CONSTRUCTION INDUSTRY IN FRANCE

by

Isabelle Louise Perkins

Submitted to the department of Civil Engineering

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Abstract

This thesis examines the French construction industry and its various characteristics.

First, the situation of the construction industry in France is described. This involves a short description of the general economic background and a look at the role and influence of the government. A look from the eighteenth century forward explains the historical evolution of the construction industry in France and its influence on the current situation.

The characteristics of the construction industry itself focus on the structure of the construction firms and their mode of operation. The description of the construction industry includes the situation of various inputs to the industry such as labor, material, equipment and financing. Also investigated is the area of R&D as France has been known for its technological advance.

Second, the international position of the French construction industry is discussed. After looking at the importance of this part of the activity, it is described in more detail according to various geographical locations. An area of special interest is the situation of French construction related firms within the US market as this appears to be the future developing area for them. Trade statistics for basic construction materials are included.

Thesis Supervisor: Professor Dr. Fred Moavenzadeh

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Aknowledgement

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Chapter 1: Introduction

1.1 Presentation of the subject and scope

The French construction industry has existed and maintained a vital presence in the economic life of the country for many years. It has had years of large success and has carried its technological resources and capabilities outside its home boundaries. Today, even if the situation is not as glorious as in the past, the construction industry is still an important part of the economic life of the country as it contributes about 7% to the GNP, provides employment for 12% of the working population and includes about 18% of the firms.

Internationally, the French construction industry has also been very active and has done work in most of the geographical areas of the globe. In 1985, foreign activity represented about 13% of the total construction activity.

Through time, the nature of the construction industry has been changing due to both effects from within and outside the industry. Internal effects are such events as technological changes, market changes and organizational changes. Outside effects that can have an influence on the construction industry are the general economic situation and major "relationship" changes such as the creation and expansion of the European Economic Community (EEC).

The purpose of this thesis is to describe the French construction industry in all its various activities, past, present and future, to create a better understanding of its current situation.

1.2. Outline of the thesis

The first part of this thesis will describe the situation of the French construction industry at home. For this, it is necessary to lay out the general background of the industry and to look at the past history of the construction industry. The characteristics of the construction industry will be discussed, including the structure of the firms, their mode of operation (i.e. relation between owner, contractors, subcontractors,etc...) and their impact on the industry. To better define the construction industry, it is important to look at the inputs required such as labor, material, equipment and financing. These are all points strongly related to the situation of the construction industry itself as they have a significant impact on it.

This will be followed by a presentation and discussion about R&D which in a way can be said to represent the future of the industry. Current R&D activities will be described , as will the applicability of new technologies and the facilities given to the development. In conclusion of this will be a discussion on the major issues facing the construction industry in France today.

Next, the international involvement of the construction industry will be presented. After looking at the importance of this segment of the construction industry, a more detailed study of the historical involvement in different geographical areas will be conducted.

This leads then to the current situation and also to the trend that can be found for the future development of this segment of the industry.

This study will then be concluded with a look at the French involvement in the US construction market, with its importance, evolution, structure and mode of operation.

Chapter 2. French Construction Industry

The construction industry in France represents an important economic activity both nationally and internationally. Throughout this chapter, the emphasis will be put on the description of the activity and situation within the national borders.

2.1 General background

2.1.1 Role of the construction industry within the economy

In 1980, the construction industry occupied about 1/10 of the working population and, through its impact in other industries, created the same amount of jobs.

The major component of the construction industry is the building sector which employes 3/4 to 4/5 of the workers.

The production of the industry for 1980 was 338 billion Francs before taxes and the value added was 7% of the GNP for France.

The recent share of the GDP for the construction industry has varied from 7% to 5%, regressing from 1970 to 1984. The construction industry has had a peak share of GDP in the 1970's.

The fluctuation of the share of GDP for construction follows, to some extent, that of the manufacturing industry. Both dropped in 1979 relative to 1970, then increased again in 1980 and fell in 1984. Although the movements are similar, the value of the fluctuations are much more important in the manufacturing industry than the construction industry.

The agriculture sector fluctuates opposite the two previous industries, decreasing its share when manufacturing is increasing its share and vice-versa.

For its value, the share of GDP of the construction industry can be compared to that of the transport & communication or mining industry and is equivalent to one-third to one-fourth of the share of the manufacturing industry.

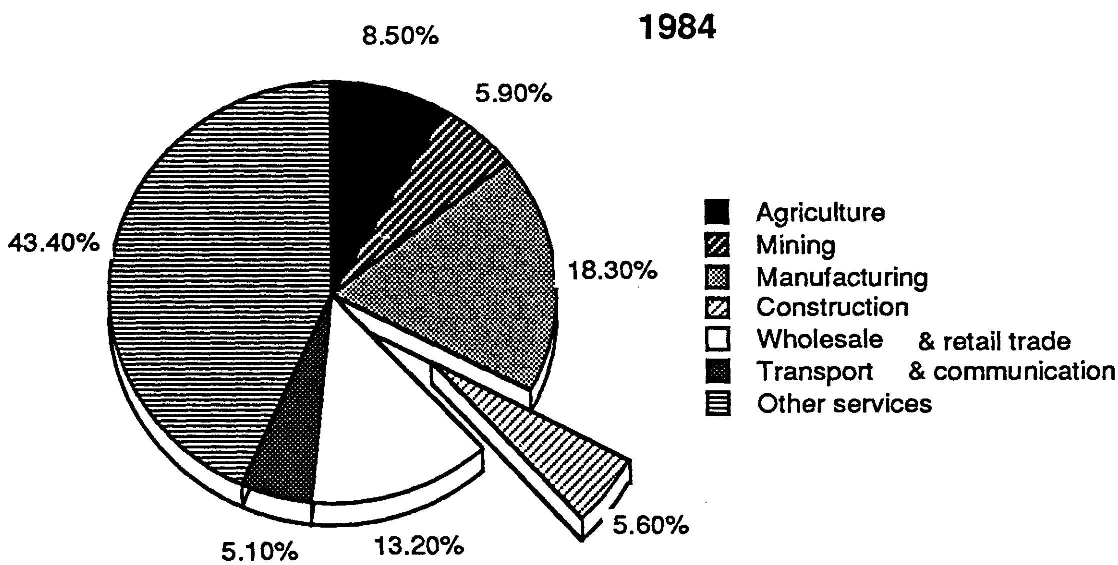
Table 2.1.1.1 shows the evolution of the construction share of GDP from 1960 to 1984 and compares it to the agricultural and the manufacturing sectors. Fig. 2.1.1.1 shows a detail of the GDP share according to economic activities for 1984.

Table 2.1.1.1 Share of GDP for agriculture, construction and manufacturing
(percent of total)

	1960	1970	1980	1984
Agriculture	9.85	6.46	4.15	8.50
Construction	5.64	7.45	6.63	5.60
Manufacturing	28.86	28.75	26.19	18.30

Source : 6 & 10

Fig. 2.1.1.1 Share of GDP by economic activity in 1984



Source : 6

2.1.2. Role and influence of the government

The government plays an important role in the construction industry since it represents at the same time the financial partner, the legislator, the owner and, sometimes, the initiator of research and development. Approximately 10% of the GDP in any given year is from government civil spending. In 1973, 35% of this total government civil spending was in the construction industry. This share dropped to 30% in 1980, having a value of 62.6 billion Francs.

In 1973, the government spending for the construction industry was equally divided among building and civil work. This 50/50 split changed in 1980 as building activity dropped to a share of a little over 30% of the government spending in the construction industry. The civil work firms slightly increased their share of total government spending during this time, up to 18.6% from 17% of total spending in 1973. This gave them a lead over building firms within the construction industry as a whole. This represents the major change from 1973 to 1980, and can be explained by the public housing activity that, after a boom in the 70's, slowed down considerably.

Table 2.1.2.1. shows the importance of the different economic activities showing their percentage of civil government spending. (Note that 70% of the research spending in table 2.1.2.1 is for the following sectors: mechanical, electronic, electrical, space and construction.)

Table 2.1.2.1 Breakdown of government civil spending by activity

	1973	1980	1980
	% of total government spending		Value (billion FF)
Agricultural products and food		0.7	1.5
Energy		12.9	27.4
Mechanical machines	8.2	11.0	23.5
Electrical and electronic machines, computers	16.9	13.8	29.3
Aeronautics and space	11.0	11.1	23.7
Other industrial supplies		12.0	25.4
Building	17.6	10.8	22.9
Civil work	17.0	18.6	39.7
Research and studies	6.4	4.0	8.6
Service and transportation		5.1	10.8
Total		100.0	212.8

Source : 3 & 4

In the last few years, the government has continued its involvement with the construction industry and has largely exercised its role of owner/developer. Since 1981 and the election of François Mitterand as president, Paris has seen six major projects started or expanded. Most of these are large scale projects and are under tight schedules. They also tend to be a showplace for new and innovative technologies - a prime example being the geosphere containing France's first Omnimax theater at La Villette in Paris.

Some further examples are:

- The renovation of the Paris train station Gare d'Orsay that has been transformed into a museum. The project cost was $154 million for 484,000 sq ft and involved 100 different companies. It was completed in December 1986 (27)
- The construction of a new Opera , at La Bastille, started in 1982. The Opera includes a 2,700 seat main auditorium (377,000sq ft) and an adjacent building with offices, restaurants, rehearsal and shopping areas (54,000 sq ft). The estimated cost is $257 million. Demolition began in 1985.
- The Museum of Science and Technique of La Villette, part of a larger project that includes the construction of the Geode, the renovation of a great hall and the creation of a music complex. The total complex is estimated at $561 million. The museum itself represents 2.2 million sq ft.

These projects have both a direct and indirect effect on the construction industry: the direct aspect is large contracts for major firms, the indirect is that such major projects require improvement work in such areas as transportation, infrastructure, roads, etc...
Also, the projects could almost be considered as practice for the engineering and construction firms which, if well carried out, using appropriate solutions and techniques, will provide strong references for them, as much nationally as internationally.

The government influence lies not only in the market that it generates by ordering various products, but also in its direct involvement within the industry through the creation and development of a sector of government owned firms.
After the 1982 nationalization, the government largely increased its influence in industry. Most notably, its influence in the industry exposed to international competition expanded. Prior to 1982, Renault was the only government owned industry involved in international competition.
In 1985, the largest area of government involvement is in energy related industries. With only 0.7% of the total energy firms, government owned firms employ almost 80% of the total

employees in this sector. Other largely nationalized sectors are: the financial sector with 47% of the employees of the sector and the transportation and telecommunication with 29% (table 2.1.2.2)

For the construction industry, this type of government involvement is rather small since only 0.02% of the firms are nationalized and they represent only 4.85% of the total number of employees working for the construction industry.

It can therefore be concluded that the major direct influence of the government within the construction industry at this time, is that of supplier of public projects to the industry rather than through the ownership of construction firms.

Table 2.1.2.2 Public sector by type of activity, January 1st, 1985

	Number of firms			Number of employees			% of annual volume
	Gov't	Total	%	Gov't	Total	%	
Agricultural and food industry	33	195,696	0.02	11,365	807,300	1.41	(1.)
Energy	40	5,632	0.7	233,305	292,100	79.9	54.8
Manufacturing	650	229,363	0.3	786,744	4,263,200	1.85	
Construction	77	348,030	0.02	58,124	1,197,300	4.85	3.5
Trade	216	652,028	0.03	203,19	2,090,900	0.97	
Transportation and telecommunication	163	86,459	0.2	377,208	1,297,400	29.0	
Service	810	1,257,519	0.06	106,067	7,414,700	1.43	
Finance and insurance	553	85,523	0.65	311,687	659,400	47.3	

Source : 8 & 14

(1): data relative to the volume of work has been found only for the energy public sector.

The construction value has been estimated based on the energy value

2.2. History of the French construction industry

Often, some of the reasons for todays situation can be found in the past. This can apply to the construction industry in France as some of the happenings, strengths and weaknesses can be explained or better understood by earlier decisions and actions.
The French construction industry was wide spread throughout the eighteenth century, when canals and harbors created by French civil engineers where used as models by Britain and the Netherlands, and through the nineteenth century when French engineers were the first to use reinforced concrete.

To find out how it came to be a leader, it is of interest to analyse the influence of such happenings as the early regroupment of craftsmen as "compagnon" and how they increased their knowledge, the creation of Royal academies and the later evolution to technical schools. It is also interesting to look at the effects that the introduction of new materials and methods has had and how the willingness to adopt them has had dramatic effects on the industry.

2.2.1. Early history of construction activity

Construction in France has been considered an important activity and has had an important position for the country's political, cultural and economic life for nearly 2000 years. However, it is not necessary to go back quite that far to understand the current situation.

In Europe, the Middle Age is the era of cathedral and temple building, as well as of bridges and fortress building. It was at this time that the "Compagnons" started. "Compagnons" are groups of craftsmen composed of carpenters, carvers and stone workers. They were employed by the military of the crusades to build bridges, defense places and temples. It appears that inside the group there was a hierarchy based on achievement, the best workers being "Chevalier du Temple" and allowed to use a cane , a distinctive sign which they kept throughout history.

The crusades bring back the notion of geometry and lines, an important point for the development of construction technology. This knowledge was eventually developed into architectural drawing with the help of the monks who were the guardians of instruction and already knew about Euclide's plane geometry. This corresponds to a major step toward thinner and more elegant structures as now the draftsman could draw details precisaly before the carver started his job. The crusades also established an "international" relation between France and the Middle East.

The "Compagnonnage", which still exists today, had another important aspect : that of teaching the trade. It can be considered the first architecture and construction university. They were developing technical skills and aspects of construction made possible by the knowledge of geometry and they ensured that improvements were known by others. The group was also subject to a moral conduct and had strong ties, this helped for steady progress although they could only go up to a certain point since they didn't yet know anything about resistance and acceleration. Therefore, their "calculations" were based essentially on previous experience and geometry.

The evolution of construction was at this time strongly related to the political situation of the country and the need for defense.

