

The economic geography of Europe's 'Productive Triangle'

The following is a special advance release from a forthcoming Special Report in German, published by EIR Nachrichtenagentur:

Europe's future infrastructure will have the form of a dense "core region" centered on the Paris-Berlin-Vienna triangle, with "spiral arms" extending throughout the rest of Europe, into North Africa and the U.S.S.R.

The central region is a curvilinear triangle with corners at Paris, Berlin, and Vienna (Figure 1). The sides of this triangle are at the same time great infrastructural axes of rapid freight and passenger transport. The northern side runs from Paris through the steel region around Charleroi, through the Ruhr region of Germany via Braunschweig to Berlin. The southern side runs from Paris through the Metz-Nancy-Saarbrücken region, via Stuttgart-Munich to Vienna. The eastern side of the triangle runs from Vienna through Prague and northern Bohemia, via Dresden to Berlin.

This central triangle has an area of approximately 320,000 square kilometers—very nearly the area of Japan. It already has the greatest density of industrial infrastructure, and the greatest average level of education and culture, of any major region of the world. It includes the densest and most productive areas of northeast France, Belgium, the Federal Republic of Germany, the German Democratic Republic, western Czechoslovakia, and northern Austria.

Approximately 92 million people reside in the central triangle today, with a mean population density of 288 persons per square kilometer. Half of these 92 million already live in 10 great industrial regions or within a 50-kilometer radius of major infrastructural axes linking those nodes. These 10 industrial nodes, which generally combine two or more urban centers inside a radius 25-50 kilometers, on the model of the Ruhr region, are shown in Table 1.

The densification of infrastructure within the central triangle creates entire corridors and nodal regions of development (see map, Figure 2, on pp. 36-37). Along these corridors, ideal conditions are generated for the emergence of new cities, such as a new "Cusa City" to be built on the present West German-East German border, at the convergence of the corridors linking the Ruhr and Rhine-Main regions with Leipzig-Zwickau-Dresden.

Spinning off from this central triangle, are great infrastructure corridors linking it to the entirety of Europe:

To the east:

- A. The axis Paris-Berlin-Warsaw, with branches into
1. Ukraine (Kiev-Kharkov);

2. Belorussia to Minsk, and through to Moscow;
 3. Lithuania, Latvia, and Estonia, through to Leningrad.
- B. An arm sweeping from the area Chemnitz-Dresden-Prague in a thick strip along the Polish-Czech border through Wrocław to the triangle Katowice-Ostrava-Krakow and from there into Ukraine.

To the southeast:

C. An arm along the Danube, connected to the Rhine via the Rhine-Main-Danube canal and running through Linz, Vienna, Budapest, into Yugoslavia, Romania through to the Black Sea.

D. An arm running from the southeastern side of the core region (Munich-Vienna) through Croatia and Slovenia (Ljubljana and Zagreb) to Sofia and Istanbul, carrying much of the flow of freight from central Europe into the Middle East.

To the south:

E. Flows from the core region into Italy, extending down the length of that country over a new bridge to Sicily, and from there to Northern Africa. The flows into Italy are:

- from Vienna via Klagenfurt and Trieste into Padua;
- from Munich via Innsbruck and the Brenner Pass (with a new tunnel) to Brescia;
- along the Rhine down to Basel via Lugano to Milan;
- from Metz-Nancy to Lyon via Grenoble into Turin;
- additional approaches under study (see below).

F. In France, from Lille (Pas de Calais) to Metz-Nancy and Strasbourg-Mulhouse, into the Lyon region, down to Avignon-Marseilles, and then via Montpellier down into Spain, from Barcelona to Tarifa with connection over the

TABLE 1

Projected population of Europe's ten main industrial nodes for the year 2000 (millions)

Paris region	8
Lille-Charleroi	3
Ruhr	10
Metz-Nancy-Saarbrücken	1.5
Rhine-Main-Neckar	2.5
Stuttgart region	2
Munich region	2
Berlin region	4
Leipzig-Zwickau-Dresden	3.5
Vienna-Bratislava	2
Prague-Plzeň-northern Bohemia	3
Total	41.5

Strait of Gibraltar to Tangier in Northern Africa.

