

RAILWAY ORGANIZATION - A PRELIMINARY APPRAISAL OF THE SWEDISH MODEL

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1. INTRODUCTION

On January 1, 1989, the Swedish Railways - SJ - was split into two organizations: a public utility type of administration for planning, building and maintaining railway lines and a transportation company for operating trains and providing complementary forms of services to transport customers. The resulting dual organizational structure will here be referred to as the Swedish model. The transportation company retained the name SJ whereas the National Railway Administration (Banverket in Swedish, abbreviated BV) was the name given to the "infrastructure organization". Hereafter, these two new organizations will be referred to as New SJ and BV respectively and Analogously, the previous single organization will be referred to as Old SJ.

The purpose of this paper is to make a preliminary appraisal of the dual organizational system for production of railway transport services including a historical explanation of the process leading to the present situation. The analysis will cover technical as well as economic perspectives. Using a systems analysis approach we analyze the production of railway services as an economic/technical behavioural system regulated by the state. This view is illustrated in figure 1.

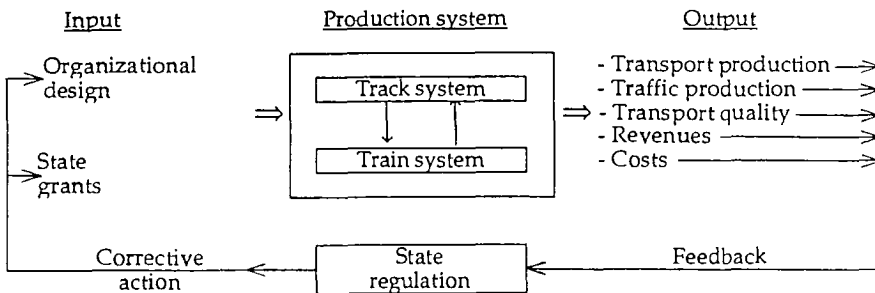


Figure 1. Production of railway services as a control system.

The key questions addressed in our paper are the changes in outcomes in important goal dimensions (dependent variables) brought about by the change in organizational structure (independent variable). Our research is based on written sources, in depth interviews with experts, and our own prior familiarity with the system under study in an informal mix. As the research is still going on, the conclusions presented in this paper must be considered as somewhat preliminary. The remaining part of the paper is divided into two chapters. Chapter two covers the economic perspective and chapter three the technical perspective.

2. ECONOMIC PERSPECTIVES

A basic view adopted in this paper is that an economic appraisal of a production system for railway transport services will have to cover aspects of internal efficiency, also called X-efficiency (see Shepherd, 1979 p. 7), as well as external effectiveness. The latter term measures how well the production system adapts its output to the changing conditions in the environment (see Stern & El-Ansary, 1988, p. 478). According to research in strategic management of organizations, the greater the congruence (consistent fit) between goals, tasks, and resources of an organization, the more efficient and effective will be the organization (e.g. see Nadler & Tushman 1980, Tushman & Nadler, 1986, Chandler,

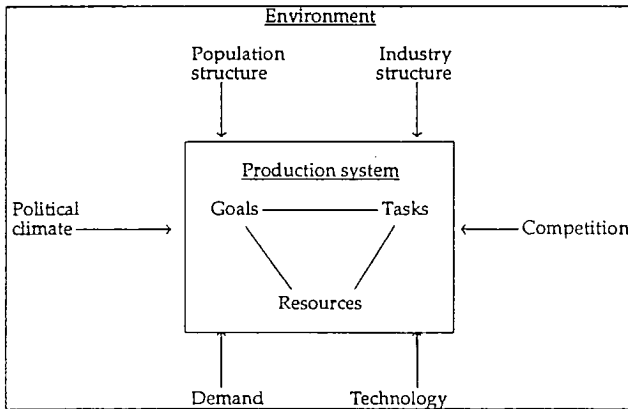


Figure 2. Conceptual model for organizational design.