In the XVI and the XVII century, the French Kings, aware of the importance of good defense for their wars, hired the best constructors. They didn't hesitate to gratify if the job was done well or dismiss if they were not satisfied. Vauban (1633-1704), who developed the star-shaped fortifications, had important impacts on the construction activity. He "endeavoured to improve the material and social standing of the Génie officer" (20). He also suggested the creation of the "Corps des Ingénieurs du Génie Militaire" in 1675 which protected the engineers from the moods of their superiors. This was a first step toward the creation of the "Corps des Ponts et Chausées" in 1715. It was during this time that the word "Ingénieur" was used as a professional title and represented a technician in the public service, scientifically trained.

With Vauban as an ally, the "Corps des Ponts et Chaussees" increased its power and type of activities. Its original task was to help the movement of the army and to build fortifications. Their work had become so valuable to the State that they soon became involved in civilian work. This is when a period of large projects began such as the construction of Versailles. Vauban also laid out the first type of contracts to be used for the relation between the State and its contractors. It contained all information regarding the execution of the work, the quality of the materials to be used, the contractors responsibility and his duties, the costs,... Many of the items listed are still used in contracts today. The need to regulate the relation between the State and contractors can be said to come from the scientific and rationalist mentality of the French military engineers.

It is at this time also that the tradition of government involvement began, first with the royal construction work of Louis XIV during the second half of the seventeenth century. It was Colbert who directed all the works. The time of the kings Louis XIV and Louis XV saw an increase of castle and public building construction. This situation changed as the revolution came and a wider interest in military and economic strength became prevalent. This marks the beginning of an increasing activity in roads, canals, and bridges construction.

At this time, France was considered a leader in Europe for exact sciences and their technical applications. Mathematicians and engineers continued their work and were developing theories then applied for design and construction. It was a period of close relation between engineers and mathematicians, often times engineers being mathematecians themselves or vice versa.

This close relation between government and construction continued through the Monarchy, the Empire and the Republics, each of them favoring the construction activity by ordering the construction of public buildings, harbors, universities, and later airports, hospitals and low income housing.

2.2.2. Creation of the academies and engineering schools.

Todays education system in France is largely based on the creation of the academies in the seventeenth century and the opening of the engineering schools in the early eighteenth century. It is also one of the rare countries where high level professional training is not given by the universities but rather by separate schools.

The understanding of the creation and the evolution of the education system is important in many ways to explain the competitive situation of the construction industry through the years. It shows the original role of the engineer as an instrument of the government, the emphasis on mathematic studies and the distinction of a technical elite.

Facts that assess the importance of the education system for the construction industry, or any industrial or decision making position, is that most of the persons holding key positions graduate from a few dominant schools. Also, when looking at the progress in science and construction techniques or construction theories, one realizes that much of it was done by former students or teachers of the "Ecole Polytechnique" and the "Ecole Nationale des Ponts et Chaussés". It is therefore interesting to go back to their creation and understand the reasons of such a development.

The mid seventeenth century corresponded to a vast academic movement and in a matter of 40 years, most areas of arts and sciences were covered.

In 1666, the academy of science was founded which could be regarded as todays mathematics and physics classes. 1671 saw the opening of the Royal Academy of Architecture.

Universities in France had existed through the Middle Age and had enjoyed a good reputation. But later years brought a strong decline which eventually led to the development of engineering schools. The sixteenth and the seventeenth century had no will to rehabilitate those universities and rather relied on private instruction or church sponsored institutions. This became a general trend and when the need for higher education became wider, this trend was continued and smaller specialized institutions were opened rather than reviving the universities.

It is through the eighteenth century that a strong need for higher education was felt, especially in scientific and technological areas. The central power decided the creation of schools that had a definite professional orientation to them was necessary. The "Ecole des Ponts et Chaussés" was created in 1715, followed by the "Ecole d'Artillerie" in 1720, the "Ecole des Mines" in 1783, etc ... Those school's primary objectives were to train officers in precise technical areas to fulfill the growing need of the nation for such individuals.

The end of the Monarchy saw the need of highly trained professionals and created the first engineering schools, but it is the revolution and its new government that expanded and eventually made the education system what it is today.
The first action of the revolution was to close all existing universities and stop all subsidies to the schools on the grounds that they had been created under the Monarchy and were favoring an elite. It is true that the acceptance into one of the schools had been more dependent on the social rank than on the quality of the student, but the revolution eventually defined a new type of elite since the entrance to the reopened schools became subject to a competitive examination and only the best could access them. (This system of selection is still true today, especially for the first schools created.) The urgent need for qualified personnel and also the support of the bourgeoisie to the school system, as the entrance into one of them had always meant a guarantied access to high level jobs, led to the reopening of the schools and the creation of the new ones. This is when the "Ecole Polytechnique" (1794) and the "Conservatoire des Arts et Métiers" (1792) were opened.

A major ambition of Napoléon was to raise prosperity in France. He favored the development of industry by different measures such as low interest rates and national exhibitions and strongly supported the development of the schools. To meet his goals, he needed what he called his elite, in various sectors ranging from medicine to engineering. But this elite had to agree with the government actions and be faithful to the power. Therefore, the government control over the schools increased greatly during this period . This is how the "Ecole Polytechnique" eventually became the supplier of army officers. This new system had the double interest of serving the power and pleasing the bourgeoisie and became very popular. To reinforce the control of the government over the schools in order to avoid having bodies standing against the government, the last measures that were taken were to require tuition for certain schools, to designate the direction of the establishment, and to have them dependent on various ministries.

The evolution of the education system from then to today follows two main ideas :

1. Most of the graduates from the schools found jobs as State employees or working for the State. This was due to the economic situation and the level of development of the country. Industry at this time had no massive need for highly qualified personel, a situation that changed through the second half of the nineteenth century. The number of graduates going toward private industry and coming out of Polytechnique, Centrale and Les Mines multiplied by nine from 1850 to 1920.
2. When created, the schools were strictly public and constituted the only real higher education system. It was essentially based on utilitarian matters. Today, there is a coexistance between the university system and the "Grandes Ecoles" but the latter have kept this specificity of teaching primarly utilitarian material.

The first opening of schools was dictated by a need for qualified personel in specific fields. Construction was the first area in which such a need was felt and was therefore the first area to have its school. This can probably explain some of the importance of construction at this time and also the rapid advances that were made as numerous engineers were taught the state-of-the-art and were then able to remain at the cutting edge. The "Ecole des Ponts et Chaussées" is the school that helped secure in the eighteenth century the knowledge and technical skills of French engineers in such areas as road and bridge construction which was widely recognized in Europe. One also has to keep in mind that their primary concern was civil work as they depended on the State.

2.2.3. Development of the use of iron and steel

Today, as will be mentioned later, the use of steel for construction work is very restricted in France and only represents 10 to 20% of the construction work. This situation may have its origin in the early development of iron fabrication and use in spite of a short period where iron and steel structures became popular in France.

The British developed the iron industry and France followed using their technology. The first real use of iron as a construction material appeared for the construction of buildings. The use for bridges had been studied and proposals had been made but their construction was too expensive due to the high cost of iron. In the case of buildings, the use of iron was made progressively, replacing the traditional masonry structures. Eventually, by the end of the eighteenth century, it was common practice to at least use iron as reinforcement.

The use of iron for construction started in France under the influence of Napoleon who was a firm believer in this material which represented for him the triple symbol of strength, durability and progress. Because of his beliefs, Napoleon chose cast iron for monuments of his time. The "Pont des Arts " over the Seine was an early example of cast iron construction. The beginning of the use of iron was slow in France because of the high cost and the lack of technology of the iron industry. The eighteenth century had shown to builders a new material and forced them to reconsider their habits.

After Napoléon's defeats , the country entered a difficult economic situation and the following monarchy was faced with high debt. To reduce it, they imposed tariffs on imported goods. Iron, being an import, became an uneconomical material compared to wood and therefore iron construction did not progress until a carpenters' strike in 1845 . The strike

lasted several months and this pushed contractors to look for alternative methods rather than stop construction. They then turned to iron and used it for the construction of floors.
The Second Empire brought social changes and corresponded to the end of the depression. This marked a boom in the building industry and many construction projects were sponsored by the government. But the only innovating structures of this time were the greenhouses.

With the appearance of rails, the iron industry grew and developed much more. The iron and rail industries were complementary to each other as the rail allowed easier transportation of material which enabled the industry to increase its production and develop new technologies for the rolling of rails. Again , France was following and copying the British and had a much slower development because of iron cost and the reluctance of the industry to modify their production technics. This accounts for the continuing high cost of iron.
The result of the development of the rail was the need for train stations . This became a first extended use of iron for construction as large open and high structures were needed to allow undisturb traffic. Between the 1840's and the 1870's , many train stations were built using cast iron.

Another type of structure that became a prime candidate for the use of iron was the market structure. The first step was the use of iron for the roofs, and eventually columns were made of iron. The result was a large success and many of those structures were built in France and Belgium between 1850 and 1900. Also with industrial and economic progress through the nineteenth century, the need for commercial structures appeared and many department strores were built in the 1880's using cast iron.

The nineteenth century also marks the beginning of prefabrication using cast iron, but this was mainly developed in England. France did not see the need for turning to this aspect of construction, at least at the early stage of prefabrication. There were many reasons for this :

- cast iron was still an expensive material
- it was felt that they were too many disadvantages to use iron for construction; frequent painting, high transmission of sound and heat compared to stone and wood, rapid heat propagation.
- France's number of colonies was lower than England's and one of the application of the prefabrication technic was in the colonies where skilled labor was rare. The prefabrication enabled all the work to be done in advance, in England , by British labor that did not have to be moved.

Eventually France entered the prefabrication area and exported skeletons of all kinds of buildings ranging from churches (Peru) to royal pavillons (Cairo), but the demand was not large enough to allow mass production. Another area that used prefabrication was the erection of temporary structures for international expositions held in Paris.

The high cost of iron in France pushed for further studies on improving the quality of the material but also on new construction technics and shape of elements to reduce the total cost. This is when "I", "T" and inverted "T" beams came out of the French mills and were used for the construction of lower cost floors. France then established a lead in the floor techniques which were shown at the 1855 exposition in Paris and admired by the British.

It is interesting to note that even if France was behind in the iron industry, it stayed very competitive in the use of iron in construction, being even the first to consider it for building construction. This was due not only to the contributions of engineers and mathematicians but also to the strong encouragement of all the political regimes. Political support came through financing of public buildings using iron, through the stand of leaders such as Napoléon I and Napoléon III that promoted bridges and buildings using this material and through the sponsorship of national and international expositions. The first international exposition took place in 1798 and was followed by ten others where industries could exhibit their products. They eventually became the showroom for French technology.

France then used its lead in technology and exported its talent throughout the world. In 1878, "three fourths of the bridges and metal structures in Spain, Portugal and Italy and nearly half of those in Australia, Rumania, and Egypt were built by French constructors." (22)

2.2.4. Discovery of cement and its impact on the construction

Concrete has its origin in the evolution of mortar used for brick construction.

As iron became more and more used as a construction material, the need of a fast setting and strong binding agent appeared. Detailed study on existing binding agents was done by Vicat, a French engineer (1786-1861). But Portland cement was patented by an English mason and building contractor, Joseph Aspdin.

This technique was imported to France in 1840 when the first Portland cement factory was constructed in Boulogne.

The idea of reinforced concrete came at the end of the nineteenth century and various patents were granted to Frenchmen in the 1850's and 1860's. But it was through Monier (1823-1906) that this new method became well-known. Later improvements in concrete techniques such as "béton fretté" (intensive reinforcement at beam-column connections) and prestressed concrete were introduced by French engineers (Considère and Freyssinet)

The beginning of the twentieth century marks the start of an increasing competition between concrete and steel construction, especially for structures such as medium span bridges.

The French influence in the construction area was of two types at this time : first, through the work and the publications of people such as Belidor, Coulomb or Navier; second through Napoleon's war which helped propagate the French style and techniques to Europe and Russia.

The USA was also somewhat influenced by the situation in France as it created the Corps of Engineers on the model of the "Corps des Ponts et Chaussees" and in 1815 was still using French reference books.

France's earlier leadership in the construction industry was probably due to a respect instilled in the eighteenth century for civil engineers and a strong technical education. It was also due to powerful government involvement which was probably the biggest client and also a strong financial supporter.

2.2.5. Recent evolution

The most recent development of the construction activity in France can be broken down into different stages throughout the years.

Between 1924 and 1950, there was a major government effort to develop hydro-electric infrastructure and also to modernize the road network. At this time, many dams, pipelines, stations, bridges and roads were constructed. It is also at this time that the construction of the first highway took place.

After WWII, and roughly between 1950 and 1965, there was an important need for housing and reconstruction. The government started a program of massive housing construction (500,000 units/year). This required the development of new technologies to allow such a production rate. Therefore this stable and guaranteed demand was an excellent opportunity for the development of prefabrication.

The period of 1959 to 1968 correponds to one where investments in material was increasing and at the same time the qualification of the workers was decreasing.

After 1965, although the housing activity was still growing, the demand for construction became more and more diversified, including projects such as hospitals, telephone centers, schools and public utilities. Also the economy was growing fast enough to require more and more office space. Therefore, this period, up to 1974-1975, saw large investments from both the private sector and the government.

Another phenomenon that took place during this period and more specifically from 1965 to 1968, was the increasing number of craftsmen that appeared. This followed the growing need for repair work since new construction was becoming more and more expensive. This also slowed productivity.

The building industry increased its volume of work until 1974 corresponding to a major change in activity. Housing projects shifted from large scale to much smaller ones, this necessitating a change in construction methods. The prefabrication industry was especially hurt.

The principal direct causes of the decline (550,000 dwellings in 1974 - 400,000 in 1980) of building construction were:

- insolvency of households
- reduction of government financing for housing and community projects to monitor the budget deficit
- shift of private companies' investment strategies, away from capacity expansion to reorganising organization and increasing efficiency.

After 1975 and up to the early 80's, the demand for construction became both more diversified and more constraining as a result of the oil crisis. This was again a favorable time for the development of new products and technologies with objectives to reduce costs. Another major impact of the oil crisis has been the large development of nuclear power plants which brought important contracts to the construction industry.