To the southwest:

G. Paris to Bordeaux, and into Spain via Zaragoza to Madrid.

To the west and northwest:

H. From the north of the Triangle through the Channel Tunnel via Dover to Great Britain.

I. Paris-Le Havre.

J. From the Ruhr region along the Rhine to Rotterdam.

To the north:

K. From the Ruhr and Berlin via Hamburg, through a new system of tunnels and bridges to Copenhagen and into southern Sweden.

These "spiral arms" cover an area of approximately 1,070,000 square kilometers, about three times that of the core region. Taken together, the system of core and spiral arms contains a population approximately equal to that of the United States—but on one-seventh the land area! Like a giant spiral galaxy, this system, with its outreaching arms of economic development, accesses a market of more than half a billion persons.

Triangle dictated by economic geography

If we conceive of an integrated infrastructure system as analogous to a great river system, then the "river bed" is defined by the regions of greatest density of population and economic activity. It is here that the greatest flow is concentrated—in passenger-kilometers, in ton-kilometers of freight, and in kilowatt-hours of energy production and consumption. We must examine the potential flow-density both per capita and per square kilometer, both in terms of values

reached prior to the imposition of "post-industrial" policies in the mid-1970s, and in terms of what can be projected into the next century.

The core area of the European infrastructure system is unambiguously identified as a curvilinear triangle between Paris, Berlin, and Vienna. This dense area of population and economic activity has well-defined boundaries in all directions. It is bounded:

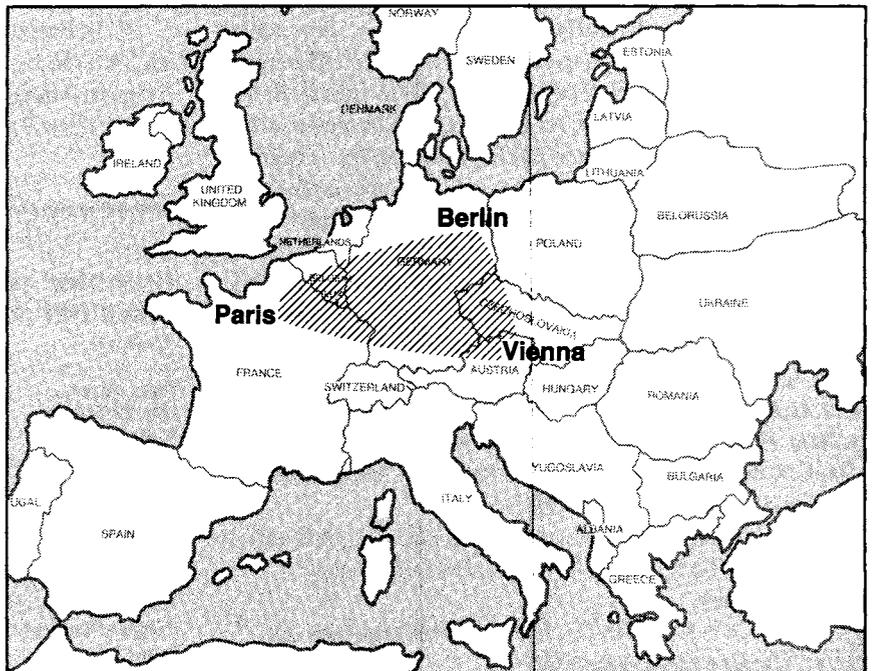
- to the north, by the much lower density of Schleswig-Holstein, and Scandinavia and northern East Germany;
- to the south, by the barrier formed by the Alps;
- to the east, by the lower density of Poland and eastern Czechoslovakia, and the Carpathian Mountains;
- to the west, by the lower density of southwestern France.

