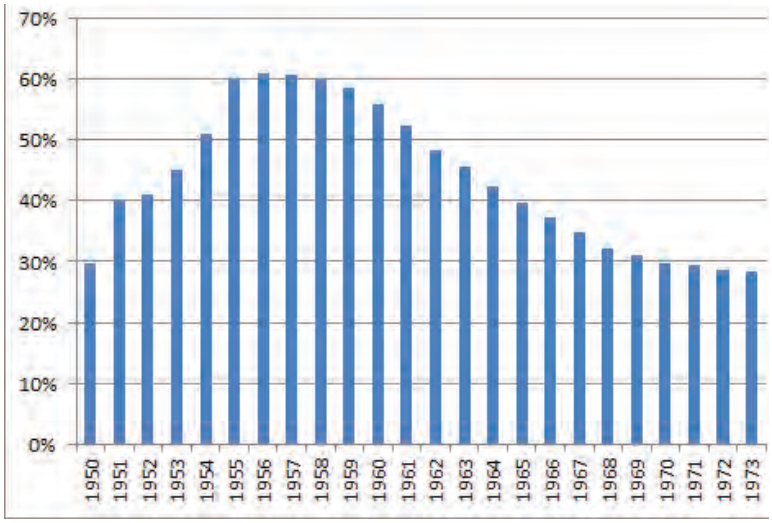
In the theory of Alfred Weber, workers did not move; the industry moved after labor. In Weber's mathematical models, labor was localized at certain points.

This static view of labor had to be seriously reviewed during the postwar years. Public transport consisted of a fairly dense network of bus lines and, in metropolitan areas, an expanded railroad network. There was also the electric suburban rail line, the 'S' Train, which from 1934 was continually developed with Copenhagen at the center of the routing. Contours for the 'S' Train's development were outlined in the first Danish urban development plan in 1947, "The Finger Plan," in which the evolution of urban growth occurred out of the "fingers" of existing and future S-Trains with the center of Copenhagen as the "palm" of the hand. The wedges between the five fingers were to be reserved for agriculture and recreational purposes.[5]

This movement was further enhanced by a motorization of the general population. When the Danish economy had fully recovered after occupation, powerful motorization occurred. Similar to the first pioneer period during 1900-1920, two-wheeled vehicles dominated. This time, however, there was not so much an increase in the number of motorcycles, but instead, the small moped for one person. In its first year, it was a "bicycle with an auxiliary motor," but it soon became a specially designed vehicle. Many of these vehicles were imported from Germany, where the occupying powers had banned the production of larger vehicles with engines of 60 cm3. When these smaller vehicles became available for purchase in 1951 and could be run with a license much easier to acquire than a proper motorcycle license, the number of purchases arose astronomically. The motors of these vehicles, however, had to have a maximum of 50 cm3, and their top speed was only 30 km/h.

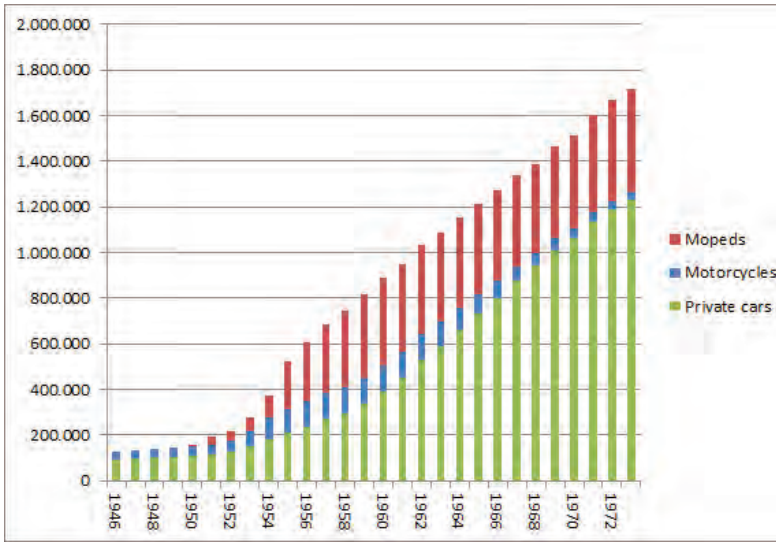
With the influx of mopeds, the workforce became truly mobile. More than half of the vehicles were two wheeled during 1954 to 1961, and the figure rose in 1956 and 1957 to over 60%. A moped license could be acquired by people as young as 16, so apprentices and young workers could drive to jobs far from their homes. The amount of mopeds purchased increased for many years, but when the economy was very strong, employees increasingly acquired cars. Until 1980, there was a steady increase in the number of cars, while the proportion of two-wheeled stabilized slightly below 30%. Motorization happened naturally around big cities where people could be driven to work. At the same time, motorization also occurred in the countryside where agricultural mechanization rendered many agricultural workers redundant. By means of a motor vehicle, the worker could now drive to a workplace even if it was very far away in the nearest big city.