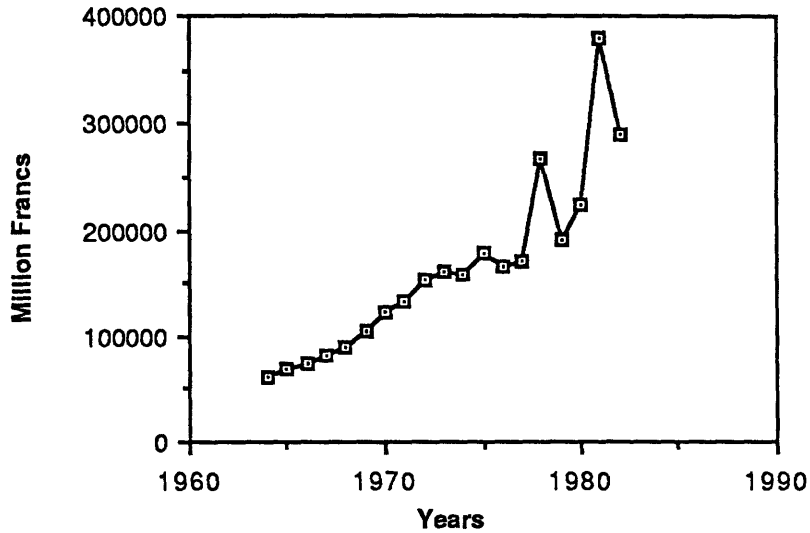
One of the major changes from 1960 to 1985 in the structure of the industry is the consolidation of companies, with a resulting increase in the concentration of the industry. This situation applies not only to the construction industry, but to all industry in general. A systematic external growth is achieved by buying out other companies. One example for the construction sector is CGE which combines Alsthom, Chantiers de l'Atlantique and CEM. There is also the example of Bouygues which, with it's last purchase, becomes the largest

French construction firm. This consolidation phenomenon was encouraged by the government and was said to give more strength to the companies.

From 1960 to 1985 the size of the construction firm increased. In 1960 there were no construction companies among the top 50 French firms, but in 1984 there were three (SCREG, Bouygues and SAE). Those firms have been able to use an excellent market over the years with the housing boom in 1973 and the development of the Middle East.

In terms of output, as defined by the OECD (value of construction put in place + value of sales of products + sales value of goods sold in the same conditions as purchased), the results of the construction industry in France have been increasing regularly up to 1975. There were then two years when outputs stayed stable and in 1978 they peaked. This corresponds to both an important increase for that year's residential construction and a high level of repair and maintenance. The following year, the output fell close to the 1977 level, to slightly increase in 1980 and peak again in 1981. The reasons for this second peak are the same as those for the 1978 peak. In 1982, the level of output went back to a lower level, but still higher than that of 1980. (Fig. 2.2.1)

Fig. 2.2.1. Evolution of the total output in million Francs from 1964 to 1982



Source : 7

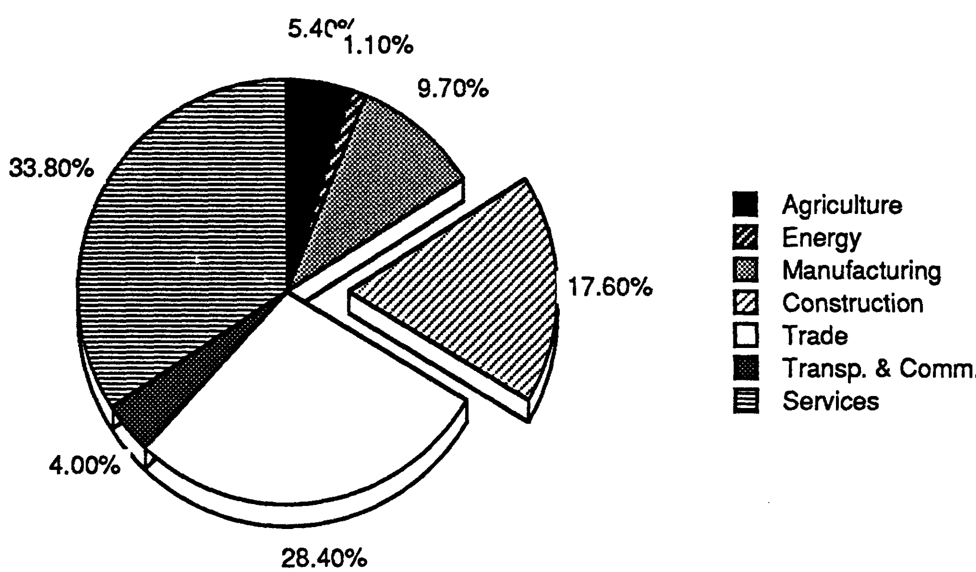
2.3. Characteristics of the construction industry

The construction industry employs about 12.3% of the working force to arrive at 6.2% of the turnover. It accounts for 17.6% of the total number of the firms. This large number is explained by the quantity of small firms that exist within the construction industry as will be seen later. Otherwise stated, 1,435,485 workers are part of 290,118 firms and produce 378,847,000 Francs (1981).

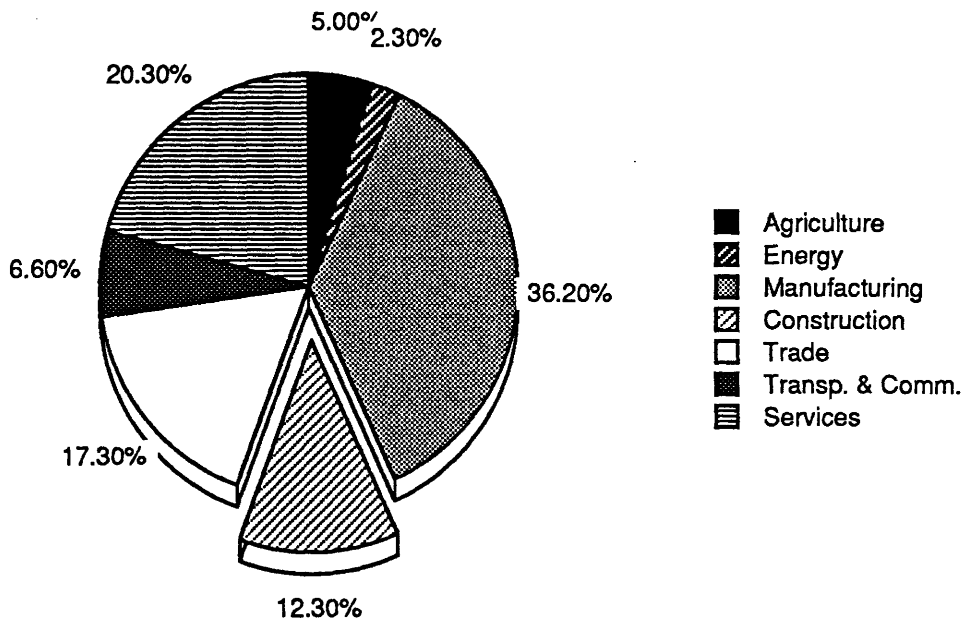
As a comparison, the situation of manufacturing is opposite: it has less firms and employees for a larger turnover. (Fig.2.3.1)

Fig. 2.3.1 Distribution of firms by economic activity - Situation in 1985

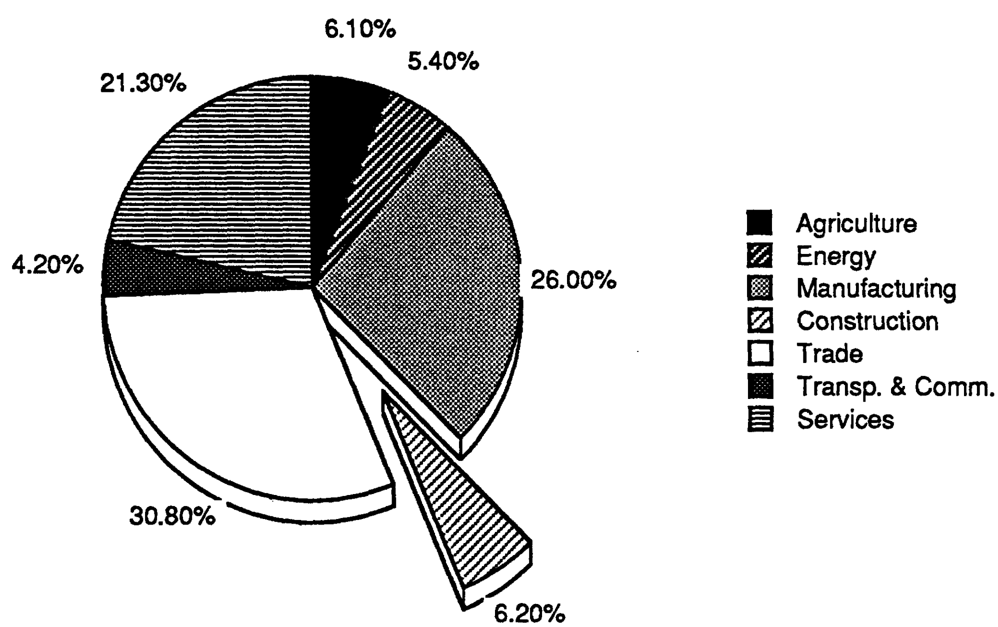
Number of firms by sectors



Number of employees by sector



Percentage of turnover by sector



Source : 2

There hasn't been any change in industry structure since 1975 as shown by table 2.3.1. The distribution of the number of firms, the number of their employees and their turnover has been stable.

Interesting to note is that the majority of these firms employ less than 20 people. Yet, while these small firms account for 95% of the total firms, they only represent 1/4 of the employees and 1/4 of the turnover.

One of the reason which can be put forward for the large number of small firms is that over 10 employees a company has increased financial burden in that it has to pay a 1% contribution to the state which is put toward housing, professional education and it also has to contribute to public transportation for its employees.

Table 2.3.1 Size of the firms and their turnover (percentage)

	1975			1977			1979			1981		
	1	2	3	1	2	3	1	2	3	1	2	3
Size												
<19	94.9	20.5	26	95.3	22.7	25.8	95.5	21.9	24.9	95.5	23.8	25.2
20-99	4.2	19.7	19.4	3.8	19.2	18.9	3.8	19.1	18.9	3.7	20.1	13.9
100-499	0.7	17.9	15.6	0.7	17.4	15.2	0.6	17.3	15.2	0.6	17.7	15.1
>500	0.2	41.9	38.9	0.2	40.7	40.2	0.1	41.7	41	0.2	38.4	41.0

1 = percentage of firms
2 = percentage of employees
3 = percentage of turnover before taxes

Source: 2

Note: the size of the firms is given by number of employees

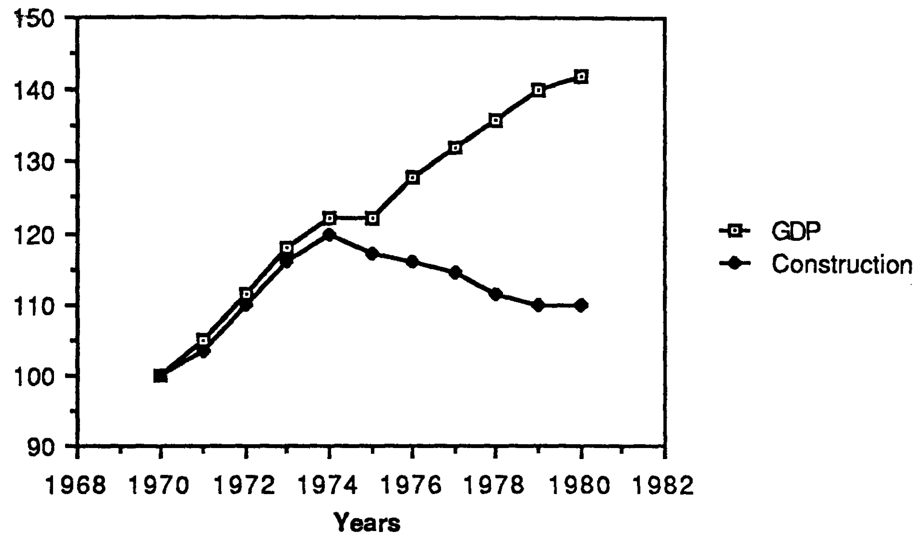
The evolution of construction output and GDP have been parallel from 1970 until 1974, when a split between the two evolutions began, GDP going up and construction down. This divergence begins right after the oil crisis during which the GDP (from 1974 to 1975) remained constant, and the construction production slowed. (table 2.3.2) The continuing shrinkage of the construction activity is closely related to building activity which is the most important activity within the construction industry and which, since 1973, has been regularly decreasing.