The impact of these geographical and economic bounding conditions is to concentrate the flow of activity to and from the core region into well-defined corridors or channels. These latter are the "spiral arms." Thus, inside the core area, infrastructure takes the form of a *dense network*. Outside that area, the infrastructure is also a network, but the density of flow is oriented along major *axes* or *spiral arms*.

East-west development corridors

Few, if any, of the many voices discussing the reunification of Germany and of Eastern and Western Europe have realized the far-reaching implications this will have on the organization of Europe's economy. An entirely new structure of movement of goods, energy, and people will come into being, with the east-west direction growing in importance relative to the present predominantly north-south direction

FIGURE 1
The European Productive Triangle



of flow in Germany and France in particular. Although the Triangle region represents a single, dense flow of goods, materials, and persons, three major east-west axes will predominate: a northern Paris-Berlin-Warsaw axis, a "middle corridor" which can be roughly identified as comprising Paris-Frankfurt-Leipzig-Krakow, and a southern Paris-Strasbourg-Munich-Vienna axis with a continuation to Budapest. Finally, in the southeastern direction, we have the Danube axis connecting the Rhine region with the Black Sea through Austria, Hungary, Yugoslavia, and Romania.

Within Germany a new "central corridor" must be developed, running from the Rhine region, from the Ruhr to Rhine-Main-Neckar, to the region between Leipzig, Dresden, and the Prague-northern Bohemia region of Czechoslovakia. This corridor passes through the geographical center of the new, reunified Germany, the region spanned by Kassel, Fulda, and Erfurt. This region will develop one of the highest densities of transport flow in all of Europe. In the larger context, this flow-strip runs from northeastern France into the Polish industrial areas of Wrocław and Katowice-Krakow, and thence down into the most densely populated regions of Ukraine, through to the industrial center of Donetsk.

To the north of this central corridor, we have the axis identified by the future high-speed rail line from Paris to Warsaw. It runs from Paris, to the industrial area of Lille-Charleroi, Brussels, Cologne, through the eastern Ruhr region to Hanover, from there to Berlin, Poznań, and Warsaw. When the Paris-Lille-Cologne TGV (*Train à grande vitesse*) line is continued through to Warsaw in this way, a trip from Paris-Warsaw will take only 3.5 hours.

The southern axis runs from Paris to Metz-Nancy-Strasbourg to Munich, Linz, and Vienna-Bratislava, with a continuation to Budapest.

A. The northern axis

Paris-Berlin-Warsaw, with branches to Kiev, Moscow, and Leningrad.

The reconstruction of Poland is key to consolidating a peaceful and prosperous Europe. Of the Eastern European nations, Poland has by far the largest population and land area. With its 37 million inhabitants, it represents the main reservoir of labor power for Europe.

A top priority is to improve the lines from the Federal Republic of Germany through the German Democratic Republic into Poland. The line from Berlin to Warsaw via Frankfurt an der Oder was supposed to have been fully electrified by December 1989. Berlin, however, has been a bottleneck, owing to the poor condition of the eastern side of the "Outer Ring" around that city. Whereas West Berlin has for 40 years been principally only a terminus for some 15 million tons of rail freight from West Germany every year, in the context of a reunified Germany, and even more so of the Triangle, Berlin will once again become one of Europe's major transport hubs. Large investment is required

for intermodal transport facilities, which should employ the most advanced technology in anticipation for very heavy flows.

The high-speed lines into the Soviet Union will bring the three largest cities—Leningrad, Moscow and Kiev—to within a half-day's train journey from Paris. The "Express Maglev" will have the following typical departure schedule:

Leave	8:00	Paris
	8:30	Lille
	9:10	Cologne
	9:45	Hanover
	10:20	Berlin
	10:55	Poznań
	11:30	Warsaw
	12:20	Vilnius
	12:40	Minsk
	13:15	Leningrad
Arrive	14:15	Moscow

It will be possible to have breakfast in Paris, traverse north-central Europe, and arrive in Leningrad in time for lunch!