1962) It is therefore important that the state as a regulating unit (see figure 1) is able to establish a reasonable congruence between goals, tasks, and resources for the production system. The conceptual model in figure 2, based on theoretical as well as on empirical considerations, shows concepts and relations which will be used in the evaluation analysis.

2.1 Historical background

The development of the Swedish railway infrastructure, the track system, started in 1856 and was with some minor exceptions completed in about 1920. What has happened

since then is mainly the electrification of the major lines and the nationalization of the private lines. During the period when the major investments in the track system were made, feasible alternatives to the inland transportation of passengers and goods were non-existent. Investments in railways seem from the beginning to have been considered as a vital strategy for the social and economic development of the country irrespective of profitability. The dominating motives were of a transport policy nature, not business economic.

Early during this century dual, and as it later appeared, conflicting goals were stated for Old SJ: (1) transport policy goals concerning acceptable access to transport services in the country and (2) business economic goals concerning coverage of operating costs plus reasonable return on the invested state capital. These dual sets of goals were first explicitly spelled out by the 1907 railway committee which, however, stressed the transport policy goals. However, it soon appeared that Old SJ had difficulties in accomplishing the business economic goals. These difficulties have increased since the beginning of 1950 due to, among other things, increasing competition from the private car, and later from air transport, on the passenger market and from the increasingly productive trucking industry on the freight market. When the investment period was over, the business economic goal was given increasing importance, and the public debate, investigations, and governmental decisions have been dominated by the question of how to improve Old SJ's net income.

Proposals and decisions have often been of a fictitious and accounting nature. This follows from a longitudinal study covering the period 1921-85 in which 8 government decisions and two committee proposals were analysed. The longitudinal analysis shows that proposals and decisions were predominantly aimed at making Old SJ a profitable business organization. The inherent contradiction in demanding profitability from an organization which was not organized for business purposes and in which investment decisions had to be taken according to non-business criteria, did not cause any fundamental change in the government regulation of Old SJ until 1989.

2.2 The Swedish model

In 1988 the Swedish Parliament decided on a new railway policy, here designated the Swedish model. This policy must be seen in the light of the process which is characterized by: permanent and growing deficits, an unmodern production system, increasing competition from other means of transport, and difficulties in responding to other external forces (see figure 2). From a predominantly economic perspective the decision has the following distinctive features:

(1) The production system is divided into a business company responsible for train operations and marketing of transport services (New SJ) and a public utility type of organization (BV) responsible for the railway infrastructure. (2) The State takes, through BV, a direct responsibility for the railway infrastructure. BV will be financed through budgetary grants or other Government appropriations. The investments in the infrastructure are supposed to be planned according to socio-economic principles (cost-benefit analysis). (3) New SJ is charged for infrastructure use and pays directly to the State. The prices are decided by the

Government after having consulted BV. Full cost coverage for infrastructure is the main principle. Exceptions can be made in order to establish infrastructure cost neutrality to other means of transport. (4) The prices for infrastructure use is differentiated on vehicle categories and expressed according to the model $Y_i = a_i + b_i X$, where Y_i is the yearly price for vehicle category i and X the vehicle utilization in gross-ton-kilometres per year. a_i and b_i are coefficients for fixed and variable price. The variable price b_i is planned to be adapted to short term marginal social costs of railway traffic on different types of tracks. The fixed charge is a construct adopted with the purpose of establishing cost neutrality to road traffic which is also subject to a fixed charge. Railway cars in combined transport are released from the fixed charge. (5) The track system is divided into main lines and regional lines. The regional authorities are given the concession for passenger transport on the regional lines whereas New SJ retains the concession for passenger transport on the main lines and freight transport on all lines. The state will buy such interregional passenger traffic on the main lines which is deemed important from a social standpoint, but considered unprofitable by New SJ. If New SJ or the local authorities give up concessions on the regional lines other parties may be given the concessions. (6) The state increases the level of infrastructure investments in the railway system for the next 10 years ahead (by about 40%) with the purpose of securing necessary maintenance and reinvestments and certain strategic new investments.