Table 2.3.2 Evolution of GDP and construction production
1970=base 100

Years	GDP	Construction
1970	100	100
1971	105	103.5
1972	111.5	111
1973	118	116
1974	122	120
1975	122	117
1977	132	114.5
1978	136	111.5
1979	140	110
1980	142	110

Source: 1

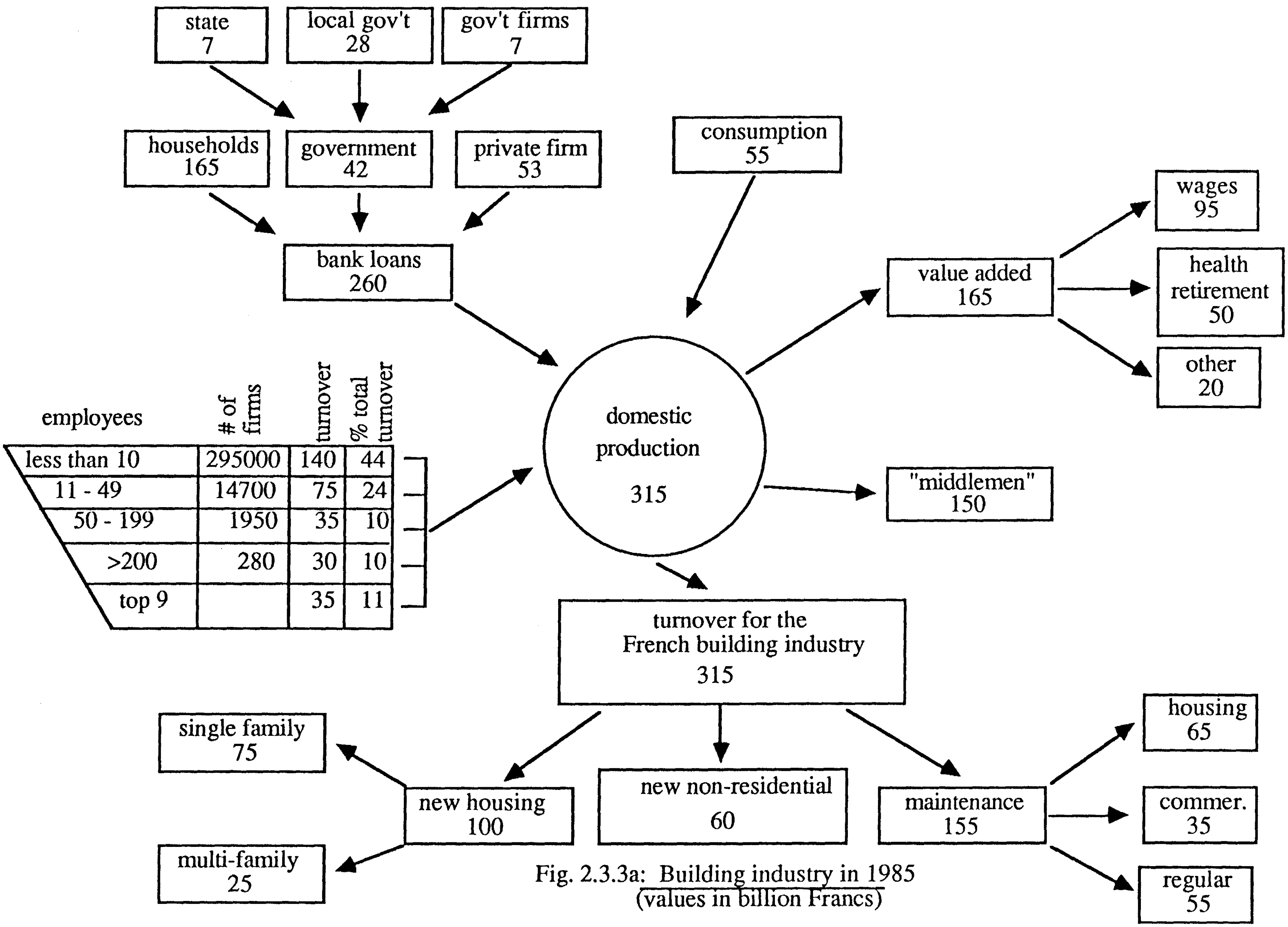
Fig. 2.3.2 Evolution of GDP and construction production



Source : 1

General statistics for the construction industry for the year 1985 can be seen in fig.2.3.3a&b. It gives an overview of the structure of the construction industry in France and points out the important differences between the building industry and the civil work industry.

This chart is a good summary of the situation in 1985 for both industries and their national production. The first point to be made is that the building industry is dominant in France as its production is over three times that of civil work. Also, the two figures represent inputs and outputs relative to the building industry and civil work industry respectively. The domestic production, or amount of work performed in France, is related to the structure of the firms that are involved, to the origin of financing, to the type of work produced and to the costs that are incured.



employees	# of firms	turnover	% total turnover
less than 10	295000	140	44
11 - 49	14700	75	24
50 - 199	1950	35	10
>200	280	30	10
top 9		35	11

Fig. 2.3.3a: Building industry in 1985
(values in billion Francs)

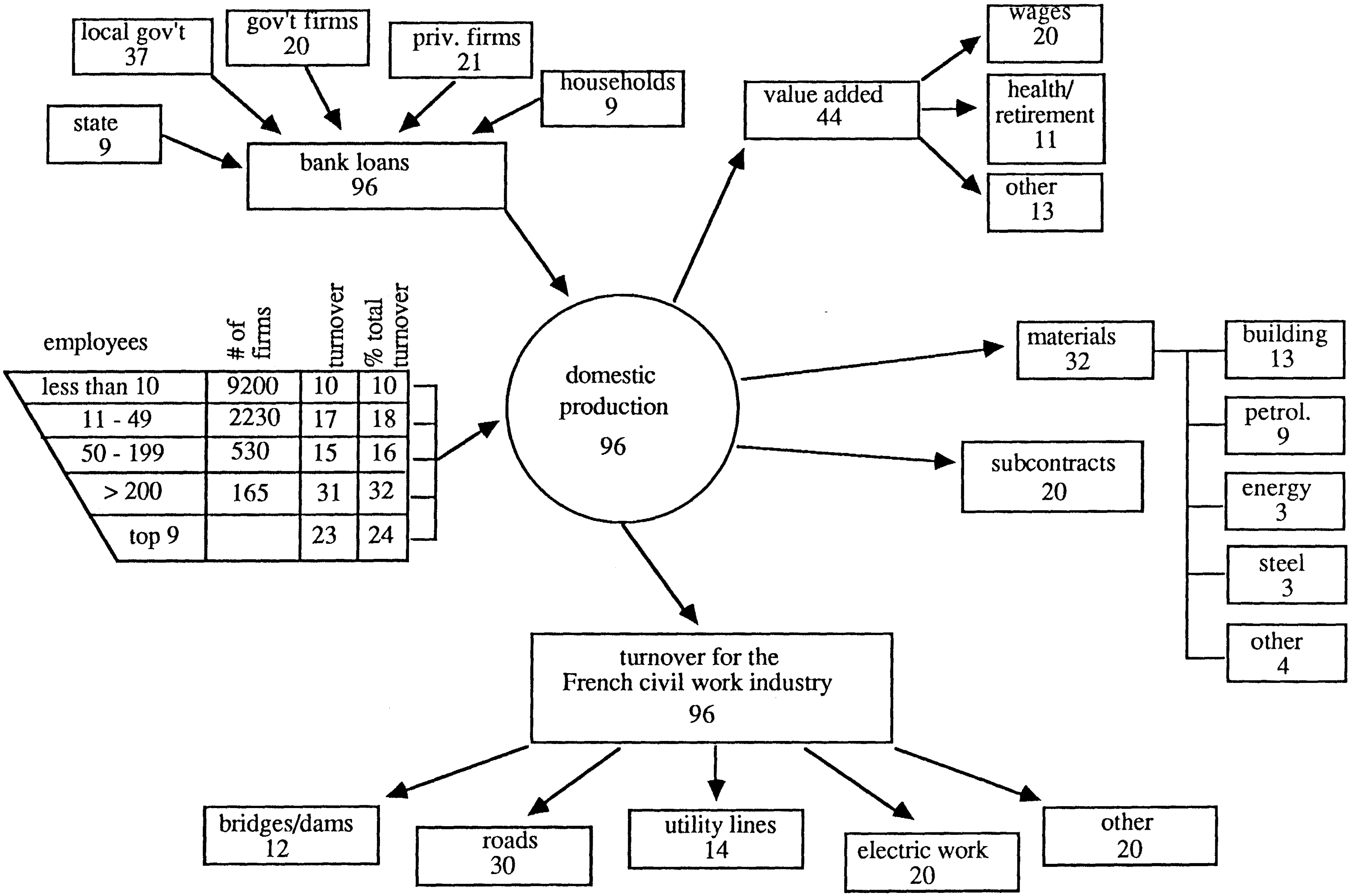


Fig. 2.3.3b: Civil work industry in 1985 (values in billion Francs)

2.3.1. Structure of the firms

Size of the firms:

The small firms (<=10 employees) conduct 44% of the total work done for the building industry while firms of this size account for only 10% of the civil work industry. The difference is less significant when looking at the percentage of the work done by major companies (9 largest) which for building is 10% and civil work 24%.

Financing:

The private sector largely finances the building industry, 64% coming from individuals and 20% from privately held firms (nonresidential building). The government share is only 16%. For civil work, the situation is opposite as government or government dependent agencies finance 69% of the work.

The national companies are investing essentially in public works such as power plants, public transportation, communications, etc..., the private companies represent the major client for building construction while -departmental government and town government are concerned with community projects, roads, bridges,... .

When breaking down the various activities of the construction industry and looking at the number of firms, the number of employees and their production as seen in figure 2.3.1.1, one can notice that, except in two cases, the firms with less than 10 employees largely outnumber those with more than 10 employees. The two exceptions are the construction of electrical lines and framing other than steel. But, although the small firms are predominant, a little over half (56%) of the construction workers are employed by larger firms who also account for 66% of the total production. There are three exceptions to this situation and those are: the metal work, roofing and plumbing and finish work activities that not only have a majority of small firms, but those firms also employ the majority of the workers and produce over 50% of the total production of their activity. It is important to notice that those activities produce about 30% of the total combined output.

The largest activity within the construction industry is that of masonry and ordinary reinforced concrete which by itself represents 24% of the total production, employs almost 29% of the construction workers and contains 26% of the construction firms. The health of this sector corresponds to the health of the building activity and especially that of residential and non-residential construction.

That same argument holds for other building activities that produce each about 10% of the total output such as finish work, metal work and electrical installation.

The largest civil work activities are that of infrastructure work and earth and water work. They have shares of respectively 9.5% and 7.8% of the total production and are more important than other civil work activities that vary from 1 to 4%. This is again a result of the dominance of the building industry as both the activities mentioned above are closely related to building construction. (Table 2.3.1.1)

Table 2.3.1.1 Characteristics of the construction industry in 1983 *(percent of total)*

	number of firms			# of employees			production (million francs)		
Size of firms	<10	>10	Total	<10	>10	Total	<10	>10	Total
earth and water work, parks and gardens	10213	1633	11846	27964	94288	122252	5416	28873	34289
			3.75			*7.18*			*7.79*
construction of electrical lines	86	234	320	573	29838	30411	121	7861	7982
			.10			*1.78*			*1.82*
infrastructure work	1360	582	1942	6885	70097	76982	2014	39973	41987
			.62			*4.52*			*9.53*
road construction	182	165	347	714	46092	46806	376	16671	17047
			0.11			*2.75*			*3.87*
drilling and testing special foundations	228	57	285	843	8875	9718	299	4628	4927
			0.09			*0.57*			*1.12*
framing other than steel	12	82	94	117	26817	26934	22	10465	10487
			0.03			*1.58*			*2.38*
conveying	508	105	613	1485	7203	8688	405	2047	2452
			0.19			*0.51*			*0.56*
electrical installation	26122	1608	27730	60964	97354	158318	13714	30501	44215
			8.79			*9.3*			*10.04*
industrialized construction	1184	229	1413	4423	26939	31356	1046	10855	11901
			0.45			*1.84*			*2.7*
masonry and ordinary reinforced concrete	75220	6794	82014	224158	268189	492347	40978	66449	107427
			25.98			*28.9*			*24.39*
HVAC	14727	1250	15977	37085	47725	84810	9602	15382	24984
			5.06			*4.98*			*5.67*
metal work	52971	2569	55540	131437	70378	201815	26943	19250	46193
			17.6			*11.85*			*10.49*
roofing and plumbing	38179	1629	39808	94931	51758	146689	20593	14290	34883
			12.61			*8.62*			*7.92*
finish work	74357	3335	77692	158700	107254	265954	27303	24302	51605
			24.62			*15.62*			*11.72*
total	295349	20272	315621	750279	952801	1703080	148832	296607	442439

Source : 8

Relating the structure of the construction firms to the actual output (Table 2.3.1.2) shows that the demand for new construction as a whole over the years has been rather stable with the decrease of the building component being compensated by the increase of the civil work component. The major change has been within the repair and maintenance area that started its increase in 1977, to peak in 1981.

The distribution of work helps to explain the importance of finish work, masonry & reinforced concrete, electrical installation and metal work that has been noticed previously, as those are areas of construction directly related to new construction, especially buildings.

Table 2.3.1.2 <u>Value of construction put in place in current billion Francs and *ocnstant billion Francs*</u> *(base 100 in 1970)*

	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982
New construction	130	134	128	149	141	104	157	112	129	195	147
	129	*131*	*129*	*143*	*135*	*98*	*141*	*100*	*119*	*179*	*128*
Building	106	109	102	117	101	71	122	98	97	156	107
	105	*107*	*103*	*112*	*97*	*66*	*110*	*76*	*89*	*143*	*93*
Residential	66	67	61	69	56	39	77	45	52	100	59
	65	*66*	*62*	*66*	*54*	*37*	*70*	*41*	*48*	*92*	*51*
Non residential	40	41	41	47	44	31	45	39	45	56	48
	40	*41*	*41*	*46*	*43*	*29*	*40*	*35*	*41*	*51*	*42*
Civil	24	25	26	32	40	34	35	27	32	39	40
	24	*24*	*26*	*31*	*38*	*32*	*31*	*24*	*30*	*36*	*35*
Current repair and maintenance	14	18	22	19	15	35	93	67	82	137	85
	14	*18*	*22*	*18*	*14*	*33*	*84*	*60*	*74*	*126*	*74*
Total	144	134	128	149	156	140	250	179	211	332	231
	143	*150*	*151*	*162*	*149*	*131*	*225*	*160*	*193*	*305*	*202*

Source : 7

The structure of firms is not only related to their job classification as seen previously, but also to the type of work (new or maintenance & improvement). The division of the firms according to the state of the work and their output appears very stable, most of the time increasing slightly from one year to the other, probably following inflation.

Table 2.3.1.3 gives us some more information concerning the allocation of new work compared to maintenance and improvement. It appears that firms that have less than 10 employees are doing more maintenance and improvement, although the lead is not extremely important since in percentage it represents about 55% compare to 45% for new work. As the firms increase in size, the proportion of new versus maintenance and improvement increasa from 55% for 11 to 19 employees, to about 60% for 20 to 49 employees and almost 75% for firms over 200 employees.

The total amount of maintenance and improvement work is not negligeable, since it represents from 40 to 45% of the total amount of work.