By contrast, a train journey today from Berlin to Leningrad takes 9 hours, Hanover to Warsaw 15 hours, and Berlin to Moscow 30.5 hours. The following schedule is typical:

Leave	3:10	Hanover
	8:31	Berlin
	18:20	Warsaw
Arrive	14:46	<i>next day</i> Moscow

B. The central axis

Cologne/Frankfurt-Erfurt-Dresden-(Prague)-Krakow, with continuation into Ukraine.

This is the key axis for an "economic miracle" in the eastern side of the Triangle. It reestablishes the flow from both the Ruhr region and the Rhine-Main region into central Germany, and further to the northern Czechoslovakian and Silesian industrial regions. From there, it follows a corridor of high population density, along the Dnestr River into the heart of Ukraine. It is most instructive to view this corridor from the standpoint of its farthest point, Ukraine.

Of all the nations and regions contained in the disintegrating Soviet empire, Ukraine has by far the greatest economic potential. With 51 million inhabitants, it has a population density of 84/km², ten times that of Russia and much higher also than that of European Russia. It has a tremendous natural water infrastructure (Black Sea and Dnepr River); unlike most of the U.S.S.R.'s waterways, these are open the whole year, with the exception of a few parts of the Dnepr which freeze over once in a while. Historically, the earliest manufacturing centers, around Kharkov, date back to the ninth and tenth centuries, when there existed a triangular alliance

between the Hohenstaufen dynasty, the Paleologue rulers of Byzantium, and the princes of Kiev. As with Germany, the reconstruction of Ukraine as one of the world's leading industrial nations is therefore the key to rebuilding the entire vast region of the former Soviet empire.

Within Ukraine, there is a natural axis from the Black Sea to Kiev (population 2.4 million, third largest city in the U.S.S.R.) on the Dnepr, a major industrial axis. From the Black Sea there is a connection to the Danube, and by way of that river through the Rhine-Danube Canal all the way to the Atlantic. The other route to the West, of course, is through the Bosphorus into the Mediterranean.

The "Maglev Express" line will run with the following typical schedule:

Leave	8:00	Paris
	8:45	Metz/Nancy Airport
	9:15	Frankfurt Airport
	9:55	Leipzig
	10:40	Wrocław
	11:15	Krakow
	11:55	Lvov
Arrive	12:50	Kiev

The current rail travel time from Paris to Frankfurt is about 6 hours.

C. The Danube arm

With the completion of the Rhine-Main-Danube Canal, Europe gains an inland waterway connection from the North Sea all the way to the Black Sea. All 2,860 kilometers of the Danube, from the Rhine-Main-Danube Canal to the Black Sea, are fully navigable by Europa-class barges. Ironically, for some time, much doubt was expressed over whether it would even be worthwhile to complete the Main-Danube connection, given the relatively low traffic on the Danube. In the context of the Productive Triangle, however, the Danube takes on the importance of a development axis. It links the Ruhr/Rhine/Main/Neckar region—with the world's greatest concentration of industrial activity—to a huge potential market, vast mineral wealth, and a chain of urban-industrial areas (including new ones) which will blossom along this axis. Running down from the North Sea, this "chain of pearls" now linked together includes: Rotterdam, Düsseldorf, Essen, Dortmund, Cologne, Basel, Strasbourg, Karlsruhe (also direct link to Vienna), Mannheim, Frankfurt, Würzburg, Nuremberg, Regensburg, Linz, Vienna, Bratislava, Győr, Budapest, Novi Sad, Belgrade, Ruse, Galați.

The key to developing the Danube region is to install "nuplex" centers along the river—centers which combine advanced nuclear power-generation with urban-industrial complexes, and which include harbor facilities.

Flowing into the Danube corridor from the north is the

Berlin-Dresden-Prague-Vienna corridor, one of the sides of the core Triangle, which will develop as a main axis of flow of goods and passengers. The "Maglev Express" line will have the following typical schedule:

Leave	8:00	Berlin
	8:30	Dresden
	8:50	Prague
	9:20	Brno
	9:40	Vienna
	10:10	Graz
	10:15	Budapest
Arrive	10:30	Zagreb

D. The southeastern arm into the Middle East

Munich/Vienna-Ljubljana/Zagreb-Sofia-Istanbul.