2.3 Evaluation

The longitudinal analysis of the Swedish railway policy shows that the State as a regulating unit in an early stage stipulated conditions which caused insufficient congruence between Old SJ's goals, tasks, and resources. Development in the environment made the lack of congruence more and more acute. It therefore seems natural to let goals, tasks, resources, and the congruence between them become important elements in a preliminary evaluation of the Swedish model. Figure 3 shows the organizational components which will be used in the economic evaluation.

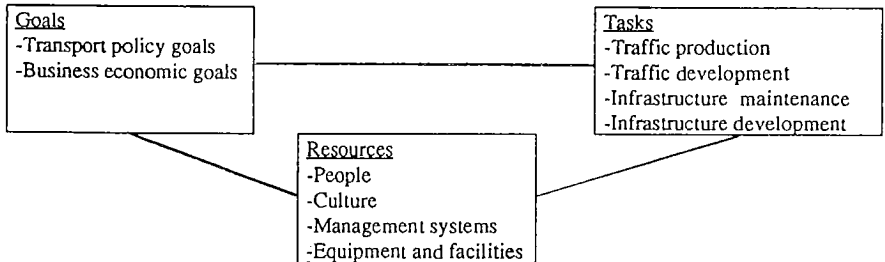


Figure 3. Organizational components

In the analysis which follows, the evaluation will be structured along four dimensions considered important: the business economic dimension, the transport policy dimension, the service development dimension, and the coordinative dimension.

The business economic dimension. The tasks of New SJ have been concentrated on traffic production and traffic development. Sub-systems, which are not needed for these tasks, have been separated from the organization. The concentration of tasks and resources makes it possible to formulate consistent business economic goals for New SJ. The organizational change thus solves a problem which has been an obstacle to the railways for a long time: the problem of dual goals which are in conflict. This is an important effect which means improved conditions for business economic efficiency of the train system.

The organizational change has also improved the congruence between goals, tasks, and resources for the train system, an improvement which is continuing. The relationships, however, seem to be different for traffic production and traffic development. There is no doubt that the organizational change has significantly improved the congruence between goals, tasks, and resources as far as traffic production is concerned. This in turn has created conditions for management by objectives and decentralized economic responsibility. Management systems have been developed for these purposes.

The organizational change seems to have improved the business economic efficiency. The effect of the organizational change on the train system's congruence between goals, tasks, and resources with reference to traffic development is more questionable. Traffic development consists of development and marketing of new transport concepts which may involve risky strategic projects with distant future pay-back horizons. Strategic projects of this type may be difficult to unite with a situation characterized by heavy emphasis on business economic goals, a pressed economic situation, optimistic expectations from the environment, and limited mandate periods for key actors. A situation like this will inevitably give priority to activities and projects with short range profitability. This may result in negative consequences for the train system's long range profitability and effective adaptation to environmental changes if not rectified by the regulating unit through organizational measures. In private companies, long term survival is the driving cue behind strategic planning and strategic investments. In a state owned railway company, the ownership as such may be perceived as a guarantee for long time survival making long term profit considerations less vital.

The transport policy dimension. From a transport policy point of view the organizational change will become effective if it increases the production system's ability of transforming budgetary grants and control measures from the regulating unit into a transport supply which is satisfactory to society. Transport supply is generated by the track system and train system in an interactive process. The analysis is therefore performed in two steps (1) the supply of infrastructure services and (2) traffic supply with a given track system. The responsibility for maintenance and development of the track system is now allocated to BV. The goals for BV are generally of a transport policy character and, for development activities, explicitly socio-economic. BV takes over the track department from Old SJ and receives budgetary grants for organizational development and for a relocation of the management function from Stockholm to Borlänge, a town in the middle of Sweden.