Table 2.3.1.3 Output of construction fims according to their size and to the state of the work (Million Francs)

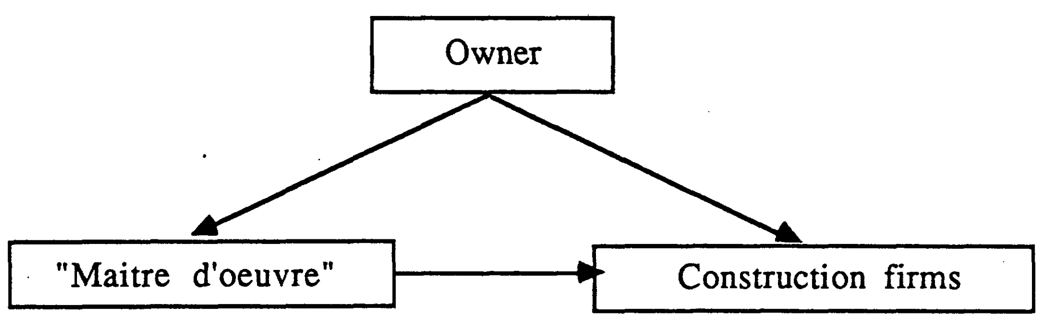
Size of the firms	1978	1979	1980	1981	1982	1983	1984
0 to 10 employees							
New	37937			55814		66605	
Maintenance & improvement	44887			65736		76900	
11 to 19 employees							
New	11599	10750	11783	13610	14055	13473	15327
Maintenance & improvement	9248	8641	11068	11738	13565	14837	14195
20 to 49 employees							
New	22026	23903	30344	29878	32957	32847	35416
Maintenance & improvement	14999	16151	19203	22522	25421	27985	28706
50 to 199 employees							
New	23202	26248	31057	32907	34884	33912	36514
Maintenance & improvement	10447	11314	13542	15327	17626	19455	19623
Over 200 employees							
New	46995	50672	55475	62781	64818	59893	56492
Maintenance & improvement	13165	15192	19522	21621	28187	28274	32388
All firms over 10 employees							
New	103822	111573	128659	139176	146714	140126	143740
Maintenance & improvement	47859	51298	63335	71208	84799	90552	94891
Total							
New	141759			194990		202731	
Maintenance & improvement	92746			136944		167452	

Source : 8

`2.3.2. Mode of operation

The way of operating in the construction industry is different between France and the US. In France, work is rarely done with a general contractor, except in a few cases when the project is especially large and involves many subcontractors. However, most international French firms have experience in general contracting as they use this method for overseas contracts. The general contracting method is used mainly for projects where the drawings and the actual building is done at the same time and when the project is complex. For example, this method has been used recently by the government for the construction of the Museum of Science and Technique at La Vilette, Paris where GTM was named general contractor. It is also following that method that several of the towers of La Defense have been built. Only the large firms have experience in that way of working and we will not detail it as its use is restricted in France and it is well known in the US.

The more common method of proceeding in France is done according to the following basic scheme, subject of course to modifications:



Who can be the owner and what is his role?

In the case of public or semi-public work, the owner can be:

- The state or any local government. They are responsible for example for all the roads and for public buildings such as town halls,...
- All the public institutions such as the SNCF (trains), EDF (electricity), GDF (natural gas) and the PTT (post offices)
- Companies with public and private funds such as HLM (low income housing), some banks and insurance group

In the case of private work, the owner is very often a company,or sometimes an individual.

The owner has to hire the "Maitre d'oeuvre" and define what he wants. All along the construction process, he can either rely entirely on the "maitre d'oeuvre" or follow the work progress. He will, at the end, accept or refuse the work, more often accepting the work with reservation.

The role of the owner and the "maitre d'oeuvre" involved in public projects has been defined in detail in the law 85-704. Even though this relates to the relation of public owner with private "maitre d'oeuvre", the general guidelines are used throughout the construction industry.

Who is the "maitre d'oeuvre" and what does he do?

The "maitre d'oeuvre" is the designer/coordinator of the work to be done.

In case of a public or semi-public owner, they have their own "maitre d'oeuvre" who are the DDE (public works department), the DDA (environmental department) for the state and SNCF (trains) and EDF (natural gas) have their consulting people within their group.

For private work, they are represented by a team of architects, counsulting engineers and construction firms. They are responsible for the drawings, calculation of the structure, surveying and coordination of the work.

Following are two examples that illustrate the case of a private construction project and the case of a public construction project.

a. Construction of a manufacturing plant

Owner = manufacturing company
|
|
|
|
|
V
"maitre d'oeuvre" = consulting firm or an architect --------------> bids

The architect and consulting firm were chosen by the owner according to the results of a competition. It is then their job to prepare the bids and determine the firms that will be involved with the construction, establish a schedule of the work, monitor the progress and verify the work.

b. Construction of a prison

Owner = ministry of justice
|
|
|
|
V
DDE
regional office in charge of public work ------------> bids
|
|
|
|
V
architects
consulting firm

In this case, the DDE chooses the architects and the consulting firm as well as the firms that will be involved on the site. They also propose a schedule to be followed by the firms.

Another important aspect of the mode of operation of the construction industry is the recent development of the importance of security at the work place.

This has a major influence on the work to be done, as all construction sites are closely followed by an agent who is responsible for checking the security aspect of the site, such as guard rails, crane movements, etc... A firm working in spite of earlier violations can be severly fined.

This is rather new and a lot of improvements and research is being done. The first issue was the mandatory use of the hard hat. It is also an issue that causes many problems as security devices are often contradictory with higher productivity which means that the construction sector has been rather reluctant to enforce them. The evolution of this aspect of the construction industry is more difficult and slower than in other industries such as manufacturing. As it develops, it is sure to have a continued influence on attitudes and worker's productivity on construction sites

2.3.3 Productivity

Productivity is a very difficult element to measure in the construction industry for many reasons:

- each worker is involved in more than one specific task and is often called to help others
- work is not standardized as in manufacturing
- there are no two tasks that are totally identical

There are different measures of productivity that can be done. The most common would be to measure the evolution of the labor productivity.

Results of this method are shown in table 2.3.3.1 for different sectors of industry.

The value of this measure for construction in France is most often lower than the value for the manufacturing industry. This measure of productivity is very variable for all types of activities, very often going up and down from one year to the next.

The construction industry shows a steady increase from 1978 to 1982 when it reached a very high level of increase of 6.7%. It then fell back to an increase of about 2% in 1983 and 1984 to get to an icrease of 3.3% in 1985.

The problem with this measure is that an increase is often the result of a larger use of capital rather than a strict increase in the productivity. The 1982 large increase can be related to the gross addition of equipment and machinery in the construction industry for the previous year.

The comparaison of the construction industry productivity with either other sectors of industry or even other countries is very difficult as many factors influence this measure: variations can be due to phenomenon ranging from the general economic situation of the country to the climate during the year.

Table 2.3.3.1 Evolution of labor productivity (percentage)

	1978	1979	1980	1981	1982	1983	1984	1985
Agriculture	2.1	1.0	4.4	2.3	1.3	4.4	1.8	2.7
Energy	1.5	6.9	2.8	6.4	0.2	7.9	8.0	4.4
Manufacturing	4.3	5.5	3.0	2.1	5.4	4.1	3.9	3.5
Construction	-0.4	0.1	0.7	1.5	6.7	2.1	1.8	3.3
Trade	2.7	2.7	0.5	1.2	4.9	0.6	1.0	1.2
Transport and telecommunication	3.3	5.6	1.9	-0.5	3.6	1.1	2.7	3.9

Source: 14

2.4. Supply to the construction industry

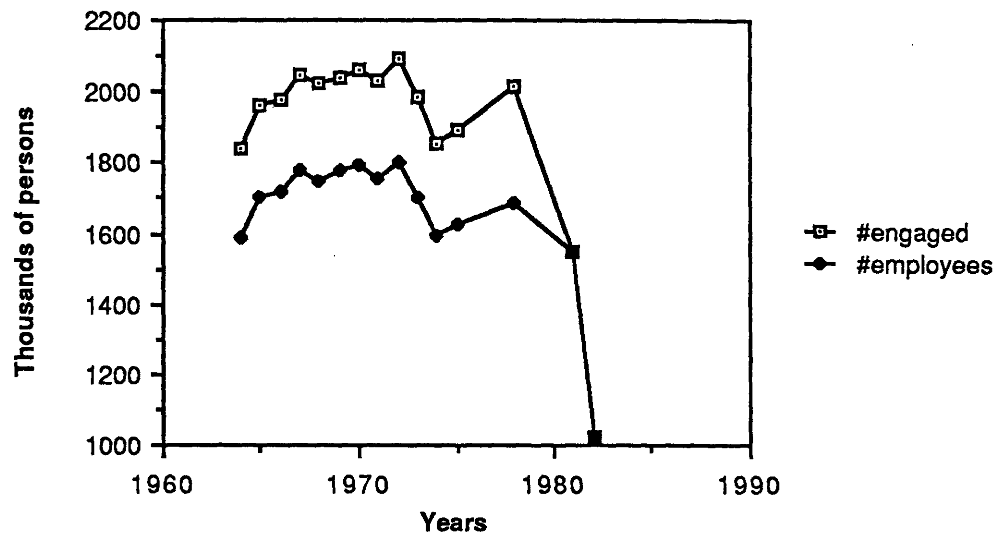
The construction industry is dependent on different types of input such as labor, financing and also the products of other industries that provide the construction industry with material and the equipment required. The most important is probably the labor input. This part will therefore be treated first. Material and equipment will then be considered, to evaluate the situation of those two specific inputs for the French construction industry. Finally, the financing aspect of the construction activity will be mentioned briefly.

2.4.1. Labor

Within the construction industry, there has been a large decrease in the number of employees from 1979 to 1982. The previous decrease that occured, from 1972 to 1974, was a direct result of the oil crisis impact on the volume of construction in France. The following increase reflects the start of new activities as well as the activity in the Middleast that created new jobs in France as well as for French people willing to work abroad.

The evolution in the number of employees in the construction industry is represented in fig. 2.4.1.1. The graph also shows, as number of persons engaged, the evolution of the number of person who work for the construction industry, inclusive of proprietors, active business partners and unpaid family workers.(7)

Fig. 2.4.1.1 Evolution of number of employees and persons engaged



Source : 7

The following two graphs attempt to classify the workers not only by the type of activity, but also by the size of the firms. As a whole, about 25% of construction employees work for firms with less than 10 employees.

The largest employer, which also has the largest production, is that of the masonry & ordinary reinforced concrete activity. Another interesting aspect within this activity is that the number of employees is almost equally divided between firms with less than 10 employees and firms over 10 employees, with a small lead (54% versus 46%) towards the latter. As a whole, this activity employs almost 29% of all the construction workers.

The next largest employer is for the activity related to finish work which employs a little over 15% of the total construction employees. This activity shares with roofing & plumbing and metal work the characteristic of having the majority of the employees within firms with less than 10 employees. All other types of activities largely concentrate their employees in firms with more than 10 employees. At the other end of the scale are those activities that have very few employees in firms with less than 10 employees. This is the case of such activities as construction of electrical lines, road construction, framing other than steel and drilling & testing.

Another interesting aspect of the division of labor according to the various activities is that 8 of the 14 activities employ less than 100,000 workers and half of these are not related directly to building construction but are more civil work; they are: construction of electrical lines, infrastructure work, road construction and drilling & testing. This shows again the dominance of the building activity over the civil work activity in France.

To finish this commentary, the 1981 and 1983 situation can be compared. There is only one main difference, and that is the reduction of the number of masonry & ordinary reinforced concrete employees by almost 100,000 persons. This reflects a slow down in building activity.

Fig. 2.4.1.2 Number of workers by type of activity. Situation in 1981

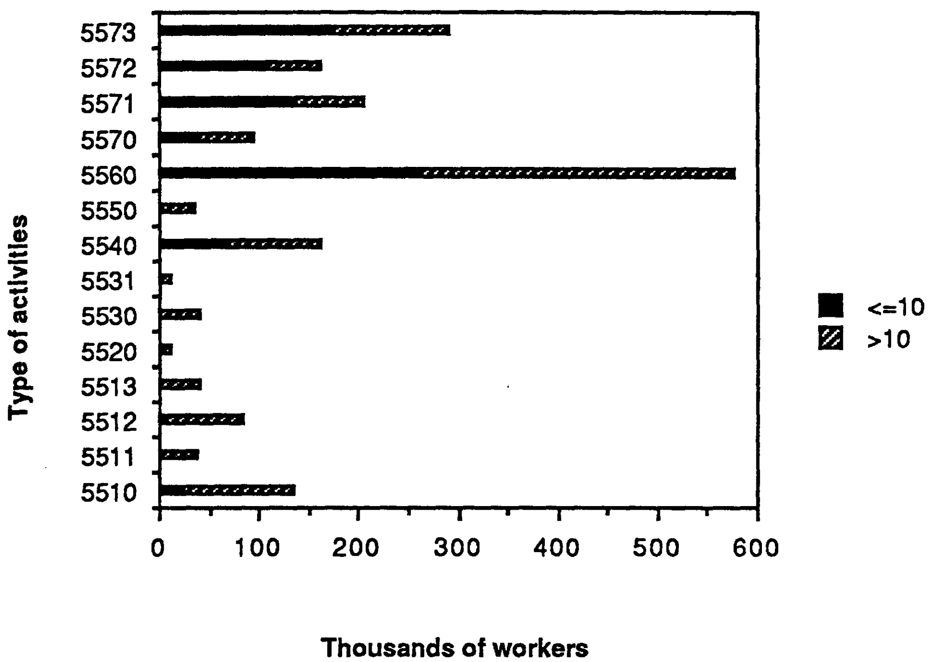
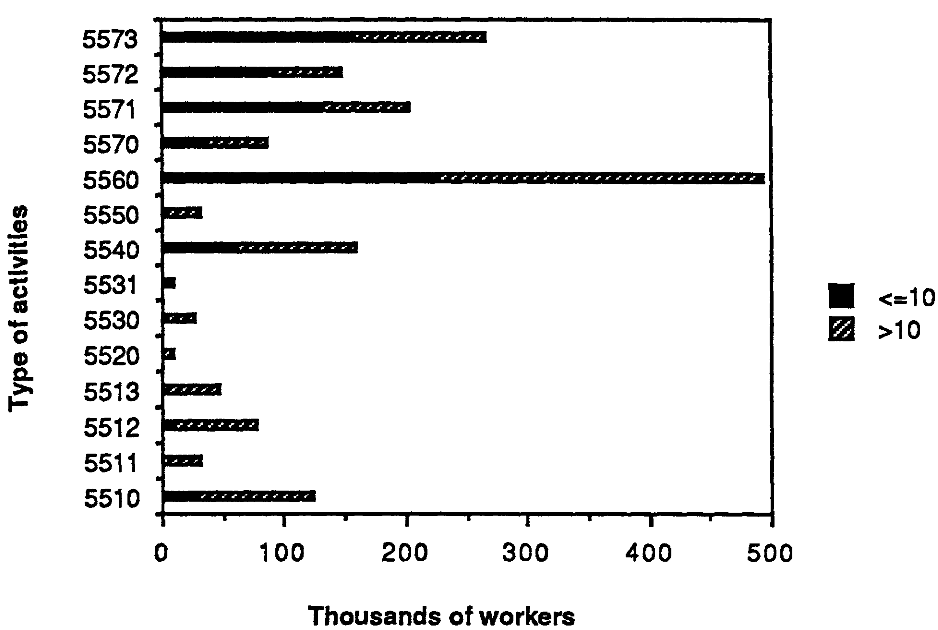


