IMPROVED ROAD STANDARD AND BUSINESS EFFICIENCY

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BACKGROUND AND AIM

The development of transportation and priority for road projects

The society is changing rapidly in many respects. In industry, increased specialization, large scale operation and internationalization can be distinguished as a clear trend through the last decades. Physical distribution plays an increasingly important part in these changes.

Increased goods transportation in Sweden is characterized by the fact that over the last 20 years the volume transported by road has quadrupled while the corresponding value for railway transportation is less than double.

The aim of the study

In recent years the interest of industry in rationalization of material flow has increased. Accompanying this there has been a discussion as to whether an improved road standard would contribute to higher efficiency in the industry. The basis of this study was to illustrate in which way road standard can be expected to be of importance for companies material flow rationalization.

A further aim of the study has been to illustrate the economic impact of lead times changes in vertical market systems.

Working method

Development in the field of material flow has been analyzed through text study and discussions with leading people in industry. Rationalization potential has also been assessed from official statistics based on industry's tied up capital.

DEVELOPMENT TRENDS IN INDUSTRY

Means of rationalization

The last decades have been characterized by the fact that the means of improving companies' profitability have changed from the basic aim of cost rationalization to an increased orientation towards material flow. This has its origin in an overall view of the distribution chain and its control, i.e. material administration (MA) of business logistics (1). The reduction of capital tied up through the increased turnover of tied up capital has grown in importance as a means of improved efficiency.

A reason for this change has been the more widely use of return an assets (ROA) as a main tool for management control instead of the traditional profit control approach.

The Just-in-time concept

An approach that has come more to the fore in recent years is the concept known as just-in time (JIT) (2). The JIT approach is not limited to production in just one's own company but covers the whole vertical flow. One way to look on the JIT-approach is to study the way of eliminating risks for disturbancies in the material flow.

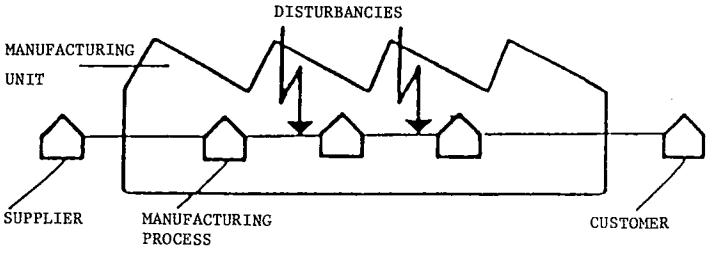

Fig. 1. Material flow in one manufacturing unit.

The "old way" of reducing these risks has been to allocate buffer stocks (see fig. 1). These stocks has later on been reduced or eliminated. Instead has the industry worked out the technique of using an "intra-flow" approach. This could be designed by line production or by using effective system for internal production control.

This development has than given the situation described in figure 2.

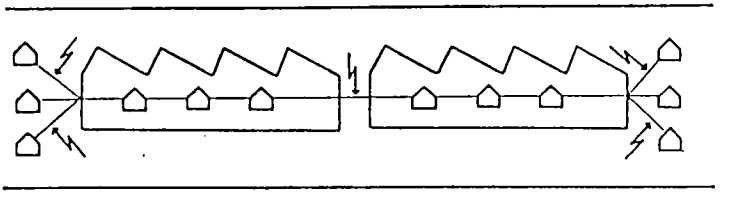

Fig. 2. Material flow in manufacturing units.

In this approach the emphasis has been on reducing the risk of disturbancies between the companies. The first step of reducing the risk was to build up stocks. Now the primary interest will be to use an "inter-flow" approach.

The JIT-approach and transportation

The impact this change of systems will have on the transports is shown in figures 3 and 4.

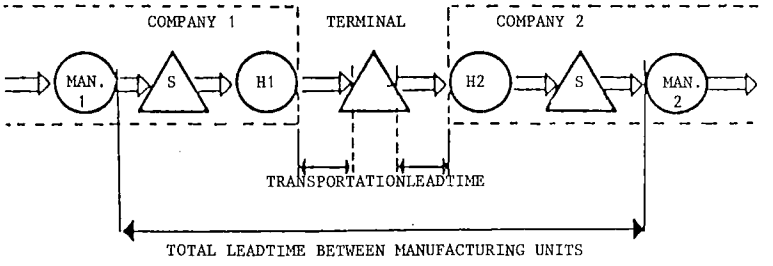

Fig. 3. Schematic description of the flow between two manufacturing units.