The homogeneity of the task set allows BV to develop a high degree of functional specialization of key resources. Personnel with high competence in infrastructure development and cost-benefit analysis has been hired, and the organizational culture emphasizes transport policy and socio-economic perspectives. Socio-economic systems for infrastructure planning are under development. BV seems to have made significant progress in establishing congruence between goals, tasks, and resources. The difference compared to the situation when the corresponding functions were performed in Old SJ is most pronounced for infrastructure development. The difference appears to be much less for infrastructure maintenance.

When it comes to traffic supply with a given track system, the state as a regulating unit has deprived itself of direct control over that part of the supply which New SJ defines as business economically profitable. Only traffic bought from New SJ by the state is controllable. In the short and medium run, and in total terms, this does probably imply that the reorganization will increase goal accomplishment in the transport policy dimension due to the increased market orientation of New SJ. In the long run the prediction is more uncertain.

The development dimension. The development of services and systems is an important activity in any transport organization. It has often been argued that the service and system development capability of the railways is inferior to that of their competitors. The following evaluation is based mainly on interviews. (1) Traffic supply. The reorganization has stimulated the rate of service and system development within New SJ, especially of commercial projects of short and mean range character. The explanation of this effect is mainly to be found in the economic decentralization and the introduction of profit-responsibility in the organization, but also in the cultural change. The reorganization does not seem to have affected the willingness to engage in long term projects which do not result in immediate profit. Systems for combined transport, which can be made competitive (see Jensen, 1990), is an example of an area where too little has been done. (2) Infrastructure supply. The reorganization has significantly increased the generation of ideas on infrastructure projects. One of the reasons is said to be that the traffic principals have got a more direct responsibility which has stimulated their involvement. Goods transport aspects, however, seem to have been lost in this process. The reason is that politicians and journalists are more interested in passenger transport. One problem is that an opposite party to BV is missing in the idea analysis stage which increases the risk of one-sided project evaluation. BV has developed expert power. The reorganization has also increased the production system's ability of realizing ideas into finished projects as far as major long range projects are concerned. This is said to be a consequence of the functional specialization of BV and of the improved financial climate for infrastructure investments (which can only partly be associated with the reorganization). An interesting observation is that the reorganization seems to have made the realization of minor short and medium term projects, which are profitable in total terms, more difficult. Projects of this type are often identified by SJ as a condition for business transactions (e.g. with freight customers), but they must be physically realized by BV. This malfunction of the production system calls for some rectifying organizational measures by the regulating unit.

The coordinative dimension. The reorganization has established conditions for increased efficiency through improved organizational congruence and functional specialization. The organizational split, however, calls for increased attention to problems of duplication of effort and sub-optimization in the production system.

In the regional units, BV is said to duplicate facilities, equipment, and management functions which also exist within New SJ's regional units. Sub-optimization problems have been observed in connection with track maintenance where BV, aiming at minimizing its own costs, has closed lines in peak periods. This has caused costs and lost revenues within New SJ. Allocating the work to periods with low traffic intensity would have been a more optimal alternative measured in total terms for the entire production system. The organizational change thus have caused some problems with sub-optimization and duplication of effort. Given the reorganization, these problems represent a potential for cost-reduction which should be exploited through appropriate corrective actions from the regulating unit.

3. TECHNICAL PERSPECTIVES

3.1 Background

An important issue in the work on the organizational reform was the exact definition of the interface between the two new organizations. The purpose of this chapter is to present in some detail how various technical functions of the production system have been distributed between BV and New SJ.

Any traffic process may be seen as an interaction between four major elements; terminals, ways, carriers and traffic control. The fact that a rail vehicle is *track borne* gives some marvellous opportunities for automating this traffic process. The fact that the same vehicle is *track bound* makes the whole traffic process inflexible in comparison to other modes. The effect is a strong interaction between individual rail vehicles. Because of this, it has always been argued that it is technically impossible to allow many parties to operate on a single rail line. This is in fact the heart of the question of open access to the track.

