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Trains, planes and computers: from high-speed trains to computerised reservation systems at French railways.

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**Trains, planes and computers:
From high-speed trains to computerised reservation systems at French Railways**

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Abstract

A link is made between the problematic introduction of a new computerised reservation system (CRS) at French Railways in 1993 and the high-speed train technological innovation, the TGV (Train à Grande Vitesse) successfully introduced in 1981. Both are about modernising railways and one interesting factor is that French Railways chose to purchase a computer system from American Airlines in 1989. The strategic role CRS played in the US airline industry in the 70s and 80s partly explains this choice. But emulating the competitive advantage American Airlines gained with the same computer system through yield management and electronic control of distribution channels proved more difficult in the French context due to differences between rail and air transport modes, US air and European rail market structures and regulation regimes.

The new computer system is closely related to the high-speed trains through differentiated pricing and yield management. Some price differentiation, together with compulsory reservation, was first introduced in French Railways on the TGVs in 1981. Yield management and quota management, heavily used in airlines, was made possible through the new CRS implemented in 1993 but proved problematic. Revisiting the TGV project helps understand the CRS implementation difficulties by recognising the French notion of rail transport as a public service and its associated social, cultural and political dimensions; how this led French Railways to conceive of TGV technology as a way to prevent rail transport decline; how the existence of the TGV shifted the focus from road/rail to air/rail competition; and how the subsequent link between the TGV and the new airline computer system, in particular through yield management, had detrimental effects. It was interpreted as imposing commercial principles on the whole French rail network and as an attack on French Railways' public service mission. The import of new tools such as CRS and yield management did not lead to a direct adoption but an adaptation of these management models to a specific national context.

The introduction of a new computerised reservation system at SNCF

The controversial launch of the computer system in 1993 at SNCF (Société Nationale des Chemins de Fer Français) is first outlined, before exploring the American origins of the system. The experience of the deregulated US airline industry in using computers for competitive advantage in the 70s and 80s, which SNCF was hoping to emulate, is examined next. Transferring air transport expertise also relates to the development of the French TGV, which is then considered. Pricing differentiation was first introduced in French rail transport through the TGV and *Socrate* can be seen as a continuation of this commercial objective. It is argued that the TGV innovation, intended to prevent rail transport decline, also made SNCF seek solutions such as CRS developed in the airline industry, which became questionable in a national rail transport company.

Fieldwork at SNCF for this case study was conducted in 1994-95 after the problematic introduction of *Socrate*¹. SNCF introduced *Socrate* (Système Offrant à la Clientèle des Réservations d'Affaires et de Tourisme en Europe), a computerised reservation system in April 1993. SNCF bought *Sabre* from American Airlines in 1989 in order to build *Socrate*. One of its aims was to transform its commercial activities through a technological investment importing techniques used in the airline industry. However, *Socrate* provoked nation-wide strikes when it was introduced and attracted considerable negative media coverage. For such an ambitious project, and perhaps because of it, there were a number of problems in its design, development and implementation.

SNCF started the *Socrate* project in 1989. One of its aims was to reposition French Railways in the competitive European environment and gain more traffic. *Socrate* would support the diversification of pricing, ticketing and reservation services. A policy that would maximise revenue was also important, since SNCF had been a semi-public as opposed to a nationalised utility since 1982. One of SNCF most important objectives was to instigate a new marketing philosophy based on yield management techniques². To do this SNCF bought *Sabre* (initially *Saber* for Semi-Automatic Business Environment Research), the American Airlines computerised reservation system and a classic example of a computer system which had provided competitive advantage to one of the largest and most successful airlines. Several years were spent adapting this software developed by a private air company to the context of the rail industry and of a national semi-public sector institution.

When it was first implemented however, both SNCF staff and their customers rejected *Socrate* and its underlying ticketing, pricing and selling philosophy. These teething difficulties were widely reported in the French press³ and investigated by SNCF itself⁴. They also drew the attention of trade unions⁵, business consultants⁶, passengers' associations⁷, and the French government⁸ which commissioned a public inquiry into the system. Technical malfunctions, political pressure, poor management, uncooperative unions and passenger resistance combined to cause a chaotic launch. The project management team neglected databases and input sets. Staff training was inadequate and did not prepare sales clerks for tariff inconsistencies that they had to deal with. The user-computer screen interface was designed using airline logic, which was difficult to understand for staff and customers. The new ticket format was too complex and difficult to understand for passengers. Public relations failed to prepare the public for the change. Database problems on timetable and routes, inaccurate tariff information, and unavailability of ticket exchange capabilities caused problems for the SNCF sales force and customers. Incorrect tariffs and train connections led to large queues of customers in main stations and to a major public outcry. Online reservations available through the Minitel public network failed, tickets were booked for non-existent trains while other trains ran empty, the railway trade unions went on strike and passengers' associations sued SNCF.

This system contributed to complex changes in French rail, which had kept relatively unchanged regarding the services on offer and passengers' practices. The new ticketing and pricing policies introduced through *Socrate* radically changed railway users' and rail workers' practices, which were grounded in important cultural dimensions of French society. *Socrate* began to indicate a new phase of forced global innovation in an enterprise facing strategic imperatives and organisational changes. The competitive environment became that of European integration, which opened the area of transport to deregulatory moves and to the growth of competition across transport modes (rail, air, and road), to which the TGV had already contributed.

The origins of *Socrate*

The reasons put forward for upgrading the previous computerised reservation system, known as *RESA*, were the need to increase yields per seat and control distribution channels. Additionally, SNCF seems to have been fascinated with air transport, which played a part in the choice of software. The rhetoric of IT-led competitive advantage and the well-documented story of *Sabre's* strategic success at American Airlines were very influential in the business world of the 1980s⁹.

Until the early 1980s sales clerks used various sources to complete transactions and rail passengers often had to go to several offices to obtain information, a reservation and finally a ticket. Only in the late 1980s did workstations in railway terminals, travel centres and telephone services began to be linked to central reservation systems. This allowed reservations to be made at the same time as tickets being printed by an all-purpose ticket machine. The workstation usually has access to a computer-aided timetable enquiry system, which suggests the best route and times. British Rail, for instance, integrated the systems into one set between 1991 and 1993 for InterCity services. Some of the objectives were to reduce transaction times and encourage reservations. Whereas British Rail built on its own systems, SNCF chose to abandon its in-house system and bought *Sabre* in 1989 from American Airlines for an initial FF 1billion (£100m). Jean-Marie Metzler, Head of Passenger Intercity Services and a 'polytechnicien'¹⁰ with a long and successful record of top positions within SNCF, including director of the first TGV programme in 1981, successfully proposed the purchase to the SNCF Board on 22nd March 1989.