The fall of the Shah of Iran and installation of the insane Ayatollah Khomeini, the Iraq-Iran war, the spread of Islamic fundamentalism—all these developments include an element of deliberate economic warfare against the kind of development partnership between Europe and the Third World which was exemplified by the old Baghdad railroad project, and, in the 1970s, by the Iran-West German nuclear energy cooperation. The Triangle policy implies a return to those historical impulses. In that context, modernizing the rail connections from central Europe into Turkey is a crucial step.

Even now, with the freight traffic into the Middle East a tiny fraction of what it would have become without the destabilization of Iran, there is a chronic transport bottleneck on the main route leading through Yugoslavia through Bulgaria. Practically the entire freight tonnage is moved by truck on highways that are in part entirely inadequate for such heavy traffic. The Trans-Yugoslav Highway from Munich to Salzburg-Zagreb-Belgrade is scheduled to be completed by 1995; it is now two-thirds finished. As useful as this project is, it does not come near to solving the problem. The only solution is efficient high-speed rail freight. That means a total overhaul of the rail systems of Yugoslavia and Bulgaria, which suffer from technical obsolescence and a nearly complete lack of modern intermodal facilities.

Austria is already undertaking a major extension of its railroad system into the south, with emphasis on two lines. The first, the Trauern line, runs from Munich, Salzburg, and Villach to Ljubljana and Zagreb. The second line runs from Regensburg via Linz and Graz to Zagreb. Here begins the unfinished Trans-Yugoslav east-west line going to Belgrade and into Greece. Both railroad lines through Austria are formerly one-track lines, and are currently being made into two-track lines. At the same time, a large container terminal will be completed in Villach in 1990, and another is planned in Graz to handle the expected increase in freight to and through Yugoslavia.

Besides the Trans-Yugoslav rail project, there is a plan to complete the bits and pieces of rail lines between Belgrade,

TABLE 2

Northern Italy has Europe's densest population

	Population (millions)	Population density (inhabitants per km ²)
Lombardy	9	373
Liguria	1.8	332
Veneto	4.4	235
Emilia-Romagna	4	178
Piedmont	4.5	175
Friuli-Venezia Giulia	1.2	157
Total northern Italy	26.214	218

Budapest, Vienna, and Nuremberg into a two-track line. All these measures, useful in and of themselves, will be inadequate to meet the present and future requirements of the region.

E. The Italian arm

Northern Italy-Mezzogiorno-Sicily-North Africa.

Outside the core area of the triangle, Northern Italy is the largest and densest industrial region in all of Europe (see **Table 2**).

This region is one of the world's leading centers of modern machine tool production and export, second in Western Europe only to West Germany. Besides machine tools, it is a major capital goods exporter to the developing nations, with strong historical connections to Africa and Ibero-America. The industry is centered in the Turin-Brescia-Genoa "triangle" with Milan in the middle. This is the industrial region which makes Italy the fourth greatest industrial nation in Europe in terms of volume of production.

A crucial bottleneck for the European economy is access to northern Italy through the Alps. Freight traffic between Germany and northern Italy is continually increasing. Already, the main railroad connection along the Rhine axis from Basel through the St. Gotthard Tunnel is technically overloaded, and the Italian railroad is unable to take more traffic arriving through the Gotthard. None of the present lines—the Gotthard and the Luetschberg-Simplon line in the West, and the Brenner Pass to the East—is adequate for rapid freight transport. The backup of traffic through the Alps has a negative effect on the entire freight flow in Germany. This bottleneck is forcing an increasing portion of goods to take a long and expensive detour via France or Austria. Since both Switzerland and Austria are, understandably, rebelling against the heavy truck traffic through their countries, any additional freight must be carried mostly by rail. Hence, the importance of the project to build an additional rail connection via a tunnel on the Splügen line. This tunnel would be

accessed from Basel.