It should be pointed out, though, that from a traffic policy point of view, the question of splitting up Old SJ and the question of open access are treated as two separate issues. The organizational committee which was set up to identify an acceptable partition did not explicitly consider the issue of open access; its task was to identify a partition which, apart from being acceptable by both BV and New SJ, would meet the expectations of transferring a predetermined volume of assets from Old SJ to BV.

3.2 Conceptual basis for the split

The analysis provided by the committee was aimed at answering the following two main questions: (1) the demarcation between facilities and activities that shall be attributed to infrastructure and business, respectively. (2) the organizational anchorage of planning, fi-

nancial and other responsibilities for infrastructure and other activities at BV, New SJ, and other actors.

The committee found it necessary to separate three types of responsibility: (1) *Planning responsibility* refers to the scope and standard of infrastructure. It includes questions concerning new investments, re-investments, maintenance or closure of different parts of the infrastructure, trade-offs among these measures, times of realization, etc. (2) *Realization responsibility* refers to the carrying out of plans for development, operation and maintenance of infrastructure that have been stipulated by planning or state authorities. (3) *Production responsibility* may be laid upon a contractor or produced by the organization carrying the realization responsibility.

In accordance with the Swedish model described in chapter 2.2 the overall planning responsibility for infrastructure is put on BV, which is also responsible for the realization. BV also manages the infrastructure, unless something else is explicitly stated.

3.3 Basic criteria for the split

The following criteria were used as guide-lines: (1) The infrastructure shall form a unified system which from a technical point of view should allow different operators to run their services, provided vehicles and drivers obey established safety rules and traffic is contained by a valid train plan or timetable. (2) All facilities and activities that directly influence system capacity and neutral treatment of different traffic operators should be part of the infrastructure. (3) Facilities and functions which are directly connected with product design and efficiency of traffic operators should not be included in the infrastructure (such as goods terminals and station buildings).

Three types of functions were categorized: (1) infrastructure (2) functions of infrastructure-like character and (3) production facilities. The basic principle is that while infrastructure is taken over by BV, functions of infrastructure-like character remain with New SJ. BV and New SJ should retain their production facilities, respectively.

3.4 Actual split

The main features of the actual split are summarized in figure 4. In at least two cases a deviation was made from the expected and rational choice. These are traffic control and marshalling yards.

A common practice for other modes is to keep responsibility for ways and traffic control together. It would therefore seem natural for traffic control to go to BV. In the internal model of Old SJ, traffic control was consistently classified as belonging to the infrastructure. It was also assumed in the 1987/88 proposition from the Government to Parliament containing the essentials of the reform. However, the final solution proposed by the committee and accepted by Parliament prescribed the following partition:

(1) Facilities for traffic control are brought to BV while New SJ retain responsibility for traffic control. (2) Only facilities and maintenance of these are attributed to the infrastruc-

ture. (3) Traffic control as to the rest is planned in connection with work on train plans and in a budgetary dialogue between all actors. On this occasion an agreement on financing should also be made. (4) This model should be evaluated after 3-5 years.

In summary, BV and New SJ are given a joint planning and realization responsibility in the form of a mutual budgetary dialogue, while SJ is given the production responsibility. The main motive seems to be the opinion of the committee that all operative traffic control should be placed within or close to the traffic undertakings. As a result BV and New SJ have signed a general agreement on the principles of track disposal. This stipulates that individual agreements should be negotiated and signed yearly at regional level for every railway line. These should be followed up by short term agreements covering the next four weeks. These are rolled by revisions every second week, which means that the exact conditions for track disposal are firm for two week periods at a time.