The previous system, *RESA* (Réservations et Suppléments Associés), was developed in-house and implemented in the 70s to respond to a growing demand for reservation management. It was argued in 1989 that a new system was needed to handle a predicted 135 million reservations a year by 1995, with the opening of the Channel Tunnel in 1994 and TGV Paris-Lille in 1993. However, a later official report to the government investigating the *Socrate* implementation problems¹¹ states that the existing *RESA* system would have been capable of absorbing future increases in reservations. SNCF seems to also have had an additional strategic agenda, which included competing with airlines, the ambition to host other rail companies' data and control distribution channels, like CRS in the air industry. Since 1987, SNCF had been planning to renovate its distribution mechanisms. The Passenger Marketing Division carried out strategic studies¹² to examine the nature of European passenger rail supply, pricing and distribution. These studies stated that SNCF had an advantage with its high-speed network but that the environment would become more and more competitive. *Socrate* would enable SNCF to compete on sales and distribution. A SNCF confidential document¹³ states that: competition would increase between rail and other transport modes, particularly air; the opening of the European market would lead to increased competition between air operators; and that more than 50% of SNCF passenger rail supply on medium and long routes would compete with air. A primary objective was to improve supply, but more importantly, "to be able to adjust supply in the short-term using the 'weapon' of pricing".

A new distribution policy entailed a reduction in distribution costs through: the use of Minitel and vending machines in stations; control of travel distribution channels; product penetration through these networks, in France, Europe and elsewhere; and, crucially, pricing flexibility. A clearly defined tactic was to establish links between the SNCF computer network and global travel distribution systems. *RESA* was seen as obsolete, but not so much in its processing capacity: "the functionalities of *RESA* do not support the marketing and distribution policies envisaged"¹⁴. These included the forecasting and optimisation of overbooking and tariff quotas. SNCF therefore chose to purchase such software from the airline industry. Arguably, building its own system would have taken SNCF seven years. Yet there was a clear ambition to be the first to set up a rail electronic distribution network in Europe¹⁵. And distribution, optimisation and short-term adjustment of fare prices were paramount in the software selection.

In their search for a technical partner, SNCF considered rail transporters AMTRAK and Deutsche Bahn, but also air transporters Swissair and British Airways, and air travel distributors such as *System One*, *Apollo*, *Galileo*, *Amadeus*. *Sabre* of American Airlines, was chosen as it had a strong emphasis on distribution and optimisation and excellent yield management. It was also technically compatible and could host services from other rail companies. This sophisticated computerised reservation system

could help SNCF fill its trains, in the same way that American Airlines filled its planes, and make SNCF as effective as air companies. In the words of two main initiators of the project¹⁶:

“Rail must reach the level of its competitors, particularly air companies. The answer to this challenge is information systems, in the form of modern reservation systems (...) International sales must be facilitated through global distribution systems such as the ones found in airlines”.

Sabre and American Airlines' competitive advantage

The use of computers in airlines has expanded over the last 30 years to include most functions. Airlines spend heavily on information technology, with an average of \$0.5 billion a year in the 1990s¹⁷. The most heavily automated functions are reservations and maintenance/engineering. Companies such as United Airlines also sell applications and automation services to other carriers, and the most extensive offerings are those of American Airlines.

The origin of *Sabre* goes back to *Sage* (Semi-Automatic Ground Environment), a real-time radar defence network to guard against surprise Soviet air and missile attacks funded by the US Air Force in 1951. American Airlines (AA) and IBM, who had been involved in *Sage*, started the first commercial real-time system, *Saber* in October 1959. Its development took over 400 man-years and cost \$30 million. The initial version was capable of handling information from and about other air carriers and AA was able to charge rent for use of its system. This first mover's advantage lasted several years until Eastern Airlines launched *PARS* (Programmed Airlines Reservations System 1) in 1965, also known as *System One*, which performed a number of functions in addition to reservations (e.g. check in, fare quote, weight and balance). By 1972, TWA had its own version of *PARS* and United Airlines had set up a system called *Apollo*. Schulz¹⁸ refers to these developments as the first generation CRS (1958-1974) which concentrated on system building and competency acquisition, with airlines becoming customers of the CRS vendor airlines. The technical lead held by AA and then Eastern was no longer so obvious by the mid-1970s¹⁹. All the main carriers had stable and reliable internal systems and communications networks supporting their main operations.

The second generation CRS (1975-1985) focussed on marketing and niche innovations. With the deregulation of US airlines in 1978²⁰, American Airlines introduced 'name check-in' which linked passenger names and marketing records, thus enabling the introduction of the first 'frequent flyer' programme. Another innovation was the realisation of the importance of the travel agent market, which had provided 30% of bookings in 1967, compared to thrice that number in 1987²¹. The introduction of terminals in travel agencies had started slowly, but deregulation provided a competitive spur in the late 1970s. AA started aggressively pursuing travel agents as 'lease' customers and installing *Sabre* terminals. Agents had access to flights of all airlines that paid AA a fee for entry onto *Sabre*. By the end of 1985 American and United had 45% and 29% of the CRS market respectively²² and by 1987, 95 per cent of travel agents were automated²³. Additionally, AA realised the market potential of *Sabre* and devised the 'co-host' scheme whereby smaller carriers can pay to have preferential displays on agents' terminals, i.e. for their flights to appear on the screen before those of competitors. This gave rise to numerous carriers and travel agents filing petitions with the Civil Aviation Board because of problems associated with CRS dominance. Vendors were not prevented from making charges, which continues to make CRS ownership a financial gold mine, since 98% of US travel agencies do their bookings on one of the four dominant CRS (*Sabre*, *Apollo*, *Worldspan* and *System One*). Control and domination of distribution channels through computerised reservations has contributed to a concentration of airline operators in the US first, then in Europe and the rest of the world (through global alliances, code sharing and use of an American CRS for all companies in an alliance). Schulz suggests a third generation of CRS (1986-1990s) characterised by smart workstations, which allowed, for instance Delta Airlines, to enter the corporate travel market. The corporate segment in particular makes use of complex databases to manage corporate clients' travel expenses. In the mass travel market, there is consolidation of nation-wide 'mega' agencies. Additionally, PCs and internet-based services allow passengers to book directly from home, and this may re-shape the travel agents industry further.

Perhaps most importantly for SNCF, “conservative estimates credit *Sabre* with a cumulative cash contribution to American Airlines between 1976 and 1986 of \$900 million, producing an internal rate of return during the decade of 68.7%”²⁴. In 1991, with 85,000 terminals in travel agencies in 47

countries providing access to fares and schedules for 665 airlines, *Sabre* accounted for about 85% of American Airlines' earnings²⁵. In 1997, *Sabre* was in place in 54 countries and 20,000 travel agents, with estimates suggesting that some 130,000 terminals were connected to the system. Each day some 1.6 billion bookings were taken over it for some 740 airlines²⁶.