Workplaces could now be placed far from the workers' residences. It should also be mentioned that relocated industries were gradually able to attract labor from new housing estates built in cities, which relocated people to large, modern housing instead of to older, smaller, and dilapidated properties.



Two-wheeled vehicles out of all private vehicles. They dominated for several years and constituted at least 30% of all private vehicles. They mainly served as transport between home and work.

Number of private vehicles; Denmark.

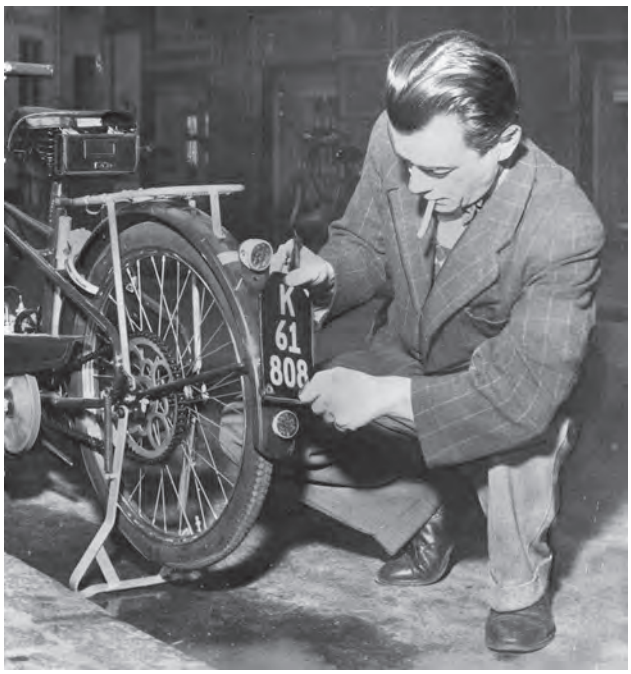


Pressure on Big City Industry

Industrial production awoke gradually when wartime restrictions were lifted. There had been more than a decade when companies had not kept pace with developments in countries unaffected by the war. Now it was time to replace rundown production facilities and also install new ones. Inspiration came mainly from the United States. The impact was massive; all engineers came up with developments "over there" when communication was again free. This trend was further reinforced when for many areas the Marshall Plan of 1947 caused heavy imports of U.S. technology to Europe. Many delegations traveled to the U.S. to see what they could learn there, and financial help followed as necessary machinery was purchased. Although most delegations had agricultural interests, some were motivated by a desire to improve industry. For example, in 1952 a delegation was sent by the Ministry of Housing to study industrial construction. The delegation was composed broadly of people from construction and industry, who after returning published a book that recorded all of the information obtained.[6]

New construction and expansion, however, remained difficult for most industrial companies. Already these companies had expanded to include new buildings and sheds, as more space became necessary. Industrial sites were getting tight, and as we shall hear, needed more room, especially for new production.