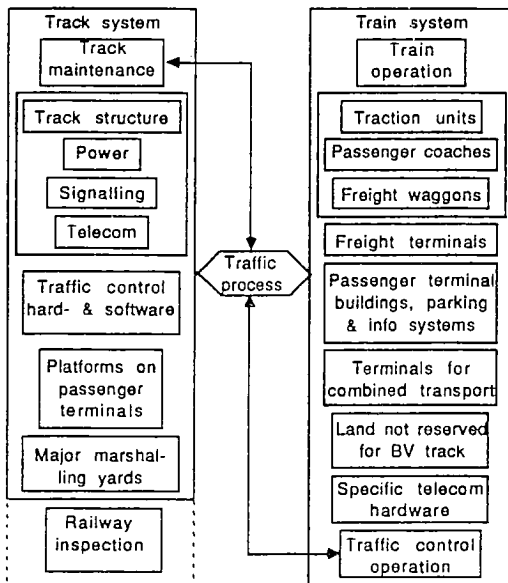


Figure 4. Distribution of major elements in the split of Old SJ. Dashed line signifies administrative affiliation only.

An important item of the yearly agreements is reliability for each line. Reliability is defined mutually. SJ agrees to maximize disturbances to contracted times for various types of track maintenance by a given number of minutes per month. BV, on the other hand, agrees to guarantee that the total number of faults or deficiencies must not exceed a prescribed figure for the whole of the year. BV also guarantees that repair personell must be on the site of a fault within a prescribed maximum time. A lower figure is agreed upon for the average turn-out time.

Statistics about actual times of disturbances and number of faults and deficiencies, respectively, have so far only been sampled and no economic compensation has been exchanged. However, it is planned to introduce a stricter enforcement including such compensation in the near future. Economic compensation

for damage is already agreed upon and is being enforced. The minimum amount is 100,000 SEK for damage occurring at a site on a railway line and 20,000 SEK elsewhere (i.e. in terminal areas).

The main content of the short term agreements concerns times and locations of the BV track maintenance activities. These are based on "strategic white times" that are speci-

fied in the yearly agreements. Such times must not be infringed upon by the traffic operator without consulting BV. Changes to the track standard should also be included in the short term agreements as well as changes to the train plan. Restrictions in the maximum momentary supply of electric power are also specified. It can be argued that marshalling yards are part of the production facilities of the traffic operations and therefore should be retained by SJ. The committee claims that the marshalling yards have important en route functions, since they exert a significant influence on line capacity and possible traffic flows. A further motive that is not explicitly mentioned is the need to relieve Old SJ of capital assets. In the Government proposal preceding the work of the committee an estimated 3.5 billion SEK worth of assets should be transferred to BV.

3.5 Evaluation

In an attempt to appraise the technical effects of the split it is of particular interest to study the interactions across the borderline between BV and New SJ. In a purely technical and short term perspective there is no reason to expect any noticeable effects. The BV employees changed their logo and clothes but continued to perform the same operative work tasks as before the reform. Experience confirmed this hypothesis. The transition from Old SJ to BV was very smooth. To find effects we must look beyond the purely operational level and extend the time horizon. The analysis will be limited to discussing two activities; track maintenance and design of train plans.

Track maintenance. The continuous rationalization of track maintenance means increasing use of heavy machinery. To make efficient use of capital invested in such machinery it is necessary to get access to reasonably long stretches of track during sufficiently long uninterrupted time periods. This causes conflicts with regular traffic production. Both BV and new SJ claim that the situation has changed to the better after the reform. The procedures for reaching agreements on time periods reserved for track maintenance has become formalized and the negotiation situation clearly cut. This has resulted in solutions that have even included total closure of lines during a certain time period to allow BV to work continuously with maximum intensity while completely exchanging most of the superstructure along the line.

One indication that a satisfactory development has taken place is that the parties have deferred introducing the right of one party to claim damages from the other party for infringements on agreed upon access to the track. One region of BV recently measured the extent to which demand for access to the track were met in the short time agreements. The result was that 92 % of the demands were met, which was deemed to be very satisfactory.

This does not mean that both parties are fully content. BV claims that New SJ does not reflect contracted agreements on train speed reductions in their timetables. This gives rise to unavoidable daily train delays for which BV, unjustly according to their own opinion, is being blamed by the media. One reason may be that New SJ cannot easily handle short term changes to their timetables which may influence the possibilities of transfers between trains and train cycles far away from the source of the problem. They may consciously choose to try to contain the problems locally by accepting the delays, knowing

that frequent changes of timetables cause as much annoyance among travellers as delays and are administratively costly.