Sabre has been cited as an example of the use of information systems to gain competitive advantage since the mid-1970s. According to Max Hopper, Vice President for Information Systems at American Airlines, who joined AA as director of *Sabre* in 1972, "we helped define an era"²⁷. However, he argues that it is difficult to document the claim that *Sabre* generated substantial increases in traffic by creating market-power advantages. He states that "*Sabre*'s real importance to AA was that it prevented an erosion of market share". He believes that most explanations for *Sabre*'s success focus on the competitive advantage realised by locating terminals in travel agencies and are too shallow. The cumulative, complementary and incremental technical and organisational capabilities are a better explanation. Factors such as well established operating routines and a long-standing pattern of tit-for-tat rivalry between American and United Airlines, even prior to deregulation, accounted for many necessary competitive counteractions. AA did not plan to dominate distribution channels but learnt by doing. Further, Copeland stated in 1991 that: "it is most unlikely that another organisation will replicate the strategic coup that American accomplished with *Sabre*"; and that "today no company would allow a competitor to gain electronic control over a distribution channel, in large part because of the example of the airlines' experience"²⁸.

CRS have also been profitable through fees from other air companies for hosting their data and SNCF was hoping to similarly charge fees to other rail companies. The intention was for *Socrate* to be in a good position in the European market, thereby changing the role of SNCF towards an international rail distribution provider: "to be the European leader in terrestrial high-speed passenger transport"²⁹. SNCF top executives took on board the strategic rhetoric of the 1980s, believed an organisational mutation³⁰ was needed and that *Socrate* was a mean to achieve it. They perceived the future core business as rail distribution and *Socrate* as the tool of a commercial and international enterprise competing with airlines. Their reasoning is partly based on the fact that 50% of SNCF revenues come from ten major routes where there is fierce competition with air. They saw it as an "absolute duty" to equip the enterprise with CRS technology, seen as an "intellectual instrument with predictive power"³¹. In the logic of global markets and increasing competition, computers are seen as a technological response to commercial (capacity management) and financial (profit maximisation) problems in the service sector generally. Increased competition in service industries such as hotels, cruises, car rentals and amusement parks has fuelled development of ever more sophisticated computer modelling systems³². However, whether American Airlines' experience over many years could be transplanted and duplicated in a different context is a different matter.

According to Hanlon³³ "proponents of market contestability consider the airline industry as almost a textbook example of a contestable market". A feature of third generation CRS is yield management. "Within the context of a deregulated environment, yield management, in combination with PC-based reservation systems, as well as the established large-scale systems, provides the airlines with unprecedented capabilities at providing customer service and 'marketplace' pricing"³⁴. Yield management techniques enable optimal filling of planes, combined with as great a profit as possible for each seat filled, through optimising the average price/rate of occupation ratio per seat. There is a constantly changing quota (proportion of seats at different prices) on each plane according to monitored demand, so that from the customer's perspective, pricing varies according to the time of booking, the type and time of airplane. Yield management, combined with electronic control over distribution channels, resulted in a strategic 'coup' for American Airlines³⁵. The European (air and rail) transport context of the 90s proved to be quite different from the US air context of the 80s, particularly regarding passenger pricing. The transferability of the US air transport deregulation model to European transport can be questioned more broadly too. There are differences that present obstacles to the transfer of US air deregulation to European rail transport³⁶. Institutional and social reasons preclude the full adoption of US-style deregulation. There are different understandings of industrial policy, state intervention and notions of public service across countries. Some of these economic, social and cultural reasons have been addressed elsewhere in relation to this case³⁷. Here we want to concentrate on SNCF pricing tactics to establish a link between advanced differentiated pricing techniques and high-speed trains. The historical success of the TGV effected a transformation of rail transport that explains the choice of airline computer systems, as well as the troubles *Socrate* encountered.

Pricing and yield management

The new commercial techniques used by *Socrate* to manage passenger travel can be traced back to pricing techniques first used on TGV trains in the early 80s. More sophisticated differentiated pricing became possible with *Socrate* and its yield management techniques. They imply that passengers will modify their buying habits to bring higher profits, particularly from the TGV network; and they still maintain cheap fares (at certain times) to fulfil SNCF public service mission. This emerges as a perfect political compromise for SNCF. But yield management is also “a pricing strategy developed since deregulation so that established airlines can at least appear to be competitive in price with the new entrants and might even be able to fill otherwise empty seats with stimulated demand”³⁸. Large US air companies used it to protect themselves from intramodal competition with other companies and still appear competitive. It would seem that SNCF also saw the importance of appearing to be competitive, but in a situation of internal competition between its own trains, the TGVs and the intercity ‘classical’ trains³⁹ on similar routes.

As a public monopoly SNCF has historically been caught between the notion of public service and budget constraints. Traditionally, the aims of managing urban and rural development and maintaining a national identity formed the basis of cross-subsidising in French rail transport. Accordingly, a kilometre had the same price all over the country, which was seen as fair and equal to all French citizens, and a ticket price was calculated on the basis of the distance travelled, whichever train or line was used and whatever the costs. Profits realised on some lines could be used to subsidise losses on others. This principle resulted from a dual constraint imposed on SNCF, that of operating unprofitable lines and that of balancing its budget on an overall national basis, rather than per market. For many years train fares were calculated according to the distance travelled, following this geographic cross-subsidising. Public utilities, including major air companies⁴⁰, apply this principle in order to provide services in the interest of national and regional development.

SNCF introduced a few changes in the late 70s⁴¹. The aim was to optimise average revenues by withdrawing fare reductions (mainly socially motivated discounts e.g. family cards, youth passes, old age citizens) at peak times so that price-sensitive passengers travelled on under-utilised trains at different times. It was based on a tricolour year calendar with three time zones, red for very busy, blue for busy, white for quiet periods, published once a year and widely available (similar to Channel crossing ferries or rented holiday cottages price calendars). It was set a year at a time according to previous results, accumulated mainly through sales figures and counting passengers and types of tickets in trains. This dealt primarily with trains in heavy demand (holidays, weekends). In the red zone on Friday and Sunday evenings no fare reductions were available. In the blue zone on bank holiday weekends or school holidays, only some reduced fares were allowed; and in the white zone all reduced fares were accepted. Special discounts only available in ‘white’ periods were also devised. This pricing system was clear and easy to publicise. Pricing was still according to the number of kilometres travelled which was understandable to passengers who could work out the cost of a specific journey. With the tricolour calendar, passengers could also establish very quickly when they could use their reduction entitlements. This price differentiation, if simple, was also heavy. The calendar had to be set a long time ahead and it had some absurd effects. However, the cost of increasing price differentiation, which involves the use of sophisticated computer systems, was initially seen by SNCF as too high to warrant any change⁴². Elaborate price differentiation would be a major consideration in the choice of the *Sabre* software.