Cities also experienced growing pains. Housing construction had also largely been stopped during the occupation, while new homes strained vacant lots. All major cities had problems with vacant land, and it was obvious that people began to think of developing the construction of satellite towns, as the Copenhagen finger plan has already suggested. The mayors of suburban municipalities wanted to expand their cities, and



Obtaining a moped to drive to work was affordable and, for some workers, necessary.

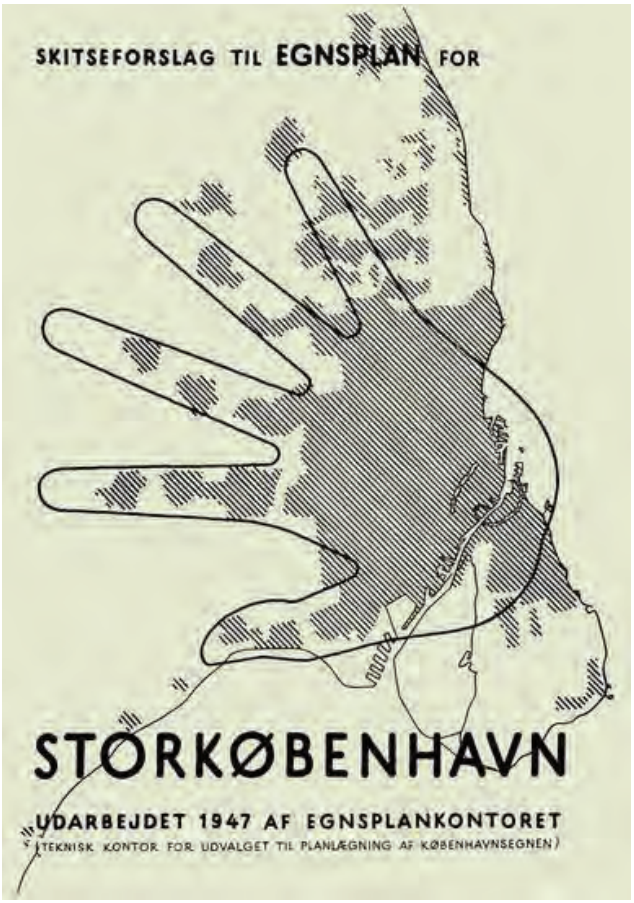
by simultaneously creating housing districts, they began to build new workplaces. It was a time when growth was paramount.

The Liberation of Industry

Locating industrial enterprises had become almost entirely unbound by its former constraints. It was no longer necessary to be located centrally in cities near the port and railway. Increasingly good roads and sufficiently large trucks made placing industries virtually free. One of the most extreme examples involves the company Danfoss, which started manufacturing pumps in a rural area far away from ports and railways. Even when the small craft business started in 1933 became a fully-fledged industry in 1951, the company stayed on at its original location far out in the countryside.

The same was true for many companies in big cities. For example, the telephone plant Telefon Fabrik Automatic was very much pressured by one of the finer addresses in Copenhagen, because 400 employees worked at its assembly plant a few meters from the residence of the king, Amalienborg. In line with major, general growth in telecommunications, Telefon Fabrik Automatic experienced a comparable increase as a major supplier to KTAS, the Copenhagen telephone company, but now it could not be further developed where it was located.

Company management was aware that after the war the company had to—and could—build in a suburb. In 1947, it had already bought a farm in Buddinge. In spite the actual ongoing restrictions on materials, the company managed to get shopping authorization for restricted goods by referring to the importance of production, and in 1949, a newly built factory was inaugurated.[7] Danfoss experienced very bad traffic conditions, and it took time to slowly establish good roads to its factory on the island of Als. Similarly,



Telefon Fabrik Automatic had poor roads in Buddinge, and was not located near the railway. Nevertheless, the smaller roads could handle the factory's transportation needs, including the less-than-a-km distance to Buddinge Station at the Slangerup Railway. So, it was not the creation

Locating industry in urban areas gradually became less rational. The photo shows a bus body hoisted down on the largest bus manufacturer DAB Silkeborg.

of new motorways that had begun to be built which influenced local transport for industry.