Fig. 2.4.1.3. Number of workers by type of activity. Situation in 1983



Source : 8

The reference given for the activities is the classification code given by the French Institute of Statistics as follows:

5510 - earth and water work, parks and gardens
5511 - construction of electrical lines
5512 - infrastructure work
5513 - road construction
5520 - drilling and testing, special foundations
5530 - framing construction other than steel
5531 - conveying
5540 - electrical installation
5550 - industrialized construction
5560 - masonry and ordinary reinforced concrete
5570 - HVAC
5571 - metal work
5572 - roofing and plumbing
5573 - finish work

There are important differences between the situation of the construction labor in the US and France. French construction labor is not divided among labor unions as in the US and there are therefore no union and non-union shops. The rights of the workers are defended for the industry as a whole, by national political unions that will form agreements on such issues as minimum wage for example. The political unions are the following:

CGT - General Confederation of Labor

CFDT - French Democratic Confederation of Labor

FO - Workers Force

CGC - General Confederation of Supervisory Employees

As a result, the relation on a French construction site between contractor and labor is much different then in the US: There is no signature of collective bargaining agreements or individual agreements. Minimum wages are set on a national level based on skill levels of various types of labor, and health/retirement benefits are automatically taken care of through the deduction for the national social security system.

Also, if French unions do have a lot of power in certain industries such as the automobile industry, their influence in the construction industry is minimal. This is due to the fact that construction labor is not concentrated in large firms but is, for the most part, spread between many small firms. They have therefore no large group effect possible.

Also, the educational and training aspect of the American trade union is, in France, taken care of by the school system with specific apprenticeship programs for people interested in manual/trade activities. They can be either entered at the time of high school or later on as night courses.

Working conditions and the skills of the construction labor are lower than in other industries unlike in the US. There are different reasons for this situation :

1. Wages are lower than other industrial activities on an hourly bases. The workers yearly remuneration is also affected by weather conditions. However, "bad weather funds" established for construction workers, by the construction industry, has minimized this.

2. The number of working hours is higher than for other industrial sectors- again however, this difference is being reduced. The construction workers went from an average of 45 hours/week in 1975 to about 40 hours/week since the beginning of 1983. This compares to an average of 41.5 for all other industries in 1975 and 39 in 1982. (Fig 2.4.1.4) This reduction has had a negative affect on the yearly earnings.

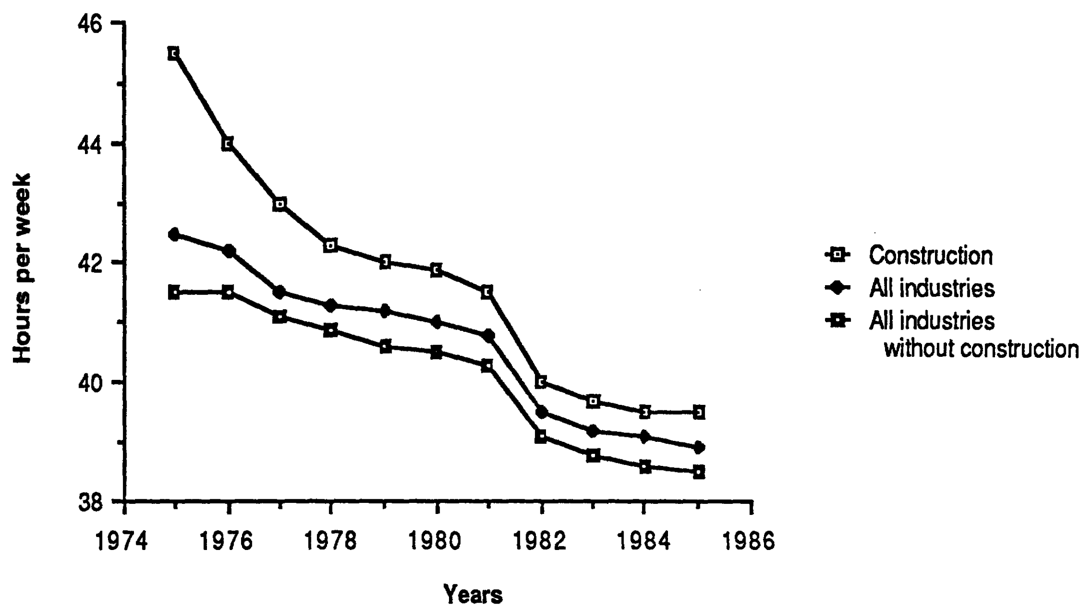
3. The dangerous and wearisome aspects of some jobs make it less attractive to workers. The construction industry is where work related accidents are the most common. As discused earlier, an effort on this point has been pushed by the French social security system and sites have certain requirements towards security to fulfill. They are regularly

inspected by authorities of the "Caisse Regionale d'Assurance Maladie". The incentive to reduce the number of accidents and to follow the security regulations has been a reduction in payments to the social security if their situation is improving.

4. Correct sanitary conditions are often lacking. The smaller the construction site, the worse they are.

5. Jobs are not always secure, the employer can lay off workers at the end of a site in case of a "limited duration contract". Also, unemployment is frequent as often firms go bankrupt.

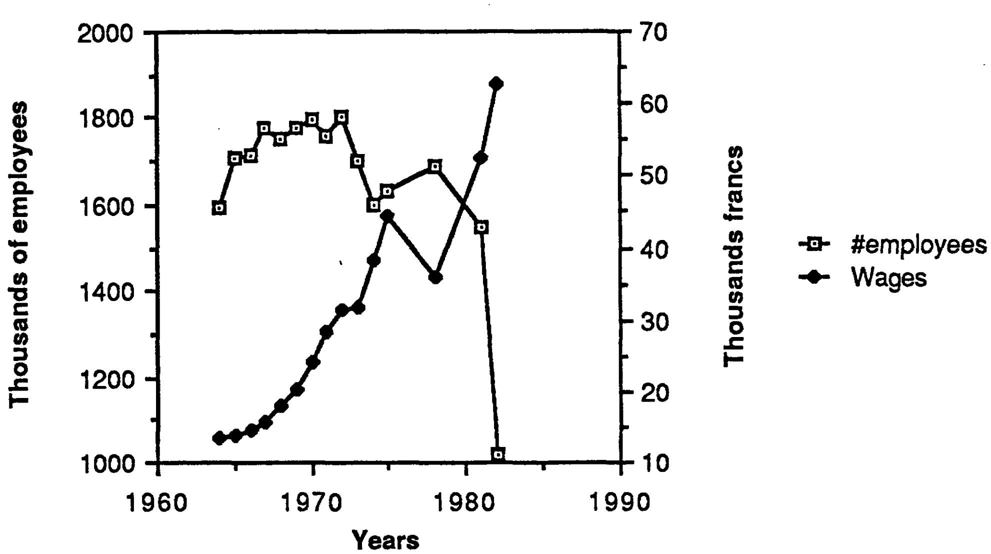
Fig. 2.4.1.4 Working week duration



Source: 14

Another problem within the construction industry with respect to labor is the reduction of the number of employees which started in 1978 and continued in a downward plunge through 1982. It is interesting to notice that at the same time the number of employees decreased considerably, the yearly average wages actually increased. This indicates that the structure of the labor force changed from more labor oriented to more supervisory and "engineer" oriented. (Fig. 2.4.1.5)

Fig. 2.4.1.5 Evolution of number of employees and their salary (yearly)



Source : 7

The labor problem is a very difficult one. Right now the situation is that of an endless circle : low skills -----> low productivity ----->low salaries ------> low skills. More than 1/3 of the workers in construction have no skills and most of the skilled people seek jobs elsewhere where working conditions are more agreable. This circle will need to be broken, especially to face the new activities such as renovation and reduction of energy consumption.

2.4.2. Material

The construction industry is tied to the input of other sectors and especially that of the construction material industry. The sale and production of this industry can be an indicator of the construction activity in a country.

Today, in order to survive, the manufacturers of construction material have to diversify their production, create new products and expand their market toward exportation. This is due to the slow down of the domestic market which increased the competition among manufacturers. The production of building materials has decreased in volume from the 1982 values to the 1985 values. The detailed evolution is shown on table 2.4.2.1.

Table 2.4.2.1. Production of building materials

	Units	1980	1982	1983	1984	1985
Bricks	1000 tons	4812	3975	3680	3510	3161
Lime	1000 tons		161	151	153	139
Plaster	1000 tons	3668	3502	3222	3302	2978
Clay tiles	1000 tons		1886	1847	1866	1762
Ready mix concrete	1000 m3		22559	41121	20976	21563
Steel	1000 tons		837	690	780	816

Source : 16

This situation of increasing competitiveness was well represented at the 1985 presentation of construction materials and equipment at the Batimat exposition in Paris. There was an increasing number of new products presented and a large number of foreign manufacturers were present : 1/3 of the exhibitors were non-French with most of them coming from Italy and Germany. Also for the first time, Japan had entered the competition and was represented by 23 companies. This situation forces all the construction material firms to invest into research, to be creative and to come up with always more successful products if they want to stay in business.

The construction material industry has a very important place in the trade balance of France as materials and parts for construction represented in excess of 8 billion Francs in exports in 1984. The overall export of material is largely superior to the imports, however, the trade balance for those same goods was negative with the other industrialized countries. This is due to the fact that this sector depends largely on the construction contracts awarded to French firms in developing countries.

For most materials, France produces enough to meet the apparent domestic consumption. In 1983, the domestic consumption decreased compared to that of 1980. Also producers had to export their production at a lower price. (Table 2.4.2.2.)

Table 2.4.2..2. Production imports and exports of construction materials
1980 and 1983

	Domestic production	Imports		Exports		Apparent domestic consumption
	tons	tons	1000 $	tons	1000$	tons
Cement						
1983	24353000	58000		1480000		17800000
1980	29104000	73000		944000		28233000
Reinforcing bars						
1983		964489	379983	828834	354606	
1980		1212000	665253	956785	634594	
Steel plate						
1983	2088000	36262	14379	2924	1899	2121338
1980	3367000	58497	33684	8240	4319	3417257
Plate glass						
1983		181151	57542	378445	121286	
1980	415000	109575	55018	260134	113312	264441
Ceramic sanitary						
1983	120000	19772	29198	37924	58872	101848
1980	144000	26926	59548	29347	56174	141579

Source : 18

The construction industry uses a certain amount of steel products which are primarly heavy and light sections, plates and wire rods. The production, import and export of those products should follow the trends of the construction industry. Table 2.4.2.3 shows how the apparent consumption has decreased steadily until 1983 with a small increase in 1984 for the consumption of plates and wire rods. These products account for about 3% of the steel consumption, and any fluctuation caused by the construction industry does not have a major impact on the steel industry.

Table 2.4.2.3. Consumption, imports and exports for steel products(1000 tons)

		Heavy and light sections	Plates over 3mm	Wire rods
Domestic production	1980	3821	3331	2538
	1981	3412	3289	2402
	1982	2911	2355	2196
	1983	2683	2034	2074
	1984	2653	2219	2328
Imports	1980	1888	1168	355
	1981	1886	1272	257
	1982	1682	1228	270
	1983	1516	902	363
	1984	1495	1088	383
Exports	1980	1481	560	1209
	1981	1493	505	1141
	1982	1182	330	1062
	1983	1279	309	1001
	1984	1457	368	989
Apparent consumption	1980	4228	3939	1684
	1981	3805	4056	1518
	1892	3411	3253	1404
	1983	2920	2627	1436
	1984	2691	2939	1722
Construction industry demand in 1984		165	29	8

Source : 15

Concerning cement, the situation is rather critical as the producers have seen the consumption decrease by almost 1/4 from 1980 to 1984. Imports have always been rather low and the volume of imports is small (between 5 to 10%) compared to the volume of exports (Table 2.4.2.4.)

Table 2.4.2.4. Evolution of imports, exports and production of cement
(in thousand tons)

	1980	1982	1983	1984
Production	29104	25981	24353	22724
Imports	73	392	58	98
Exports	944	3032	1480	1780
Apparent consumption	28233	23341	22931	21042

Source : 16

Tables 2.4.2.3 and 2.4.2.4 also illustrate the situation in France where steel is not a material extensively used for construction. In 1984, the construction industry demand in steel was about 1% of the apparent consumption of cement.

Building construction is done largely in concrete, steel being used for factory sheds and in some cases manufacturing plants. Outside building construction, steel is sometimes used for bridges, although most of the highway structures are concrete.

2.4.3. Equipment

The evolution of the amount of equipment and machinery acquired each year can give us an idea of the situation of the construction industry since this is strongly related to the activity of the industry.

Between 1976 and 1982, the aquisition of equipment has been rather stable, exept for two years that showed a peak: 1978 and 1981. The 1981 peak could correspond to the optimism of constructors and the award of major contracts in France by the government.