SNCF started experimenting with further price differentiation on the first TGV line Paris-Lyon that opened in 1981, and then Paris-Ouest in the early 90s⁴³. A major change was the use of compulsory and chargeable reservation and the introduction of different types of ‘supplements’ for very busy trains (TGVs as well as classical intercity trains). The objective was not only to fill empty trains but also to increase profits on busy routes and compete with air, which proved successful on the Paris-Lyon route. Prices varied from a factor to 1 (for the slower classical train to the same destinations) and 1.35 on the TGV. When the TGV to Le Mans was launched in the early 90s, the increase in the second class price was between 25.4% to 53.5% (according to the period in the calendar) over ‘normal’ prices, i.e. calculated on the basis of kilometres⁴⁴. One implication of this system (which was superimposed on the tricolour calendar system) was that it was cheaper to travel first class in certain trains than second class in others. The principles of cross-subsidising were becoming eroded in the sense that price became

related to the type of train and the time and day of travel rather than the distance travelled. TGV technology and differentiated pricing became successfully associated.

Socrate was launched to coincide with the opening of the new TGV Paris-Lille in April 1993. Sophisticated pricing mechanisms were implemented on the TGVs, although pricing differentiation was less extreme on the rest of the network⁴⁵. The well-publicised opening of the new TGV Paris-Lille, and the parallel introduction of *Socrate* with its modifications of commercial principles through yield management, affected passengers negatively. Sophisticated price differentiation threatened the principles of geographic and social cross-subsidising and equal access to transport. More parameters could now be used to modulate pricing⁴⁶: not only the type of train and a more refined division of the time of travel (the day of the week but also the exact time of the day), but also the type of purchase, and the flexibility (or lack of) of the bought product. Like marketing, yield management seeks to redefine and segment demand and concentrates on the price/quality relationship. Yield management includes both pricing and inventory control. In the air industry seat inventory control enables the air company to influence yields and total revenues in real time, on a flight-by-flight basis, within a given price structure.

Reservation now affects the price. Seat numbers ('quota') are blocked according to fare groups, and the prices also vary according to the date of purchase (e.g. from 2 months to 45 days - or from 44 to 15 days - before the time of departure). Some constraints are introduced such as staying a Saturday night. The prices vary (the earlier one books the cheaper it is) to constantly experiment with the size of quotas, until departure. The system limits capacity for discounted fares in order to smooth demand peaks and to fill the lows. The means to do this are quota management and overbooking. According to demand so far, if the risk of rejects (too much demand and dissatisfied customers) is greater than the risk of waste (unoccupied seats therefore loss of earnings), priority is given to the high fares group. Conversely, if the risk of waste is higher than the risk of rejects, the priority is given to the low fares group. Compulsory booking enables the gathering of information to constantly adjust the quotas online.

Passenger associations⁴⁷ objected to these new pricing and booking principles. For example they argued that: when pricing was modified on the first TGVs in 1981, prices were 20% higher than the kilometric unit applied to the intercity classical trains (reservation costs and supplements were additional to this); in 1993 this over-pricing was for example 51% higher for full fares and 102% for reduced fares on Paris-Le Creusot, 57% and 130% on Paris-Le Mans, 84% and 141% on Paris-Lille. These difficulties and the problems associated with the new ticket, led to dissatisfaction and anger in a clientele which had been historically faithful to rail transport because of convenience and simplicity⁴⁸ as well as prices. Passengers compared the new system to the previous one in which prices were clear, with only a few supplements on 'luxury' or busy trains, and in which travellers could organise their trips easily and flexibly without booking ahead and improvise if necessary⁴⁹.

Yield and quota management, when compared to the previous pricing differentiation where several techniques were simply used in conjunction, is a fundamental shift. Detailed information is gathered about each train seat throughout every day, week and year. This goes far beyond dividing prices into crude time periods: information is gathered continuously on seats sold so far, enabling the modification of the price mix on each train in real time; each train journey becomes identifiable and marketable as an individual and isolated product or market segment. This puts into question geographic and national cross-subsidisation and socially orientated price structures. The emphasis on market segments coincides with the development of the most profitable part of the network, the TGV lines. Yield management maximises the proportion of TGV high fares and is seen as imposing slower trains upon less wealthy passengers. The development of the TGV is also perceived as contributing to the "désertification" of less populated areas as TGV lines are more profitable with fewer stops: "We do not stop everywhere"⁵⁰. Yield management can also lead to maintaining an offer at a slightly lower level than demand, to maximise revenue per seat.

Passenger associations officially complained that the new *Socrate* commercial techniques did not fulfil public service requirements under French transport law. Following the controversies about over-pricing (above the standard franc/kilometre baseline), a compromise was reached in an amendment to legislation⁵¹ in July 1994 after negotiations between SNCF and passenger associations. It limits maximum prices (to 40% above baseline prices) and the proportion of overpriced trains. Nevertheless, passenger representatives thought that this was a poor compromise in that the amendment in effect legitimated the end of geographic and social cross-subsidisation and abolished the link between price

and distance. On the other hand, a senior SNCF yield management expert⁵² said that it was “too small a step in the right direction”; some SNCF interviewees stated that “passenger associations were not representative”; they used detailed technical counterexamples during interviews to demonstrate that passenger associations were wrong or did not understand the system; or stated that “no system is perfect” and that it was easy to find the “odd exception to the rule to prove the system wrong”.

Passenger representatives also opposed the generalisation of yield and quota management to the whole SNCF network. Retrospectively, it seems to have been a serious misjudgement, particularly in the case of regional transport (the system was never applied to urban/suburban transport). It certainly contributed to the negative perception of *Socrate*: names of small destinations were not included in the database system which concentrated on profitable segments⁵³, leading to manual input and long queues; and incomprehensible tickets and prices are not acceptable for relatively short journeys. More generally though, the boundaries between long-distance, high-speed long-distance, national, regional, regular and occasional travelling market segments are fuzzy, as illustrated in the case of Lille-Paris TGV users, who were some of the most vocal in their opposition to the new pricing and compulsory reservation⁵⁴. Lille is only one hour away from Paris by TGV and this radically changed travelling habits. Its use as a commuter train presented unanticipated difficulties and blurs the boundaries between transport market segments.

From the TGV to *Socrate*

There are clear links between the TGV trains and the *Socrate* system through pricing, and between the computer system and airlines through competitive advantage. The political and institutional dimensions of the TGV rail innovation, and its relation to airlines, precede and thus explain further the *Socrate* events. The TGV innovation was a way for SNCF to deal with new economic challenges in the context of growing withdrawal from the State⁵⁵. It was the result of SNCF looking to innovate to stop what was perceived as the terminal decline of rail transport. This was a political problem as SNCF had continuous budget deficits; and it was an economic problem for constructors as market demand in rail equipment was diminishing. TGV technology legitimated the existence of railway engineers and constructors. The perception of the decline of rail came partly from the US, where road transport was winning over rail transport. At the same time (late 60s early 70s) the *Airbus* was being designed in the aerospace industry, and its potential effect was thought to modify air/rail/road competition. However, and unlike the air industry, the history of innovation in rail originates primarily from the rail enterprises rather than the manufacturers (e.g. *Aérospatiale*).