There were still companies with a strong need for rail transport. Such was the case for Nordisk Kabel og Traad (i.e., the Nordic Cable and Wire Factory), or NKT. NKT had long had its main factory of cables lying in an industrial area in Frederiksberg, a part of Copenhagen, near private railroad tracks. After many extensions, expansion options were not particularly good, and during the war, the management had already realized that the factory had to move. Therefore, the company bought a farm in the suburb of Glostrup in 1944, and in 1951, construction began on what is today one of the largest business parks in Denmark.[8]

Since NKT produced heavy goods, it was a prerequisite to obtain loading tracks so that rail cars could enter the grounds. During the first year, roads were fairly small, but since a north-south highway in the Copenhagen area had been established and was located very close to the company, the company could had good use of the highway later.

Affording a Modern Factory Building

There was not only room for factory buildings in the new industrial estates; there was a lot of space altogether. Base prices were a fraction of prices in the big cities.

Land prices had been a large proportion of all industries' costs. In 1950, the land price was 28% of the property price seen for an average of 908 Copenhagen factories and warehouses. However, land prices were much lower in surrounding municipalities, where prices approached to the price of farmland, or almost 5,000 DKR per hectare. Although the cost of land development had to be added to this cost, land prices were much less than the 27,000 DKR per hectare of 1950 and the average price in small provincial towns, to say nothing of the average price in the center of Copenhagen: 307,000 DKR per hectare. With land prices in surrounding towns at maybe 3% of the past cost in the big city, land prices were in reality not a burden anymore.

However, companies had to consider a true necessity that at up hectare upon hectare: parking spaces. When large workplaces were conveniently, centrally located in big cities, workers could easily get to work. For example, the approx. 2,600 workers of the large electro-mechanical factory, Thrige, in Odense, around 1,950 walked, rode the tram, or rode their bicycles. Only 2% drove a car or motorcycle. This changed when people could come from afar and therefore needed parking spaces for their vehicles.

Overall, and for the first time, low land prices made building factory buildings optimal. For reasons of spare space, one no longer built factory buildings to maximum heights in order to utilize expensive ground. Now factories could fill up with whatever they would.

Construction was often made so factory and warehouse buildings were constructed to be one-level building, while

Ford's assembly plant in 1924 was built from reinforced concrete. It was not until the construction of pre-cast concrete that building large, pillar-free factories was possible.

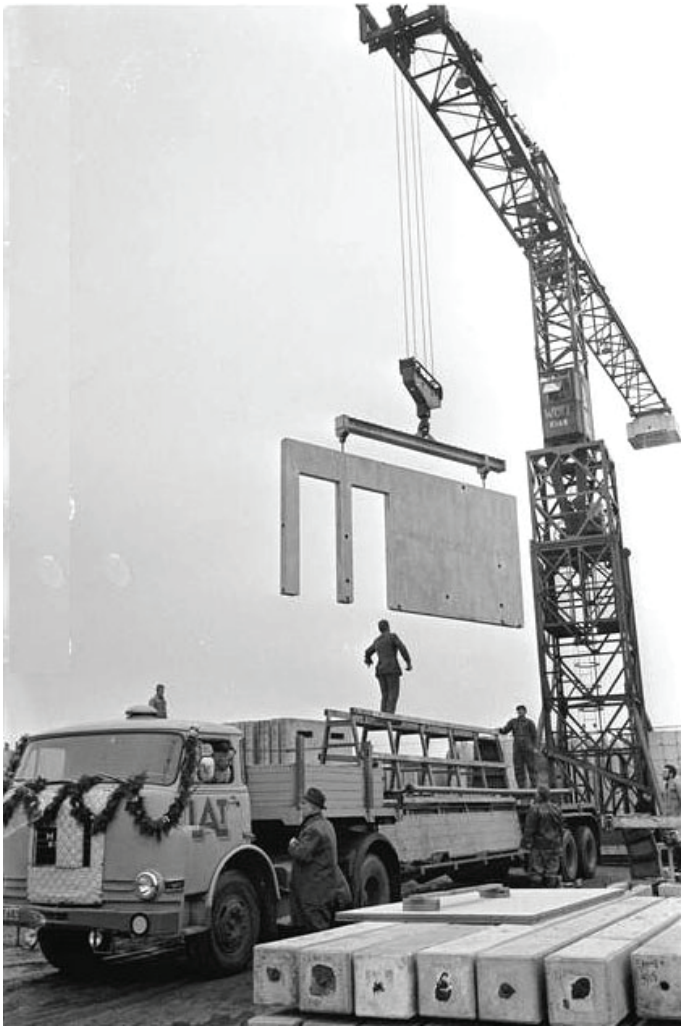
administrative and public buildings could be well built in a house with several floors. Factory buildings were also much cheaper when they did not require elevators to be installed or stair systems. Foundations were also much more cheaply established when one could simply cast concrete brooches into the ground and not worry about a high building's stability.