Table 2.4.3.1. Evolution of aquisition of equipment

Years	Gross value of equipment acquired (Million Francs)
1976	6665
1977	5390
1978	10409
1979	6281
1980	7651
1981	14062
1982	9424

Source : 7

Note: the values apply for firms with more than 10 employees

The equipment industry was subject to more than 10 years of decline that seems to have leveled off in 1985 when their turnover increased by 6.1% in current Francs (or 0.3% in constant terms) from the previous year, to reach 12.7 billion Francs. The 1985 list of top construction equipment manufacturers (table 2.4.3.2) shows that the major manufacturers have increased their activities by more than 10% over 1984. Poclain increased by 14.6%, Potain-Poclain by 20.9%. It is also interesting to notice that among the five largest manufacturers of construction equipment, two of them are subsidiaries of Caterpillar and Liebherr which are two main competitors of French equipment manufacturers.

The French owned equipment industry in France is dominated by two major firms: Potain for cranes and Poclain for excavator-type machines.

Poclain's actual share of the European market for excavators is 16% and they are aiming for 20% in 1988 with the introduction of their last model. Poclain is the largest excavator manufacturer in Europe and the largest wheeled excavator manufacturer worlwide. The impact of the competition with Japanese producers has been reduced since Europe introduced import duties in that area.

Potain sells by itself half the number of tower cranes sold. That accounts for 40% of sale value. It's main competition in that area is the manufacturer Liebher of West Germany.

The market for tower cranes is largely European. The distribution is as follows, according to 1985 sales:

Europe (including Turkey): 70%

Asia: 15%

Africa: 8% (90% of them being in Algeria)

North America: 6%

Oceania: 1% Source: 24

Because of that distribution, the French crane industry went through some rough times in the early 80's when the European demand slowed.

In 1986, the equipment manufacturers enjoyed a somewhat better outlook than the previous year, although the situation remains precarious for them. The decline of the Dollar and the Pound Sterling as well as the reduction of mark-up due to the increased international competition makes it difficult for French owned construction equipment firms to increase their profit after many years of decline.

In order to compete against intense rivals such as Germany and Japan, they have to become more efficient, increase their R&D and not hesitate to automate their production line even if it means the loss of jobs. The government is expected to support the manufacturers efforts with tax reliefs and other forms of assistance. The EEC has set-up protectionist measures against Japanese equipment imports but this does not necessarly completely eliminate the competition as such firms as Hitachi are negociating with European firms to build their product in Europe enabling then to sell without restrictive measures.

Table 2.4.3.2 Top construction equipment manufacturers

	Turnover 1985 Thousand Francs	Evolution 85/84 %
Poclain	3,226,755	14.6
Caterpillar France	1,372,925	23.2
Liebherr France	1,329,104	18.4
Potain	1,001,271	9.2
Manitou BF	903,282	6.4
Potain-Poclain Materiel	512,971	20.9
Montabert	444,385	13.1
Atlas Copco	440,000	
Bergeaud	358,000	
JCB France	315,000	-3.0
Fenwick	299,510	7.7
Fiatallis	265,000	
Maco Meudon	159,290	9.5
Sambron	145,243	-7.5
Equipco (Poliet)	159,742	-7.1

Source: 26

2.4.4. Financing

The financing of projects in France is done primarly through bank loans taken by the owner/developer of a project. The status and structure of the borrowers are quite different if the work is for the building industry or for civil work.

In 1985, civil work was financed primarly by local governments, which contracted for 37 billion Francs worth of work, or 38% of the total civil work production for that year. Government owned firms and private firms both contracted about the same amount of work each, which represented 21% of the total civil work or 42% combined. Households and State financed each 9 billion Franc worth of civil work or almost 20% of the total civil work. The state is responsible for the financing of some roads that are not under local government jurisdiction (such as interstates) and various other work. The household share corresponds to the part of the utility line work required for housing.

For the building industry, the structure of financing is rather different as the primary financing comes from households with 165 billion Francs or 64% of the total building industry, in 1985. The rest that year was shared between private firms with 20% or 53 billion Francs and the government with 16% or 42 billion Francs. The private firms are responsible for part of the non-residential construction and have also a share of the maintenance aspect of the building industry. The same is true for the government, which is also responsible for part of new housing through the sponsorship of low cost housing. The government component is divided among the local governments which have the largest share (28 billion Franc or 67% of the total government share), and then the state and the government owned firms with each 7 billion Francs or a total of 33%. (table 2.4.4.1)

Table 2.4.4.1 Source of financing in 1985. Billion Francs and percentage

Source of financing	Building industry Billion FF	%	Civil work Billion FF	%
Government	42	16	66	69
State	7	3	9	10
Local government	28	10	37	38
Government owned firms	7	3	20	21
Private firms	53	20	21	21
Households	165	64	9	10

Source: 26

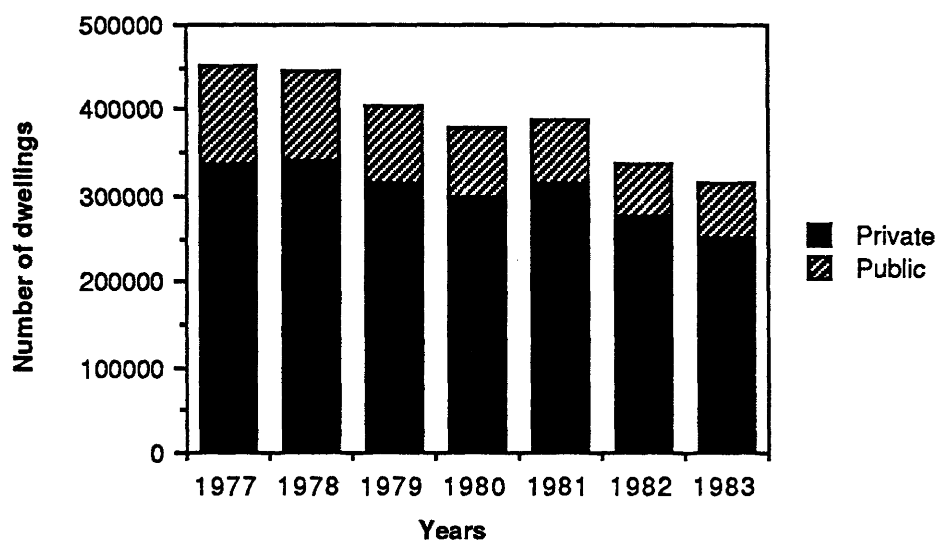
For the housing construction, the private investments have always been largely dominant as, already in 1977, they represented 74% of the total investment for housing. This involvement of private financing has increased steadily since 1977 to reach a high point of 82% in 1982. The number of dwellings in which state and local governments have invested has stayed rather constant, varying from about 3,000 dwellings per year to a little over 4,000, in a total market of over 450,000 dwellings per year. The number of dwellings financed by both other government bodies and private investors has been declining almost regularly between 1977 and 1983. (Table 2.4.4.2 and fig. 2.4.4.1)

Table 2.4.4.2 Dwellings completed by type of investors

Years	State and local government	Other public bodies	Private
1977	3195	112341	336063
1978	4005	101221	339512
1979	3593	83529	316435
1980	2916	74695	300737
1981	4086	70199	315805
1982	3393	56739	276173
1983	3688	59635	250820

Source : 6

Fig. 2.4.4.1 Dwellings completed by type of investors



Source : 6

Cash availability for the construction firms plays a major role in project financing. The nine most important French construction firms are all publicly held and most of them have some of their shares held by bankers.

Table 2.4.4.3 Bank shares of major French construction firms (1985)

Company	Bank	% of control direct or indirect
Dumez	Caisse des Dépots et Consignations	2.24
SGE	Crédit Lyonnais	5.0
GTM Entrepose	Caisse des Dépots et Consignations	3.82
	Crédit Lyonnais	7.55
Bouygues	Caisse des Dépots et Consignations	4.03
	Crédit Lyonnais	10.0
Campenon Bernard	Crédit du Nord	10.0
Fougerolles	OPFI - Paribas	32.0

Source: annual reports

2.5. Research and development

Research and development is an important part of an industry that wants to stay strong and competitive at an international level.

In 1983, France had 1300 firms and 48 professional organizations that declared being involved in research and development. But the research effort is still inferior to that of the larger French industrial partners. We can, as an example, compare the total interior spending for research and development of 5 industrialized countries, the percentage of spending relative to the GDP and the number of reseachers per capita.

Table 2.5.1. Information about R&D for 5 industrialized countries

	US	Japan	Germany	UK	France
Domestic spending (France = 100)	681	254	138	106	100
Domestic spending/GDP (%)	2.73	2.55	2.57	2.46	2.15
Number of researchers for 1000 inhabitants	6.4	7.0	4.7	3.6	3.3

Source : 9
Note: the values are from 1983, exept for the UK (1981)

The table shows that the research spending relative to the GDP is lower in France than in the other countries. Therefore, to be efficient, public spending has to be done selectively in the areas that have the most chances of success or that have already proved their capability. In 1986, the budget for research and development was 22 Billion Francs and 15.5 was allocated to sectors of industries which have recognized competitive technologies (space,transportation, nuclear, telecommunications)

France also has another characteristic in research which is that the public involvement is fairly strong: the large centers for research are national centers and, in 1983, the administration financed 57% and developed 42% of the research done in the country. Those numbers are among the highest compared to other industrialized nations (table 2.5.2.) They were even higher 10 and 20 years ago. The actual tendency is for a reduction of the share of government financing and a promotion of private R&D spending (Table 2.5.3). In 1959, the government financed 70% of the national R&D spending, a level which has been reduced to 57%after 1980. At the same time the percentage of interior R&D spending done by public institutions dropped from 55% to 40%. Private firms have increased their R&D spending from 30 billion Franc in 1980 to 54 billion Franc in 1984.

Table 2.5.2. R&D financing in 1983

	Excecution		Financing	
	Firms	Government	Firms	Government
US	72	28	49	51
Germany	70	30	57	43
UK	62	38	44	36
France	58	42	43	57
Japan	62	38	64	36
Italy	57	43	50	50

Source : 9

Table 2.5.3. Evolution of R&D financing (million Francs)

	1959	1980	1982	1983	1984
National R&D spending	3123	50939	75400	85600	95800
government financing	2173	28670	43200	49000	55100
percentage	*70*	*56*	*57*	*57*	*57*
private financing	950	22269	32200	26600	40700
Interior R&D spending	3078	51014	74800	84700	95000
by public institutions	1678	20226	31450	36800	41000
percentage	*55*	*40*	*42*	*43*	*43*
by firms	1400	30788	43350	48000	54000

Source : 14

Note :

- public institutions include the State, universities and non-profit organizations
- firms include private and government owned firms and professional organizations

The research performed by firms is mainly done by large companies. 70% of the research work is done by firms with over 2000 employees (for the number of researchers and their spending). They also receive more than 85% of the government financing. On the other hand, there are more than 700 firms with less than 500 employees that do some research work, but they only spend 11% of the total spending and only receive 5% of government financing. (Table 2.5.4.)

Table 2.5.4. R&D concentration according to the size of the firm in 1983

	Firms and organizations with (n) employees					
	n<500	500<n <=1000	1000<n <=2000	2000<n <=5000	n>5000	Total
Firms and organizations with R&D activities						
number	709	248	160	134	76	1327
percentage	53.4	18.7	12.1	10.1	5.7	100.0
Researchers						
number (equivalent full time)	5310	3866	3185	6343	19565	38269
percentage	13.9	10.1	8.3	16.6	51.1	100.0
R&D staff						
number (equivalent full time)	16145	12297	10007	23220	70531	132200
percentage	12.2	9.3	7.6	17.6	53.3	100.0
Domestic R&D spending						
million Francs	5278	3997	3592	8104	27127	48098
percentage	11.0	8.3	7.5	16.8	56.4	100.0
Public financing						
million Francs	546	540	375	1218	8215	10894
percentage	5.0	5.0	3.4	11.3	75.4	100.0

Source : 11

Research has gone through a major revival since the arrival of the socialist government which has made it one of its priorities. The new government created a Ministry of Research and Technology with wider budgetary power than the former Secretary of State for research. The main priority has been to increase the percentage of research spending compared to the GDP. The priority sectors in 1982 were the following : biotechnology, electronics, energy, improvement of working conditions, scientific and technical cooperation with developing countries and robotics. Those sectors were to receive intensive efforts because of their strategic importance toward independance of the countries competitiveness.

In 1981, research was menacing to die as very few new scientists and researchers had been employed since the 1970's and very few efforts were made toward it.

In 1981, the new minister of research, J.P. Chevenement, established a plan whose major intentions were as follows :

- come back to a level of spending comparable to other major industrialized countries with an objective of 2.5% of GDP for 1985 when the 1981 level was 1.8%
- create six priority missions as mentioned previously
- improve sharing of research results and improve the relation between scientists and industry

Those objectives have been slowed slightly in 1984 due to a tight budget, but all in all it still increased faster than the general state budget. In 1984 the situation was as follow :

9.4% growth for the budget

2.6% growth for employment

2.3% of GDP for 1985 (Source : 13)

Another problem that has been noted is that researchers have been considered as federal workers since 1981. They are therefore associated as administrative personel with job security and numerous benefits. The result tends to be a certain "laxism".

In spite of the planned efforts, in 1986 France is still in 5th position for R&D behind the US, Russia, Japan, and West Germany. Efforts in 1982 and 1983 to increase the R&D budget reached a maximum of almost 17 billion in constant Francs corresponding to the largest creation of R&D jobs with 2,462 new researchers/technicians added. However a slowdown of the research effort in 1984 and 1985 was a result of no budget increase in 1985 and very few jobs were created. But this may soon change for the better as in 1986 a small effort appears through a small budget and job increase. (table 2.5.5)

Table 2.5.5. R&D budget for non military research

	Budget (billion Francs)	Increase current francs	Increase constant francs	Number of jobs created
1981	19.68	17.6		615
1982	25.41	29.1	14.8	1580
1983	32.52	28	16.9	2462
1984	37.58	15.6	7.7	905
1985	39.64	5.5	0	1008
1986	43.82	10.6	6.3	1400
Average 1982-1986		17.4	8.9	

Source : 13

2.5.1. Comparison with other sectors of industry

Before looking at the R&D within the construction industry more specifically, it is interesting to discuss the situation for the industry generally and compare the construction industry to other industries to be able to evaluate its importance and particularities.