The Italian spiral arm, which splits into two filaments running along Italy's eastern and western coasts, will provide the solution to the chronic underdevelopment of Italy's Mezzogiorno, with its major population concentrations in Campania (5 million population, 400 persons/km² with Naples and Palermo) and Apulia (3.6 million population, 200 persons/km²).

Crucial to the industrial revival of the Mezzogiorno is to install "pearl chains" of nuclear power stations and improved power distribution facilities along the eastern and western filaments, paralleling the fast freight system.

Access to Sicily (5 million population, 190 persons/km²) will be improved by realization of a long-planned bridge connection to the mainland. Sicily will become one of the busiest economic centers in Europe, the stepping-stone to Northern Africa. Already, plans exist for a "freight pipeline," which can carry sealed freight containers along with oil, from the tip of Sicily across the Straits of Sicily to Tunisia. There has also been discussion of a tunnel from Sicily to Tunisia—a far more ambitious project, but one which deserves serious study.

A southern "Maglev Express" line will run with the following typical schedule:

Leave	8:00	Berlin
	8:20	Leipzig
	8:55	Nuremberg
	9:15	Stuttgart
	9:45	Basel
	11:00	Milan
	11:35	Florence
	12:05	Rome
	12:35	Naples
	13:40	Messina
Arrive	14:10	Palermo

Compare this with a typical current rail schedule:

Leave	5:53	Stuttgart
	16:28	Bologna
	22:56	Naples
Arrive	8:58	Palermo

F. The Marseilles-Gibraltar arm

Lille-Marseilles-Barcelona-Tarifa-Tangier.

France plays a unique role in Europe, with its special relation to Africa and the rest of the developing nations, with its nuclear capability, its remarkable scientific tradition and capability. But, the French economy suffers from the lack of a well-developed, export-oriented *Mittelstand* (small and medium-sized industry), on top of a low population density (103/km²). The entire central strip of France is virtually emp-

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ty, with about two-thirds of the land area populated at less than 80/km². France would do well with double its present population. New technologies should give France the capability to better use its own raw materials, given that for the first time in her history, France possesses a truly abundant energy resource: nuclear power.

A crucial condition for France's future development is to reindustrialize the Alsace-Lorraine region on the basis of nuclear energy and a range of new high-technology industries. The authorities in Metz are proposing nuclear-based hydrogen production and development of hydrogen technology as a major area for the future. To this should be added industries producing high-temperature ceramics and other new materials. A further precondition for development of the whole eastern side of France is a long-overdue reconstruction of the historic canal system, which goes back to the work of Jean-Baptiste Colbert (1619-83), and even earlier.

The main transport axis today is Lille-Paris-Lyon-Marseilles, which forms part of a loop continuing from Marseilles to Toulouse and Bordeaux, and, from there, back to Paris. Revival of the Metz region will tend to strengthen the flow of activity from Lille down to Metz/Nancy, and directly down to Lyon and Marseilles, without going through Paris. Revival of the inland waterways will strengthen the flow through the interior, from Nantes along the Loire into the Lyon area. This would be a gain to the overall layout of the French economy, which is too much bound to the single hub of Paris.

Another plan, already in progress, is to develop an international airport near Metz, which would relieve the congestion of the airspace around both the Frankfurt and the Charles de Gaulle/Orly airports of Paris. This new airport, lying approximately midway between Paris and Frankfurt, will be linked by fast rail to both cities in such a way that passengers to either would arrive in the city centers at approximately the same time as if they had landed at the existing airports.

The further continuation of the north-south axes of flow in France leads into Spain along three branches: one from Toulouse via Zaragoza to Madrid; one along the northern coast from Bordeaux to Bilbao, Gijón-Oviedo, Vigo, Pôrto, and Lisbon; one along the southern coast from Marseilles to Barcelona, Valencia, Murcia, Granada, Málaga, and down to the Strait of Gibraltar. These coastal strips are relatively densely populated compared to the interior of Spain, which suffers even more than France from lack of population. Large-scale water projects are needed to reclaim the desertified regions around Madrid, once highly fertile lands, and to repopulate them.