SNCF is subjected to political, financial and administrative control from the State to ensure the ‘public good’. The notion of public service in French Railways can be summarised as ‘no barrier to access to each and everyone, speed and safety’. But at the core of the public enterprise lays a tension. Its financial structure is designed to ensure solidarity (and this affects fare structures), whilst it clashes with profit objectives. In the post-war period, including the 70s when the TGV project was beginning to take shape, the notion of public service was strong and shared across actors even with different interests (workers, engineers, executives, civil servants). There was pride in belonging to the enterprise and a belief in the spirit of innovation for the public good, even if it served various groups unequally. The search for speed came to represent this. Aeronautic engineering influenced this search, and there were various projects in the late 60s such as turbotrains and aerotrains that drew on jet engines. There was also international competition with the US and Japan high-speed trains. Engineers easily imposed their faith in the success of speed. This coincided with executives’ aims of catching up with the US and Japan and of presenting SNCF as a dominant and profitable company. The representation of the project thus evolved and arguments which convinced and enrolled politicians were issues of regional development, a ‘new’ rail system (not just faster trains but new lines) and policy, decentralisation and equality symbolised in the slogan ‘Speed for Everyone’. TGV technology became a mean to achieve business objectives and bring competitiveness as well as address political aims.

The TGV project was technically successful because it effected a major shift: instead of running faster trains on existing lines, new lines were built, separate from normal intercity trains but kept compatible when using the urban network to reach central city stations. By changing the nature of the network, it became possible to address the technical issues of speed. Perceiving speed as the most rational and modern way to deliver a transport mode was coupled to a democratic purpose: ‘Democracy through Speed’⁵⁶. The French TGV represented an adaptation of rail transport which saved rail from decline,

“like motorways for road transport”⁵⁷. Investments were funded through SNCF self-financing, State contribution and borrowing guaranteed by the State⁵⁸, revealing faith in the TGV potential to achieve commercial success: “in the same way as Columbus and his ships redrew the world map, the TGV produces Europe”⁵⁹. Other elements which had a positive influence on the project were: the choice of line for the first TGV (Paris-Lyon); and the fact that, after the 1973 oil crisis, electricity became the dominant energy, the main rail network was largely electrified, and the aero-dynamic TGV was represented as saving energy and more cost-effective than road and air.

Once in place, the TGV spurred a transformation in usage, increases in traffic and profitability, and more competition with planes. It became an important new transport mode which expanded into Europe and TGV technology was sold abroad. But it was not sufficient to stop the crisis at SNCF. There was still loss of traffic, attitudes to opening new TGV routes changed, and passengers complained about reservations and pricing (their experiences with TGV reservations and pricing in the 80s may have influenced their reactions to *Socrate* in the 90s). The tensions between public service and profit making were still present in the mid-80s, and some of the initial aims and rhetoric surrounding the *Socrate* project were very similar to the ones surrounding the TGV project. For instance, addressing business objectives and public mission at the same time, through the use of yield management to simultaneously bring higher profits and maintain a public service mission; using technology to solve political and economic problems; a faith in technical progress represented in the 80s by computers (as opposed to planes in the early 70s). A link between high-speed trains and computers was made in 1989 by the ‘European Conference of Transport Ministers’⁶⁰ as representing modernisation and progress. The TGV was seen as successful so an effort was made to prolong it through *Socrate*. The TGV innovation formed minds to seeking similar solutions, but it became a factor as it had itself changed the scene. TGV technology had an important effect on transport planning and pricing: dedicated lines allow speed, but require rigid sets of carriages of fixed capacity⁶¹, like airplanes, so it is impossible to add just one or two coaches to deal with demand variations. This leads to capacity management issues, which brings to yield management. Indeed the price of speed is a loss of flexibility.

The TGV increased competition with air and TGVs are a kind of hybrid between planes and trains. This set the course for SNCF to seek plane-related solutions and look to becoming an organiser and distributor of transport through advanced use of CRS. However, the model encapsulated in *Sabre* contributed to intramodal (between TGVs and classical intercity trains) as well as intermodal (between air and rail) competition. This deregulation model has implications for transport planning through the separate accountability of identifiable and marketable segments enabled by CRS and yield management.

There is ongoing public debate on European transport liberalisation and deregulation⁶². The French transport situation is still changing and the *Socrate* project has had serious effects too. In an effort to rebuild its image, SNCF carried out an audit and set up consultative committees with passengers⁶³. It reversed its differentiation principles and reviewed pricing and ticketing in early 1994 and simplified its ticket⁶⁴. The 1993 Moissonnier audit report to the Transport Ministry in fact had recommended that commercial optimisation should only be used on the TGV and that it should be suspended from the rest of the network (in the short-term only). SNCF improved TGV boarding conditions without reservation; reinstated and improved ticket reimbursement and cancellations of group tickets; introduced an ‘access ticket’ in case of very long queues at ticket offices; decreased prices on reduced fares; reintroduced free exchanges of tickets and reservation changes without penalty; provided better information on prices breakdown (reservation, supplement); allowed some ‘open’ tickets; increased quotas for reduced fares on some TGVs⁶⁵. SNCF claims that these measures regained lost traffic (due to the initial problems with *Socrate*) by 1994⁶⁶. This policy has been continued in the ensuing years⁶⁷: by allowing passengers to change their choice of TGV until the last minute⁶⁸; by allowing reduced fares on all TGVs⁶⁹; by simplifying the number of reduced fares categories⁷⁰; by introducing new advantageous types of tickets⁷¹. Pricing simplification and decreases were credited for a 3.5% increase of long distance traffic in 1999, superior to 1998 predictions, and a 4.3% increase in revenues⁷².

Many viewpoints exist on the nature and direction of European rail transport⁷³. Recent developments in French rail have been: separation of infrastructures and operations; opposition to the construction of new TGV lines considered too expensive and as having negative effects; investment in classical intercity lines; complementarity of intercity and high-speed trains using TGV carriages more flexibly and on non-dedicated tracks; simplification of pricing differentiation; and limited use of yield management. One possibility is SNCF becoming a multimodal, intermodal, combined public transport

company. The use of new tools such as CRS, yield management and new pricing tactics, did not lead to a direct adoption but an adaptation of these management models to a specific national context. Whether high-speed trains can replace airline services between European cities is a question that remains open, together with the implications it will have for public, regional and national railway networks.

APPENDIX – List of interviewees, Paris, 1994-95

Interviewees' names do not appear for reasons of confidentiality.

More than one job title appears when several people were interviewed together in the same department or organisation.