The figure 3 will in a schematic way show the processes between two production units. As could be seen in the figure the flow of goods will pass at least two stocks and several types of handling processes. In many cases will also terminal stops and terminal handling be a part of the transport. In a JIT-approach the handling will be reduced, e.g. quality control process will be reduced becaused of a better cooperation between the seller and the buyer.

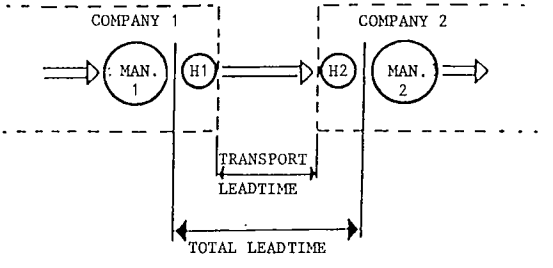

Fig. 4. Schematic description of the flow between two manufacturing units with a JIT-approach.

The new situation is described in figure 4. In the figure it could be seen that leadtime for the transportation perhaps will be a little shorter in absolute numbers.

The main difference from the figure 3 is, however, that the time for transportation relative to the total lead time is quite different. In a JIT-system the disturbancies in the transportation will have an immidiate effect on the total lead time. The main reasons for this is: (1) the time for transportation relative to the total leadtime is greater and (2) the slacks in the total leadtime is reduced (close) to zero.

The slacks mentioned above appear today everywhere in the material flow. The control systems are today under rapid improvement in the industry. This development will give the best contributions in the aspiration of reducing the total leadtime. This could be summarized as in figure 5.

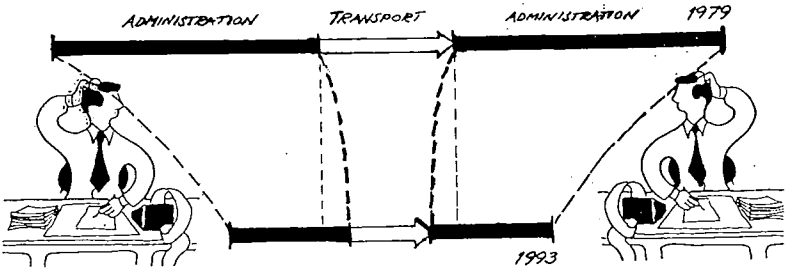

Fig. 5. The potential leadtime in the material flow.

RATIONALIZATION POTENTIAL

Transportation costs

One way of describing transportation costs is to assess their share of the total price of the product. A cost calculation of more interest, however, should be obtained if all MA-related costs are studied instead. These often form a considerable share of the total price of the product.

A study of capital tied up in Swedish industry (3) shows that the total material flow costs in Sweden amounted to 85 billion SEK in 1980, of which external transportation accounted for 29 billion (34 %). These figures could be related to the GNP as 18 % resp. 6 %. The study also shows that the total capital tied up in material flow can be calculated to be 286 billion SEK.

Transportation costs apparently play a minor part in relation to the total MA-costs. There is, therefore, probably only a limited possibility of influencing the total costs for a product by tackling the transportation costs. The relation should instead be that the transportation itself also influences the other MA-costs. A "more correct" means of rationalization could therefore perhaps be to increase the transportation costs and as a result reduce the other MA-costs even more.

Tied up capital

Of the above tied up capital in industry (286 billion SEK), 146 billion SEK was in goods. Table 1 below summarizes the distribution of this capital over different types of stock. The table also shows the mean turnover rate for certain stocks.

Table 1. Mean values of stocks and turnover rates in Sweden in 1980. (Source: Ågren, 1983)

Stock	Goods value	Turnover rate	
	billion SEK	times/year	number of days
Industry's goods in	22.0	6.6	55
Industry's products	28.0	10.4	35
Wholesale	24.2	6.3	57
Retail	13.3	7.5	48
Subtotal	87.5		
Other	58.7		
Total	146.2		

Using the values in the table and the turnover rates, an assessment can be made of the effects of changes in flow times. The changes in turnover rate can themselves be caused by a number of factors. The greatest potential today is, as mentioned above, probably on the administrative side. As the administrative systems are developed, operational elements will play increasingly important parts. The potential for increasing turnover rates from the present position is estimated to be great. For this reason it is of interest to assess the amounts that can be released through increased turnover rates.