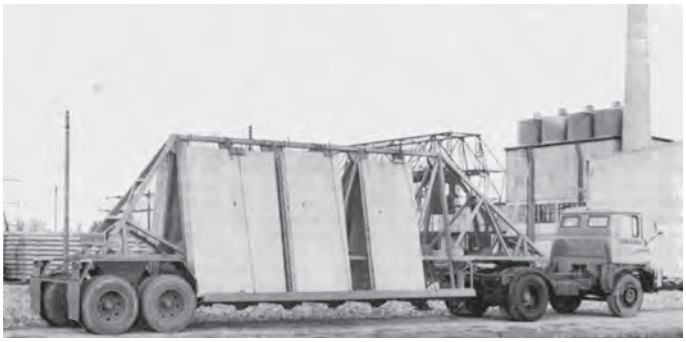
Architecture: "No Strings to Hold Me Down"

For the layout of factories, there were virtually no restrictions. Engineers and architects may well have sung the same song as the once-wooden Pinocchio turned real boy: "I have no strings to hold me down."

The rational factory building was not a new building form in Denmark. The widespread version with a hall where overhead cranes could lift units in place, which was produced in associated surface buildings, had already been established at Ford's assembly plant in the center of Copenhagen in 1924, which was, to a great extent, a copy of the Highland Park factory of 1913.[9]

Concrete construction had developed even earlier; the use of iron-timbered constructions had been seen as early as about 1870, while skeletal structures of reinforced concrete began by around 1900. There was, however, one new addition to concrete construction: the prefabricated element of construction. Until a certain point, the casting of concrete was performed at the construction site, and since concrete often took 7 days to harden—sometimes much longer—building could not commence until the structural layer had finished hardening. By establishing an independent factory, manufactured elements could be put together on an assembly line. At the same time, new forms of production could be





Special vehicles for the transport of building elements, 1962.

established by casting in standard dimensions, which allowed molds to be reused many times. This kind of assembly-line production was often scheduled six months in advance. Soon, however, assembly was performed by automatic casting machines.

This element of building started out small in 1930 with small building elements, while large building elements were added in the late 1940s. Prefabrication really took off in the 1950s, particularly following the new weight rules introduced in 1955, which doubled the permitted driving weight. Although it had previously been possible through special permissions to drive trucks with greater weights than the maximum weight, doing so required a laborious process of getting permission from the police, along with devising often special and long driving routes.

A special technology was used in the preparation of long porters, which allowed them to be built for large, pillar-free spaces. Pre-stressed concrete emerged around 1950 when the wire used for reinforcement had a tensile strength of nearly five times that of ordinary reinforcement iron. The manufactured form was constantly under development, and by 1958, porters could be produced with a span of 35m and a weight of about 15 tons.

Low loaders soon became necessary for the transport, and the journey became a specialist task to be carried out in close cooperation with the contractor. The "just-in-time" principle was introduced both at the component factory, during transport, and at the subsequent mounting.

The construction of NKT's plant in the suburb Glostrup in 1951 was one of the first in which pre-stressed concrete and pre-cast concrete were used on such a large scale. During the first year, the element factory was established close to the building, but after a few years, production of the large units moved into actual element factories in the region. The smaller units were still cast locally.