ORGANISATION DEPARTMENT	POSITION at time of interview and <u>PREVIOUS</u> ROLE in <i>Socrate</i> project if different
SNCF, Service Grandes Lignes, Relations Internationales, Paris	- Directeur <u>Previously:</u> Directeur Voyageurs Grandes Lignes et Directeur Projet <i>Socrate</i>
SNCF, French Railways Ltd, London	- Computer Department Manager - Marketing Manager
SNCF, Service Grandes Lignes, Département Communication, Paris	- Délégué aux Missions Extérieures - Déléguée Adjointe
SNCF, Service Grandes Lignes, Maîtrise d'Ouvrage <i>Socrate</i> , Paris	- Gestionnaire de Projet
SNCF, Service Grandes Lignes, Service de Veille Technologique, Paris	- Documentaliste - Chercheur
SNCF, Direction des Services Communs à la Clientèle Voyageurs, Pôle Service et Distribution, Paris	- Manager de la Formation <u>Previously:</u> Responsable des relations humaines du projet <i>Socrate</i>
SNCF, Service Grandes Lignes, Département Marketing, Paris	- Manager
SNCF, Direction de l'Informatique, Maîtrise d'Oeuvre Informatique Voyageurs, Paris	- Gestionnaire de Projet <u>Previously:</u> Responsable informatique du projet <i>Socrate</i>
SNCF, Direction de l'Informatique, Pôle Recherche Opérationnelle, Paris	- Responsable Informatique <u>Previously:</u> Optimisation commerciale, projet <i>Socrate</i>
SNCF, Service Grandes Lignes, Direction du Personnel, Paris	- Liaisons syndicales
SNCF, Gare Paris Montparnasse, Service Ventes	- Vendeur Guichet (Agent Commercial) - Vendeuse Guichet - Inspecteur Trains (Agent Commercial Train)
SNCF, Service Grandes Lignes, Direction du Contrôle de Gestion, Paris	- Manager Audit de Gestion <u>Previously:</u> Responsable des Ventes Grandes Lignes et membre de l'équipe <i>Socrate</i>
SNCF, Service Grandes Lignes, Comité Central d'Entreprise, Paris	- Coordinateur
Club Méditerranée, Direction de l'Informatique et des Télécommunications, Paris	- Directeur Informatique <u>Previously:</u> SNCF, Responsable des Ventes Grandes Lignes et membre de l'équipe <i>Socrate</i>
Confédération Générale du Travail, Syndicat des Cheminots de Paris Montparnasse	- Secrétaire Général - Secrétaire Adjoint - Membre
Confédération Française Démocratique du Travail, Branche Cheminots, Syndicat des Cheminots et Travailleurs des Activités Ferroviaires de Paris Ouest Rive Gauche	- Secrétaire Général Adjoint
Fédération Nationale des Usagers du Transport, Paris	- Secrétaire Générale - Secrétaire Adjoint
Nouvelles Frontières, Unité d'Enseignement du Tourisme, Paris	- Chargée de Formation - Responsable d'Agence

¹ Research access was relatively easy and the timing was judicious: access immediately after the events (summer 1993) would certainly have been refused as SNCF was greatly exposed to media scrutiny for several months and a climate of blame prevailed. In fact, interviewees appeared to welcome an opportunity to re-examine events six months later, and most interviews lasted 3-4 hours. I was also given liberal access to internal files and documentation covering the initiation and development of the *Socrate* project, starting from 1989. Several of the original members of the *Socrate* executive team were interviewed, as well as SNCF senior managers, yield management experts, marketing, human relations and training managers, SNCF sales staff, railway union representatives, passengers' associations, CRS experts and travel agents. For a list of interviews, see Appendix.

² L. Bromberger, 'Avec Socrate, le système de réservation de la SNCF, découvrez la nouvelle façon de prendre le train', *La Vie du Rail*, 21-27 janvier 1993, 10-17; P.P. Belobaba, 'Airline yield management: An overview of seat inventory control', *Transportation Science*, 21(2), May 1987, 63-73; P. Lévy, 'Des billets de train gérés comme des billets d'avion: le système Socrate de gestion entre en service', *L'Usine Nouvelle*, 2362, 30 avril 1992; I. Yeoman, I. and A. Ingold (Editors), *Yield management. Strategies for the service industries*, Cassell, London, 1997 (see also new edition: A. Ingold, U. McMahon-Beattie and I. Yeoman, *Yield management strategies for the service industries*, 2nd edition, Continuum, London and New York, 2000).

³ D. Broussolle, 'La mort du service public?', *Le Monde*, 21-22 mars 1993, p27; M. D'Aufresnes, 'La SNCF épinglée par la justice: Le tribunal de Metz donne raison à un usager', *Le Monde*, 23 juin 1993; P. Dutertre, 'Socrate fait dérailler la SNCF', *Le Quotidien de Paris*, 29 mars 1993; A. Faujas, 'Socrate, la cigüe et le marketing', *Le Monde*, 29 avril 1993; A. Faujas, 'Dix-neuf associations de consommateurs mettent fin au dialogue avec la SNCF', *Le Monde*, 13 mars 1993; J. Henno, 'SNCF: histoire d'une modernisation ratée', *Capital*, mai 1993, 109-110; N. Pénicault and P. Riche, 'La SNCF se brûle les ailes en voulant jouer à l'avion', *Libération*, 30 août 1993; V. Devillechabrolle, 'La grève à la SNCF et la journée d'action CGT: le trafic ferroviaire a été fortement perturbé', *Le Monde*, samedi 29 mai 1993, 18; F. Maleysson, 'Socrate ou le miroir d'une dérive', *Que Choisir*, 295, juin 1993, 11-15.

⁴ J. Berducou, *La politique commerciale Grandes Lignes*, Conférence de Presse de Jacques Berducou, Directeur de l'Activité Grandes Lignes, SNCF Grandes Lignes, 6 janvier 1994, Paris; J. Berducou, 'Action programme wins back lost traffic', *Railway Gazette International*, October 1994, 645-648; 'Conseil d'administration SNCF du 26 mai 1993', *Temps Réel*, Direction de la Communication SNCF, 61, 26 mai 1993; *Les résultats du trafic Grandes Lignes au premier semestre 1993*, SNCF Grandes Lignes, (GLYi), Paris, 1993; 'Le suivi de Socrate, les TGV Nord Europe, les prix, l'accès au train, la réservation, les échanges, les automates', *Socrate Cartes sur Table*, No 2, 13 juillet 1993, Paris.