New SJ, on the other hand claims that BV is not sufficiently sensitive to commercial realities when allocating positions in time and space to individual trains. BV is one among very few railway administrations that only perform maintenance work during daytime. Clearly it is in the interest of New SJ to shorten maintenance times by the use of longer working hours. Theoretically they could achieve this goal by offering to compensate BV for the extra costs incurred by changing work routines. However, since the unions heavily resist such action it is doubtful, whether this incentive is strong enough. One possibility to strengthen the incentive for change would be to accept the principle that by paying the fixed infrastructure charges New SJ has acquired an unrestricted right of way. To get access to the track BV would have to compensate New SJ according to a predetermined price list that recognizes the variation of track shortage costs as a function of line, season, weekday and time of the day.

Design of train plans. According to the intentions by the organization committee BV should be given the planning responsibility for traffic control. A clear definition of the rights and obligations associated with this responsibility was never given. In our opinion it is reasonable to assume the rights would involve exercising a strong influence on or even full control over the composition of train plans for each line. Today this is not the case. On the contrary, SJ has retained full control of the train plans. The response by BV is to argue publicly that the realization and production responsibilities for traffic control should also be transferred to BV. SJ strongly opposes this. The fact that the Swedish model does not explicitly treat the question of open access to the track is likely the reason that traffic control has become a hot issue. The organization committee never made an in-depth analysis. The compromise quoted above was a way of avoiding taking a clear stand. This impression is amplified by the agreement on further evaluation after 3-5 years.

Today open access is widely debated in Sweden, unfortunately so far from a poor understanding of the stakes involved. BV and New SJ have taken opposite stands in this debate. This is probably the reason why they have also taken opposite stands concerning responsibility for traffic control, since adoption of the principle of open access would require a complete transfer of the responsibility for traffic control to BV. It is not our intention to analyze open access in this paper. Rather we would like to take a further look at the merits and shortcomings of the shared responsibility for BV and New SJ that is now in force.

Let us first point to the important role of the train plan. This plan is the instrument that shows how the capacity of the production system is utilized. Because of the complexity of this system, capacity cannot be defined in general terms; it has to be defined in relation to a given train plan with specified quality and levels of service for various types of corridors in the time-space domain. Such a plan represents an allocation of a share of the total capacity to each of a number of imaginary, potential trains. The reason that capacity cannot be defined in general terms is that the number of alternatives to such a plan is very large, with each alternative leading to a different measure of the total traffic production capacity.

To each allocation may be attached an economic value that can, however, only be evaluated towards one or several specific transport markets. The true value of the allocation is the difference between its worth on the transport market and the production costs encountered in the train system, when supplying the physical train service allowing this worth to be transferred into an income to the system. This net true value, which is not easy to forecast, is what remains to be shared between BV in the form of payments from, and net profit for, New SJ.

The problem of how to design and make optimal use of such an allocation is a classic micro-economic problem that can only be efficiently handled by New SJ because of the large amount of internally generated information needed. Giving BV the right to make a unilateral decision on details about each allocation based on information supplied by SJ represents a great risk for loss of efficiency of the joint production system. It should also be borne in mind that closely coupled to the train plans are separate plans for cycles of all kinds of moving resources that belong to the train system, both humans and machines. Good use of these resources also greatly effects the efficiency of the overall production system. Train plans used to be a stable planning instrument which was only changed once a year and with only minor alterations each time. Today major changes are demanded at short notice as important customers get ready to sign agreements on the transport of large volumes of freight. Thus the power to exert a direct influence on train plans has a strong influence on the effectiveness of the production system (see figure 2).

Our conclusion is that for reason of internal efficiency as well as external effectiveness of the production system, New SJ must have a strong control of the way train plans are created and changed.

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