The construction method was fast; it took an impressively short time to build large halls. One space of 4,400 m^2 was built in 50 days. Construction pace was at its peak in 1953, when the same space could be built at the rate of 150 m^2 per day.

The Motorization of Internal Transport

Large, pillar-free factory space provided an opportunity to optimize the organization of a plant. One could place machines to create a "flow process" in which all production aids were stored along the production line and were eventually used before the product could even leave the factory. Plenty of room emerged, and with a one-level building, it was possible to use forklifts. Forklifts had been used with trucks in ports as early as the 1930s but only with the large, coherent factory space could the vehicle become common to more industries.

If internal transport were carried out exclusively by forklifts, the floor could be raised to 1.2m above street level to aid the loading of trucks or rail cars. Buildings with ground floors level to the street became the norm so that other vehicles could drive inside. Doing so necessitated the design and construction of special ramps where trucks could load and unload other vehicles. This could be done by vehicles from

outside that had driven to the building in a recessed access or by trucks that had driven up a ramp to the vehicles themselves. Inclines of these ramps could be at no more than an 8% increase to accommodate what had become the ordinary truck.

Indoor trucks could go fast, and new speeds meant that security became an issue for the planning inside the buildings. Therefore, clean passage lanes for oncoming traffic in the interior of buildings adopted a width of approx. 4m.

Floor coating also had to respond to new vehicle needs. Asphalt and gravel roads were not usable indoors, and even cement floors had be of a particularly high quality in order to not become worn or dusty.

Stocks were built to naturally correspond to the new mode of transport. Since trucks had gradually come to be built bigger and to handle a bigger lifting height, it was possible to build more rational stocks. In the 1960s, it was therefore not unusual for companies to design high-bay warehouses of 4m. Thus, loading could be done with 1 ton pallet trucks that ran in time at a width of 2m.

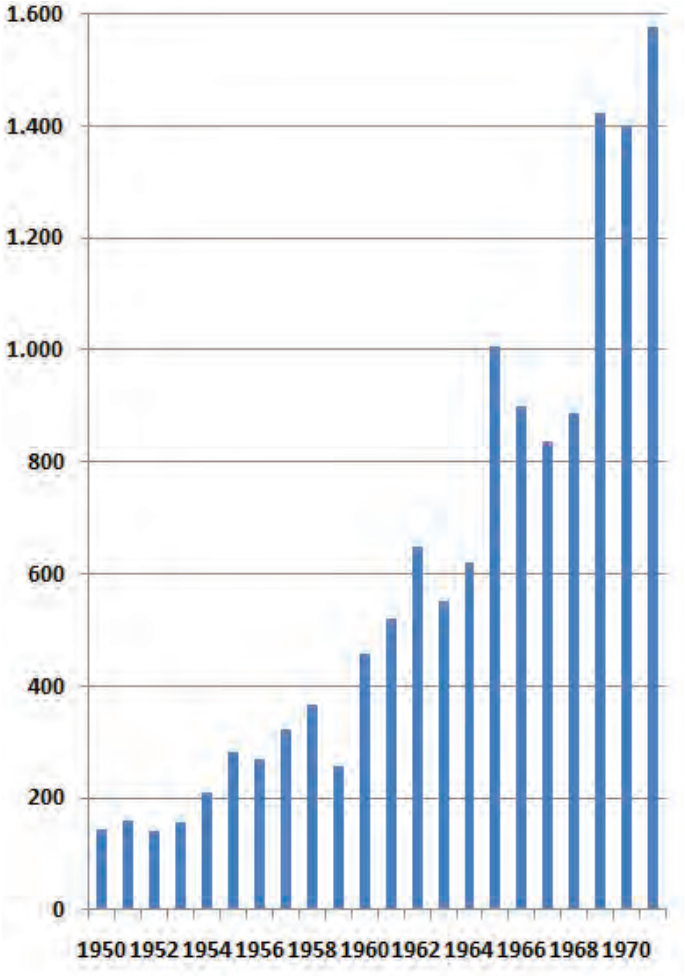
Two Logistics Systems Became One

Simply put, forklift trucks used pallets. At a certain point, this partnership meant in fact that the supplier and the customer's logistics systems had merged. Though a pallet had been packed by the supplier, it was put in storage at the client's without reloading. .