Last May, the Moroccan transportation minister, Mohamed Kabbaj, opened a conference of 300 international experts to discuss plans for a bridge or tunnel connection from Europe to North Africa via the Strait of Gibraltar. Moroccan Prime Minister Laraki stated that the project would boost economic relations between the European Community and the

Arab Maghreb Union linking Algeria, Libya, Mauritania, Morocco, and Tunisia. It would also open up Europe to Western Africa by means of a road network between Tangiers in north Morocco and Lagos in Nigeria. Feasibility studies place the cost at \$5-10 billion. Morocco, Algeria, and Tunisia together have a population of more than 50 million (Morocco, 23 million; Algeria, 21 million; Tunisia, 7 million), concentrated at nearly Western European density along the coast.

G. The southwestern arm

Paris-Bordeaux-Zaragoza-Madrid.

Spain's decision to build TGV lines from Madrid is a crucial step forward. To link Spain to the "economic miracle" of the Triangle, it is crucial that its rail system be rebuilt on standard gauge. This will open up Spain's industrial potential and make it a stepping-stone to Northern Africa.

H. The Channel Tunnel and the role of Britain

The continuing controversies in England concerning the Channel Tunnel and related infrastructural facilities will largely decide the fate of that country. Without a strong infrastructural connection to the Triangle, there is virtually no hope that the United Kingdom will emerge from its present economic morass. The stubborn stupidity of many of Britain's policymakers was underlined recently when Prime Minister Margaret Thatcher declared that her government was "not in the business of financing European railroads." At the same time, Prince Philip and Prince Charles's increasingly fanatical advocacy of radical ecologism reflects a clear strategy to try to bottle up the potential of continental Europe, and a reunified Germany in particular, through a new mobilization of the "green" movement. Perhaps the shock of watching Europe adopt the Productive Triangle will finally prompt British policymakers to drop their commitment to post-industrial decay, and link into it, on the motto: "If you can't beat 'em, join 'em!"

Such a decision would unlock the tremendous potential embodied in such advanced research centers as the Harwell nuclear facility, the military laboratory at Aldermaston, the laser fusion facility at Rutherford-Appleton Laboratory, and the world's largest experimental fusion reactor, the Joint European Torus (JET) at Culham, in the British aerospace industry, along with some advanced biophysics research. This scientific and technological potential cannot be sustained indefinitely in the face of an overall erosion of Britain's industrial infrastructure. Conversely, if Britain were to feed her advanced technology into a "new industrial revolution" on the island, based on reviving independent, medium-sized high-tech industry, she would have nothing to fear from continental Europe. The precondition for such a revival is to thoroughly modernize Britain's infrastructure, and to attach that improved internal infrastructure to the European Triangle. Like the economy of the United States, the British economy has sunk below the point at which a purely internal revival

could be achieved, without massive imports of investment goods from the outside.

I.-J. The Le Havre and Rotterdam ports

The most urgent priority for Europe's harbors is to install new semi-automatic and automatic transfer facilities permitting more efficient intermodal transfer of freight between ship, truck, and rail-maglev. Unfortunately, plans made in the 1960s to introduce standardized, fully compatible containers, were not realized. Today, we have a chaotic situation with containers of every possible size, with the particular problem that seaborne containers tend to be too large for direct loading onto ground transportation. This has led to a thriving business for companies that unpack one size of container and repack the contents into other size containers—an exercise contrary to the whole purpose of introducing the containers in the first place! The proposal put forward here is to impose absolute standardization for all freight to be moved on the fast freight system of the Productive Triangle, and to use the new system as the norm for gradually cleaning up the mess of the rest of Europe's freight transport.