⁵ CGT, *Socrate: la SNCF recule*, Secteur Fédéral des Cheminots CGT de Paris-Montparnasse, 27 septembre 1993, Paris; CGT, CFDT, FO, CGC and FMC Directions centrales, *SNCF: filialisation danger. Plate-forme syndicale commune des cheminots européens*, Confédération Générale du Travail, Confédération Française des Travailleurs, Confédération Française des Travailleurs Cadres, Confédération Générale des Cadres, Fédération des Maîtres Cadres, Paris, 1994; FO, *Défendre le service public, défendre le statut*, Fédération syndicaliste Force Ouvrière des Cheminots, Paris, 23 novembre 1994.

⁶ Causa Rerum, *Evaluation des effets de la médiatisation de Socrate auprès de la clientèle*, Etude réalisée par Causa Rerum, sous la responsabilité de Marie Cabanès, Pôles Etudes Clientèles et Services, Département Marketing, Direction Grandes Lignes, SNCF, Paris, 17 février 1993.

⁷ FNAUT, *La SNCF est et doit rester un service public*, Jean Sivardière, président, FNAUT, Fédération Nationale des Associations des Usagers des Transports, Paris, 1993; FNAUT, 'TGV: le prix du train', *Fnaut Infos*, no 19, janvier 1994; FNAUT, 'SNCF: vers la déréglementation tarifaire', *Fnaut Infos*, no 22, avril 1994; J. Sivardière, 'Socrate l'empoisonneur', *Fnaut Infos*, avril 1993.

⁸ H. Cuq and D. Bussereau, *Une nouvelle donne pour la SNCF*, Tome I, Rapport de la Commission d'Enquête(1) sur la situation de la SNCF, no. 1381, Les Documents d'Information, Assemblée Nationale, Paris, 15 juin 1994; Journal Officiel de la République Française, *Décret No 94-606 du 19 juillet 1994 portant approbation de la modification de l'article 14 du cahier des charges de la Société Nationale des Chemins de Fer Français*, Ministère de l'Équipement, des Transports et du Tourisme, Paris, 21 juillet 1994; V. Malingre, 'Le rapport Martinand met en cause la politique commerciale de la SNCF', *Le Monde*, 2 mars 1996; L. Moissonnier, *Rapport au Ministre de l'Équipement, des transports et du tourisme sur les conditions de fonctionnement du système de commercialisation des prestations voyageurs de la SNCF dit Socrate*, Conseil Général des Ponts et Chaussées, Paris, mai 1993.

- ⁹ M.D. Hopper, 'Rattling Sabre: news ways to compete on information', *Harvard Business Review*, 68(3), May-June 1990, 118-125; D.G. Copeland, 'So you want to build the next Sabre system?', *Business Quarterly*, Winter 1991, 56-60; R. Adam, 'A license to steal? The growth and development of airline information systems', *Journal of Information Science*, 1990, 16(2), 77-91; D. Henderson, 'More cash for computers: airline automation outlays', *Air Transport World*, 8, 1994, 82-83; L. Monteiro and S. Macdonald, 'From efficiency to flexibility: the strategic use of information in the airline industry', *Journal of Strategic Information Systems*, 5, 1996, 169-188; W.C. Schulz, 'The emergence of the real-time computer reservation systems as a competitive weapon in the US airline industry 1958-1989. A paper on strategic innovation', *Technovation*, 12(2), 1992, 65-74.
- ¹⁰ From 'Ecole Polytechnique', one of the elitist educational institutions leading to senior civil service in France.
- ¹¹ Moissonnier, *op. cit.*
- ¹² Interview Chercheur Service de Veille Technologique.
- ¹³ SNCF, *Note pour le conseil d'administration: rénovation de la distribution SNCF, le projet Socrate*, Confidential, 12 janvier 1989, SNCF, Paris, 8p.
- ¹⁴ *ibid.*
- ¹⁵ 'Vendre des réservations à tous les Européens? Le rêve de la SNCF', *Médias*, Mai 1992.
- ¹⁶ J.-M. Metzler and A. Lemaître, 'Vers un système de distribution ferroviaire international avec RESARAIL 2000', *Revue Générale des Chemins de Fer*, 109, décembre 1990, 21-24.
- ¹⁷ Henderson, *op. cit.*
- ¹⁸ Schulz, *op. cit.*
- ¹⁹ Adams, *op. cit.*
- ²⁰ G. Williams, *The airline industry and the impact of deregulation*, 2nd edition, Avebury Aviation Ashgate Publishing Limited, Aldershot, 1994.
- ²¹ Adam, *op. cit.*
- ²² Schulz, *op. cit.*
- ²³ Monteiro and McDonald, *op. cit.*
- ²⁴ Copeland, *op. cit.*
- ²⁵ *ibid.*
- ²⁶ K.A. Russell and N. Johns, 'Computerised yield management systems: lessons learned from the airline industry', In *Yield management. Strategies for the service industries*, edited by I. Yeoman, and A. Ingold, Cassell, London, 1997, 120-127.
- ²⁷ Hopper, *op. cit.*
- ²⁸ Copeland, *op. cit.*
- ²⁹ SNCF, 'La nouvelle politique des prix', *A Savoir*, No 1, SNCF, Grandes Lignes, octobre 1992.
- ³⁰ Interview Metzler, and Directeur Grandes Lignes, see also G. Dumont, *Innovation organisationnelle et résistance au changement. L'introduction du système Socrate à la SNCF*. Paris: Université Panthéon-Assas (Paris II), 1996.
- ³¹ Interview Metzler.
- ³² Arthur Andersen, *Yield management in small and medium-sized enterprises in the tourism industry*, General Report, European Commission Directorate-General XXIII Tourism Unit, Office for Official Publications of the European Communities, Luxembourg, 1997; I. Yeoman and A. Ingold, *op. cit.*
- ³³ P. Hanlon, *Global airlines: competition in a transnational industry*, Butterworth-Heinemann, Oxford, 1996, p. 37.
- ³⁴ Schulz, *op. cit.* p. 71.
- ³⁵ Copeland, *op. cit.* p. 60.
- ³⁶ K. Button and D. Swann, 'European aviation: the growing pains of a slowly liberalising market', In *Transport deregulation. An international movement*, edited by K. Button and D. Pitfield, MacMillan, London, 1991, pp 104-105.
- ³⁷ N.N. Mitev, 'The globalisation of transport? Computerised reservation systems at American Airlines and French Railways', In *Prometheus Wired: history, globalization and technology*, edited by P. Lyth and H. Trischler, Edgar Elgar, forthcoming.
- ³⁸ Belobaba, *op. cit.* p 64.
- ³⁹ 'Classical' intercity trains were introduced in the mid-70s.
- ⁴⁰ J. Villiers. 'Regard sur le transport aérien en Europe. An overview of air transport in Europe', *Institut de Transport Aérien Etudes et Documents*, 34(94/2), août 1994.
- ⁴¹ P. Gianfaldoni, 'Déréglementation commerciale dans les transports: implications stratégiques sur l'organisation du Service Voyageurs à la SNCF', *Technologies Idéologies Pratiques*, 11(3-4), 1993, 29-58.