Table 1 shows four stock groups, together tying up approx. 87 billion SEK. A reduction in lead time for these of one (1) working day releases 3.2 billion SEK or approximately 4 % of the tied up capital. The capital released can be presumed to be used for other productive investments in industry. At a return on investment the capital reduction for 1 working day in 1980 was equivalent to a saving of about 500 billion SEK per year. The calculations are, however, based on mean values, which are not directly applicable to single industries. To assess the relevance for individual industries, tests were carried out in associated industries. The conclusion is that the value of the capital reduction of 3.2 thousand billion SEK (a cost saving of 500 billion per year) could be used as an approximate value for obtaining a reduction of 1 working day of lead time for each of the four stock types. It was used to achieve this lead time change should today primarily tackle the administrative systems. An assessment of rationalization potential through experience indicates that a lead time change of 1 day is too pessimistic an estimate. Shortened mean leadtimes of up to four or five days should not be impossible to achieve.

CAPITAL RATIONALIZATION AND ROAD STANDARD

The influence of road standard on industry

This research clearly indicates that development towards the JIT approach is proceeding rapidly. The effects of this will be shown in several ways, among them being higher transport frequency and smaller quantities per transport. The shorter lead times aimed at are also combined with measures for guaranteeing arrival time. All these measures put great demands on transport safety. By the beginning of the 1990´s the approach should already be so widespread that transport disruption has a great effect on tied up capital. The very risk of such disruption means that the need for safeguards can be seen.

The calculation, detailed above, is based on the supposition that lead times in industry are shortened by one working day. Against the background of the aim of this study, the following question must be put, "Can a reduced lead time of one day be achieved with an improved road standard?" The answer to this question must be that it is quite feasible.

One basis is that it is the risk of delay in the goods transport that is decisive. The trend towards stock reduction leads moreover to the demand for quick, precise transportation increasing in future. Many companies centralize, e.g. their European stock in one place. This also influences the risk of delay because of road conditions, since the customers are still spread around and competition does not allow a level of service with a longer total supply time.

To summarize, the assessment is that the approximate values calculated are rather for cautious estimates than for high values. The effects of road standard improvement can, on average, probably contribute to a reduction in tied up capital of more than one day.

Road works priority

The risk of transport disruption occurring through road standard is not today estimated to be great since various forms of safeguard exist. As the administrative systems develop, however, the operational elements (a.o. transportation) will be linked more closely together. The greatest rationalization gains through reduced lead times are also achieved with better administrative systems. One of the results will be that the safeguards will for the most part disappear. In this situation even today´s traffic disruptions present problems.

For example, a deterioration in road standard through reduced maintenance (including winter road maintenance) compared to today, would have a negative effect on tied up capital. The necessity of a uniform road standard over long distances has also been made clear. A short stretch of road of lower standard decides the choice of both vehicle (loading capability) and packaging. There can further be difficulties in time planning, i.e. the delay risk. New investment in the road network should therefore be systematically made in "weak links" in the first place.

The European interstate highway E6 is crossing Sweden along the west-coast. Its total length in Sweden is around 500 km. From south and 360 km north E6 has a good standard (mainly divided highway) except of 30 km long distance in the middle. To upgrade this "missing part" of

the E6 to divided highway would have cost approx. 350 billion SEK 1980. In comparison, it can be stated that the estimated annual cost reduction of 500 billion SEK in 1980 is equivalent to the investment for building approx. 46 kilometers of divided highway. In 1984 there were approx. 900 km of such roads in Sweden, with 60 km completed between 1980 and 1983.

Another type of improvement of importance for capital tied up in industry is the development of fixed links with Denmark. A published report (4) states the cost of building a bridge between Malmö and Copenhagen to be between 2.86 and 4.7 billion SEK, depending on the type of bridge. If these amounts are calculated to the 1980 level, the approximate value of 3.2 billion SEK in 1980, calculated above, falls exactly between the cheapest and the most expensive bridge.

A further effect of the reorientation taking place may be an increase in traffic intensity through more closely scheduled transports. This in turn puts demands on guaranteed passability on tight stretches such as through roads in densely built-up areas. This type of situation, with uncertain passability also leads to a "need for compensation" in the form of increased buffer stocking.

In future we can assume a higher level of product processing in our country. This will mean high capital value in products and accompanying high costs for tied up capital. Furthermore, production is often in several stages in a number of places, which means that capital tied up through uncertain delivery can accumulate to relatively long times. The apparently marginal effect of road standard on tied up capital in industry today, will, thus, in the not too distant future, become an important factor.

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