In this context, special emphasis must be placed on the largest of all ports, Rotterdam, which suffers greatly from lack of adequate rail connections, and from hopeless overloading of roads leading to and from Rotterdam through Holland. What is obviously required is a complete redesign of the harbor area, with emphasis on ultramodern transfer facilities between ship and rail-maglev, downgrading the relative importance of long-haul trucking. The task is to greatly increase the effective "power density" of harbor facilities, i.e., the throughput capacity in tons per hour per unit harbor area.

It should be noted that Europe's harbors and shipbuilding facilities, in particular, are the natural locations for assembly-line production of "floating factories." These include nuclear power plants, desalination plants, and fertilizer and other chemical plants constructed atop floating platforms for easy transport and installation at coastal and off-coastal sites in the developing sector. Westinghouse began work on such a facility in Florida, only to be shut down when world economic growth collapsed in the late 1970s. Now is the time to revive these concepts.

K. The Scandinavian spiral arm

Water crossings and long transport distances now separate Scandinavia's 23 million inhabitants from the core region of the Triangle. The passenger rail links from Hamburg have the following typical times: Hamburg-Copenhagen, 5 hours; Hamburg-Stockholm, 14 hours; Hamburg-Oslo, 15 hours; Hamburg-Helsinki, 30 hours.

The main bottleneck is the lack of a direct land connection from central northern Europe to Sweden. Three great bridge-tunnel projects in Denmark can solve this, opening a new era in the history of the region. The first is already under construction: a combination bridge and tunnel linking the

island of Fyn—which is already connected to the European mainland by a bridge to Jutland—with the island of Sjaelland where Copenhagen is located. This 23-kilometer-long "Great Belt Connection" includes a suspension bridge with a span of 2 kilometers, the longest in Europe. The train connection will be completed in 1993, and the road lanes will be opened in 1996. The project cost is estimated at \$2.9 billion and will employ a total of 15,000 man-years of construction labor. Once completed, it will permit automobile, truck, and rail traffic to run from Hamburg via Kolding on Jutland through to Copenhagen.

The second great project is a proposed bridge-tunnel connection from Copenhagen across the Øresund to the city of Malmö in Sweden. The total length of 17.6 kilometers is to consist of a 2,000-meter tunnel from Kastrup (the southern suburb of Copenhagen, where the International Airport is located) to an artificial island south of Sydholm; the rest of the span is a combination of low and high bridges over to the Swedish mainland. If approved this year, the project could be completed by 1997. It would cost an estimated \$2.1 billion and would employ 3,700 construction workers for six years.

The third project is a 23.6-kilometer rail and highway tunnel from Puttgarten in Germany over the Fehmarn Strait to Rødby on the Danish island of Lolland. It would largely replace the present ferry line between those two locations. If approved this year, the Fehmarn Strait tunnel could be completed by 1998 at an estimated cost of \$1.9 billion. It would employ about 2,000 construction workers. Since Lolland is already connected to Sjaelland by rail and road bridges, this tunnel would provide a direct traffic link from Hamburg to Copenhagen. High-speed passenger trains could then make the Hamburg-Copenhagen run in two hours or less.

The package of the Øresund bridge-tunnel and Fehmarn tunnel has been baptized under the name "Scanlink," and is being promoted by the European Round Table of Industrialists as a high-priority project. The Japanese are reportedly interested in financing part of it, and there is considerable support from northern Germany, which would greatly profit from easier access to the Scandinavian market. But, in the context of the Triangle, all these considerations are thrust into a much bigger strategic dimension.

The most important thing about the Scandinavian spiral arm is the remarkable scientific and technological potential embodied in its population, among the highest per capita in the entire world. This potential is exemplified by the way in which Sweden, a nation of only 8.3 million inhabitants, developed its own autonomous nuclear reactor industry.

Recent developments in the Baltic states and the U.S.S.R. add a crucial strategic dimension to the Scandinavian arm. Latvia, Lithuania, and Estonia have always been closer culturally and economically to Scandinavia and Western Europe, than they ever were to Russia. Together, the Scandinavian arm and the axis from Berlin via Warsaw to the Baltic states will be crucial to the rebirth of those states.