- ⁴² E. Quinet, *Analyse économique des transports*, Presses Universitaires de France, Paris, 1990.
- ⁴³ J.-F. Bazin, *Le TGV Atlantique: la seconde génération de train à grande vitesse*, Denoël, Paris, 1988.
- ⁴⁴ J.-M. Sanchez, 'Transformations de la politique commerciale SNCF: vers une nouvelle problématique de l'équité et de l'accessibilité', *Technologies, Idéologies, Pratiques*, 11(3-4), 1993, 59-107.
- ⁴⁵ SNCF, *Plan d'action commerciale 1993*, Division Commerciale Voyageurs, SNCF, Direction de Paris-Rive Gauche, Paris, 1992.
- ⁴⁶ Gianfaldoni, *op. cit.*
- ⁴⁷ Interviews, FNAUT representatives; see also FNAUT. TGV: Le prix du train, *op. cit.*
- ⁴⁸ Moissonnier, *op. cit.* p.13.
- ⁴⁹ Sivardière, *op. cit.*
- ⁵⁰ Attributed to Jean-Marie Metzler, Directeur Commercial Voyageurs and head of the *Socrate* project. It has been argued that the large distances between TGV stations is "desertifying" the smaller towns and regions in between.
- ⁵¹ Article 14 is a piece of legislation that specifies pricing principles for SNCF. It is part of LOTI, "*Loi d'Orientation des Transports Intérieurs*", a law first formulated on 30th December 1982 (Décrets 82-1153, 83-109, 83-817) which determined SNCF status, responsibilities and constraints, see "*Cahier des Charges de la SNCF*", Journal Officiel 21 juillet 1994, *op. cit.* and Broussolle, *op. cit.*; Article 18 states that SNCF as a public enterprise "aims to exploit, manage and develop the national rail network according to public services principles"; it has been criticised for not clarifying these principles (see. Cuq and Bussereau, *op. cit.* p. 18, who also criticised the SNCF "*Contrat de Plan*" 1990-1994 for being vague and not mentioning issues of regional development and territory management).
- ⁵² Interview, Responsable Recherche Opérationnelle, Projet *Socrate*, SNCF; various other SNCF interviews.
- ⁵³ This was rectified quite rapidly but proved to have been a serious oversight. One reason why database inputs were neglected was the rush to coincide with the opening of the Paris-Lille TGV.
- ⁵⁴ FR3, *Le cheminot et le Président, le blues de l'usager*, La Preuve par 3, Magazine Economique de la Rédaction de la FR3 (France Regions 3, Third French TV Channel), 28 février 1997, 20h30, 50 mins.
- ⁵⁵ E. Suleiman and G. Courty, *L'âge d'or de l'état. Une métamorphose annoncée*, Editions du Seuil (L'Histoire Immédiate), Paris, 1997.
- ⁵⁶ C. Lamming, *La grande aventure du TGV*, Larousse, Paris, 1987.
- ⁵⁷ J.-F. Troin, *Rail et aménagement du territoire: des héritages aux nouveaux défis*, Edisud, Aix-en-Provence, France, 1995, p. 11.
- ⁵⁸ P. Descoutures, *La France dans l'Europe des Transports*, Conseil Economique et Social, Direction des Journaux Officiels, No 4199, Paris, 1992.
- ⁵⁹ F. Plassard, 'Le transport à grande vitesse et le développement régional', In *Table Ronde 94*, Conférence Européenne des Ministres des Transports, Paris, 37-83 (Laboratoire d'Economie des Transports, Lyon), 1994, p. 47.
- ⁶⁰ CEMT, *La coopération internationale des chemins de fer à l'heure de l'informatique et de la grande vitesse*, Conférence Européenne des Ministres des Transports, Publications de l'OCDE, Paris, 1989. (also available in English as "Rail network co-operation in the age of information technology and high speed"); see also M. Hepworth, M and K. Ducatel, *Transport in the information age. Wheels and wires*, Belhaven Press, London, 1992.
- ⁶¹ Bazin, *op. cit.*, pp. 98-99.
- ⁶² L. Cartelier, J. Fournier and L. Monnier (Editors), *Critique de la raison communautaire*, CIRIEC/Economica, Paris, 1996; J. Fournier, *Le train, l'Europe et le service public*, Editions Odile Jacob, Paris, 1993; C. Julienne, *SNCF: le rapport interdit*, Les Belles Lettres, Paris., 1996; J.F.L. Ross, *Linking Europe. Transport policies and politics in the European Union*, Praeger, London/Westport, Connecticut, 1998; C. Barrère, 'Gestion publique et gestion marchande du transport ferroviaire', *Sciences de la Société*, 43, février 1998, 25-46.
- ⁶³ SNCF, 'Le suivi de Socrate', *op. cit.*
- ⁶⁴ Berducou, 'La politique commerciale Grandes Lignes', *op. cit.*
- ⁶⁵ CGT, 'Socrate: la SNCF recule', *op. cit.*
- ⁶⁶ Berducou, 'Action programme wins back lost traffic', *op. cit.*
- ⁶⁷ C. Jakubyszyn and E. Le Boucher, 'Louis Gallois souhaite que la SNCF baisse ses prix: entretien avec Louis Gallois, président de la SNCF', *Le Monde*, 11 octobre 1996.
- ⁶⁸ SNCF, *Changez de TGV jusqu'au dernier moment!* SNCF, 29 novembre 1998, Paris.
- ⁶⁹ SNCF, *Guide des prix réduits*, Grandes Lignes, No 92, SNCF, Paris, 1994.

⁷⁰ SNCF, *Guide TGV Nord Europe. Guide pratique, horaires, prix*, SNCF, Paris, 1998; SNCF, *Guide TGV province-province (sans changer à Paris). Guide pratique, horaires, prix*, SNCF, Paris, 1998.

⁷¹ SNCF, *Découverte, une réduction pour tous*, SNCF, Paris, 1998.

⁷² 'Le Web dope les ventes de la SNCF', *Le Monde*, 17 décembre 1999.

⁷³ For example: M. Caniaux, *Rail-route: la clé de l'avenir. Vers une nouvelle politique de transport en Europe*, L'Harmattan, Paris, 1995; M. Savy, *Le rail et la route: le commerce ou la dispute? Le transport intermodal en Europe*, PREDIT (Programme de Recherche et de Développement pour l'Innovation dans les Transports), Direction des Transports Terrestres, Direction de la Recherche et de l'Action Scientifique et Technique du Ministère de l'Équipement, du Logement et des Transports, Presses de l'École Nationale des Ponts et Chaussées, Paris, 1997; E. Quinet, 'Vers une politique des transports', *Futuribles: analyse et prospective*, 195, février 1995, 53-58. Troin, *op. cit.*; Malingre, *op. cit.*; Ross, *op. cit.*