The rationalization was made possible by standardizing pallet size to fit both the truck and storage systems. Similar to recycling, the pallets were made to be reused. At the same time, packing became standardized to a large scale, so that packages of soap, for example, could be made to completely fill a pallet. Packaging also became designed to fit the shelves of the self-service stores, which grew up after the first pioneering businesses in 1949. At the same time, packaging came to also accommodate an advertisement for the product.

Rationalization continued and automatic packaging machines were designed to fill the pallets. The transport side was also rationalized since it was often advantageous to use semitrailers so that drivers did not have to wait while goods were loaded and unloaded. One of the country's largest in terms of volume manufacturers, Dansk Grovvare Selskab (Danish Agricultural Grocery), provides a good example. The company stopped packing grain and feed in 100kg jute bags for transport on sack trucks and instead began using 50kg self-closing valve bags to be transported on pallets. The first machines could wrap approximately 30 tons per hour, and soon newer machines handled as much as 60 tons per hour. Bags could be moved into a packing machine, from where they were loaded onto pallets to be palletized with three sacks in each layer, each individual bag condensed before palletizing. At one ton each, pallets could be stacked three high on top of each other to be transported by trucks designed not to exceed the roadway weight limit.

Thought previously used 3 to 8-ton trucks, shipping routes were now conducted with 20-ton vehicles. Transition to pallet transport and larger vehicles had strongly reduced wagon loading time, which was reduced from 4 hours to 1 for every 20-ton load. Similarly, the time spent on unloading has been reduced when the unloading increased by from 3 to 5 tons per hour per man using sack trucks of 30 to 40 tons for pallets driven by truck.[10]



Import of fork lift trucks into Denmark.

Even the newly built warehouse for the country's largest grocery company, FDB, did not in the 1960's have access ramps. Trucks performed all-weather transport to deliver goods.

New types of palletizers were introduced that could accommodate stores 4 meters high. Storage for groceries (FDB, Vejen).

The Impact on Working Conditions

The many changes mentioned have affected working conditions. They helped to push for a development that had for many years been forming, but which has now made eye-catching breakthroughs.

The location of industry in large cities had sometimes been a bit random, especially regarding factories with a long history that had developed near residential areas. New industries in the suburbs were placed in planned areas—industrial parks—that were often separated from residential districts.

New factory buildings had made mechanization possible, and craftsmanship was replaced by unskilled machine operation.

Mechanization also rationalized the use of machines in the evening, at night, and on weekends, while shift works increased in variety.

The rational utilization of production facilities meant an even larger series of specialized products, making work more monotonous. Mass manufacturing had fostered other consequences; specialization meant cheaper prices, so consumers alone received

higher real wages. Mass manufacturing also meant a need for larger markets and free-trade zones, whose formation in Europe by EU proved to be of political necessity.

Improved transport links at particular road transport from the years 1945 to 1980 meant as indirect prerequisites for sharp changes to working conditions. It also gave Denmark and similar countries a wealth increase of unprecedented proportions, whose growth rates only countries that have improved transport by using current containers can match.

Litterature

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Endnotes

1 Böcher 1952.

2 Weber 1909, in English exist a commented translation (Friedrich).

3 Statistisk Maanedsskrift 1938 and Forchhammer 1948.

4 Danmarks Statistik various years and Burchardt and Schönberg 2006.

5 Egnsplankontoret 1947.

6 Hansen 1953.

7 Information from Virk-info.dk http://virk-info.dk/Virk-G/GN-Store-Nord/GNT-Automatic.htm

8 Kjær and Burchardt 1998.

9 Den Store Danske, definition of ”industrial buildings

10 Tekniske hjælpemidler i grovvaredistributionen. I: Transport nr. 5, 1973, s. 35-39.