Research and development spending in the industry has been relatively stable and concentrated in a few areas. In 1983, the breakdown of the major spenders was as follows:

electronics	22%	domestic spending
aeronautics	18%	
automobile	11%	
chemical industry	9%	
energy	7%	
pharmaceutical industry	7%	

Those sectors account for 74% of industrial potential, where as other more traditional sectors such as the construction industry have very little importance.

The comparison of the different sectors of industry and their research and development spendings relative to their individual value added shows even more the importance of certain sectors compared to others:

aeronautics	38%	value added
pharmaceutical industry	32%	
electronics	24%	
computers	13%	
textile industry	0.8%	

construction materials	0.8%
metal work	0.6%
construction industry	0.1%

As those previous numbers suggest , the share of the construction industry in R&D is very small. Its 1983 total budget was 320 million Francs (or 583 if including the construction materials and ceramic industry). This represent 0.6% (and 1.1%) respectively of the total R&D budget (Table 2.5.1.1.) Those numbers are relatively low if we consider that the construction industry has 17.7% of the total number of firms, employs 12.2% of the workers and its turnover is 6.2% of the total turnover of industry.

The public financing of R&D for the construction industry is lower than other sectors of industry. The manufacturing industry is the largest recipient of R&D public funds and is also the industry that has the largest part of its total R&D budget publicly financed (21.3% versus 10.3 for the construction). The government participation in the construction industry R&D budget is about half of its average participation of 19.6% for all research work.

The primary investments in R&D for the construction industry are done by the firms themselves (almost 88% of the budget for the construction industry and over 96% for the materials)

Table 2.5.1.1. Financing of R&D in million Francs *(percent)*. Situation in 1983

	Total R&D budget	Gov't financing		Financing from firms in that sector		Other	
		million F	% total budget	million F	% total budget	million F	% total budget
Agriculture	1055 1.9	61 0.6	5.8	931	88.2	63	6.0
Energy	4119 7.4	272 2.5	6.6	3342	81.1	505	12.3
Construction materials and ceramic	263 0.5	5	1.8	253	96.1	5	2.1
Manufacturing	48359 87.0	10311 94.6	21.3	31962	66.1	6086	12.6
Construction industry	320 0.6	33 0.3	10.3	281	87.9	6	1.8
Transportation	307 0.5	9 0.1	3.0	297	96.8	1	0.2
Engineering	834 1.5	136 1.3	16.3	470	56.4	228	27.3
Other	354 0.6	67 0.6	18.9	279	79.0	8	2.1
Total	55611	10894	19.6	37815	68.0	6902	12.4

Note : other financing includes contracts and subsidies from industry, including those from other sectors than the one concerned, and from non-profit organizations and foreign countries

Source : 11

The construction industry has 25 firms and 3 professional organizations involved in R&D activities (1983). This represent a ratio of 1 for 12,624 construction firms but they contain 5.6% of the construction employees and participate for 12 % of the total turnover.

The concentration of researchers in the firms involved in R&D represent 0.1% compared to the average of 1.5% and 2% for the manufacturing companies. (Table 2.5.1.2.)

Table 2.5.1.2. Firms with R&D activities. Situation in 1983

	# of firms	# of profes. organi.	turnover million F	total # of employees	Total # of R&D employees	# of researcher		# of people around 1 res.
Agriculture	129	19	116999	120831	3499	1046	0.9	2.35
Energy	24	1	398101	257158	5920	1974	0.8	2.0
Construction materials and ceramic	26	4	10652	21139	744	177	0.8	3.2
Manufacturing	1119	21	889373	1631888	118237	33079	2.0	2.6
Construction industry	25	3	53013	95740	900	284	0.3	2.2
Transportation	4		82164	324926	592	313	0.1	0.9
Engineering	47		18269	21123	1477	799	3.8	0.9
Other	14		4323	11229	831	597	5.3	0.4
Total	1388	48	1572894	2484034	132200	38269	1.5	2.5

Source: 11 Note :

- The total number of firms can be higher than the number of firms really involved in R&D as some firms are involved in research in more than one economic sector
- The total number of employees is only related to those firms doing R&D work
- The people around a researcher are technicians, clerks and administrative assistants

How is the R&D budget spent ?

If considering all the firms involved in R&D activity, the development is the part that requires the most money as it uses 66.4% of the total budget, compared to 30.6% for applied research and only 3% for fundamental research. Most of the sectors of industry follow this pattern of higher expense for development, some having larger needs in that area (transportation 73.2%, manufacturing 68.1%), others spending almost the same amount for development and research such as the construction material sector (45.9% and 48.8% respectively).

The construction industry is a very good representative of the average situation as it spends 3.5% of its R&D budget for fundamental research, 30.8% for applied research and 65.7% for development.

The construction industry and the construction materials industry have the highest percentage of interior spending (94.1% and 93.9%) which shows that almost all their work is generated by them, they receive very few R&D contracts. (Table 2.5.1.3)

Table 2.5.1.3 Distribution of R&D. Situation in 1983 in million Francs

	Total R&D budget	Exterior spending		Interior spending		% of interior spending by type of research			Average spending per researcher
		budget	% total	budget	% total	fundamental research	applied research	development	Th. FF
Agriculture	1055	133	12.6	922	87.4	2.5	43.1	54.4	881
Energy	4119	847	20.5	3272	79.5	8.1	38.1	53.8	1657
Manufacturing	48359	6137	12.7	42222	87.3	2.54	29.4	68.1	1276
Construction materials and ceramic	263	16	6.1	247	93.9	5.3	45.9	48.8	1395
Construction industry	320	19	5.9	301	94.1	3.5	30.8	65.7	1059
Transportation	307	112	36.5	195	63.5	2.3	24.5	73.2	621
Engineering	834	178	21.3	656	78.7	5.7	43.7	50.6	821
Other	354	71	20.0	283	80	1.2	50.3	48.5	474
Total	55611	7513	13.5	48098	86.5	3.0	30.6	66.4	1257

Source: 11

2.5.2. Evolution within the construction industry

The situation of research in the construction industry is much different than in other industries for the main reason that the production and sale of the products does not follow the same process at all. Also, the sectors of industry that spend large amounts on research are often characterized by their heavy concentration (automobile, chemistry,...) which means that the production depends on a few large firms that have the possibility of financing their own research. The structure of the construction industry does not permit the same approach. But there is a common factor between industry and the construction industry which is the large professional interest in research.

Research in the construction industry has always been a concern somewhat restricted to the professional. The direct government involvement into research activity and financing has never been really strong, even though there are several public organizations or ministries that have important research facilities. Examples of these facilities are:

- the "Laboratoire Central des Ponts et Chaussées" (LCPC)
- the "Laboratoire de Champs-sur-Marne" dependant on the CSTB
- the "Conservatoire des Arts et Métiers" which has facilities that are available for tests related to housing
- the "Institut National du Bois" (Ministry of agriculture)
- the "Laboratoire d'Essais de Matériaux de la Ville de Paris"

The major impetus for direct research for the construction activity has largely come from the professionals. The following events can illustrate this situation:

In 1905, the "Comité Scientifique et Technique de l'Industrie du Chauffage" (COSTIC) was created by HVAC professionals.

In 1933, the "Bureau Securitas" started its activity, followed by the "Institut Technique du Batiment et des Travaux Publics".

Also many research institutes have opened, each being related to a specific area of the construction industry. As an example, we can mention:

- the "Centre d'Etude et de Recherche Spécialisés" that is concerned with hydraulic binder
- the "Société Professionnelle" which deals with clay, both with the improvement of the material and the modernization of the equipment
- the "Institut de Recherche de la Siderurgie" concerned with steel.
- the "Institut de Recherche Appliquée au Béton Armé" (IRABA) for research in concrete and its use
- the "Institut de Recherche Appliquée au métal" (IRAM) for research on metal
- the "Institut de Recherche Appliquée au Bois" (IRABois) that deals with wood.

The life of the construction industry is "supervised" by the 'Fédération Nationale du Batiment et des Travaux Publics" which has also an importance in the smooth development of the research activity. It created the "Union Technique Interfédérale" which has, for a primary role, to organize the research activity: they are in charge of directing the efforts, avoiding a dispersion of capital and means and assuring that the same area is not studied twice. To fulfill their role, they have set different commissions in every specialized activity who evaluate the research program proposed. All their work together helps to determine the needs and the line to pursue for future work.

The present situation for research in the construction industry is summarized in table 2.5.2.1 (1983 values).

The government financing is primarly concentrated in the construction industry, as opposed to the construction materials industry. This shows the trend in the government interest for the research in that field. It has been more concerned with productivity for building construction, implementation of infrastructures and their maintenance. The financing of research is more oriented toward the organization of construction rather then the material aspect of it.

Table 2.5.2.1 Summary of research in the construction industry - 1983 values

	Construction industry	Construction materials
Total R&D budget (million Francs)	320	263
Government financing (million Francs)	33	5
% of total R&D budget	10.3	1.8
Financing from the sector (million Francs)	281	253
% of total R&D budget	87.9	96.1
Other financing (million Francs)	6	5
% of total R&D budget	1.8	2.1
Number of firms	25	26
Number of professional organization	3	4
Turnover (million Francs)	53,013	10,652
Total number of employees	95,740	21,139
Total number of R&D employees	900	744
Number of researcher	284	177
Number of people around one researcher	2.2	3.2
Exterior spending (million Francs)	19	16
% of total R&D budget	5.9	6.1
Interior spending (million Francs)	301	247
% of total R&D budget	94.1	93.9
% of interior spending by type of research		
fundamental	3.5	5.3
applied	30.8	45.9
development	65.7	48.8
Average spending per researcher (thousand Francs)	1,059	1,395

Source: 11

Where exactly is research being conducted?

1. Public organizations.

There are three primarly public financed institutions that conduct research for the construction industry.

The LCPC, created in 1831 as a Chemical Laboratory of the Academy for Roads and Bridges, became in 1949 an external service of the Ministry. The LCPC is involved in research in the areas of civil engineering, planning and environment. The research is done in collaboration with regional laboratories for Roads and Bridges. The results of the research are tested on the regional network to assess their effectiveness. The LCPC is divided in eleven divisions such as road materials, structure and characteristics; signal systems; geotechnics; environment; inspection of construction work, etc... Their principal source of financing is that of the Ministry of Town Planning and housing.

The CSTB was created in 1947, under the sponsorship of the Ministry of Construction and the Ministry of Research. The CSTB does research for both government and private organizations. Its field of work includes such areas as construction technology, HVAC systems, acoustics, lighting, building materials, fire safety, climatology, etc... The financing for the CSTB's activities comes from different sources: 60% from the Ministry of Research, 15% from other public agencies and organizations, 15% from private industries and 10% from their various publications.

The CNRS, "Centre Nationale de Recherche Scientifique", is supervised by the Ministry of Education. The CNRS is a more general research institute that concentrates on fundamental research rather than applied research. The CNRS also is in charge of the synthesis of the research activity in France. The statutes of the CNRS specifies that its tasks are to:

- develop, orient and coordinate all forms of scientific research

- conduct a continuous analysis of the statute of science on behalf of the government (Source: 25)

2. Universities

Those establishment are more concerned with fundamental research than technical research. Their importance toward the construction industry is very limited. Engineering schools have laboratories for their own use that civil engineering student are using for study purposes and for some thesis work. The situation might evolve somewhat as the funding for schools decreases and as they are looking for outside research contracts to conduct in their laboratories, but the overall research activity is negligeable.

3. Private institutions

These include many centers specific to different areas of industry that are sponsored by the industry itself. Previous examples were given , this is only a small list of what exists today. Note that the government is still somewhat involved in those institutions since their financing comes from"compulsory contributions from firms totally or partially active in the trade or the profession considered." Therefore those institutions are also subject to state supervision.

2.5.3 How easy is it to use new technologies?

When comparing the situation of the building industry between the US and France, one can notice that the use of recent technology is at a much different stage. Often new technology is applied much later in the US than it has been introduced in Europe. There are probably many reasons for such a situation, the most obvious being the increasing US liability problem.

What are the reasons to use a new technology or material or to develop new products and methods?

The construction firms directly benefit from any cost savings as the bidding process is done on the architect rendering rather than on engineering drawings. The cost involved in construction has a large component in material and labor. Therefore the need to always reduce cost is a large incentive to use new methods or materials

Also, the investment yield of a project has been a strong concern of owners. This acknowledgement has helped to facilitate the application of research to be applied on site and to open doors to new technology.

New products and methods are subjected to technical approval which provides the future user with a certain guarantee of the work. Eventually, research results are included in codes.

The government has also provided a large incentive for the use of new technology through the plan called REX which states that the government will be responsible for the increased cost of a new technology used on a construction site for the first time.

This not only gives an incentive to explore new methods of construction, but also helps to implement the technique for the first time when it is usually difficult to be competitive because of higher start-up cost and steep learning curve.

2.6. Major issues facing the construction industry in France

The largest sector in France for the construction industry is the building industry which, in 1985, did about 315 billion Francs of turnover, compared to 96 billion for civil work. The industry is therefore very sensitive to the overall market, especially the housing situation and the office building needs.

As the housing demand has been decreasing steadily since 1974, (-3.9% in 1985), and also because the future does not promise any drastic increase, the industry has to reorganize and change its tasks. One area that is gaining activity is the renovation and maintenance of existing buildings. This activity, which represents now about 50% of the building activity, has been largely sponsored by the government which spends 2 billion Francs per year and also by the developer because of the good market it represents (a renovated condominium sells for the price of a new one).

Overall, the activity of the construction industry is subject to all major works that are commissioned by the government and this makes for a rather unstable situation since those projects can be delayed. The recent increase in activity can be largely attributed to the many major works that have been started in Paris such as the pyramid of the Louvre, the Opera of the Bastille, the museum of La Vilette, etc... Other major work must follow to avoid a significant slowdown in the activity.

Chapter 3. French international construction industry

The French involvement in the construction industry as seen in chapter 2.2, has been a long story. Similarly, its participation at the international level goes back at least to the Napoléonic wars when the "Génie Militaire" was in charge of construction/reconstruction related to the war activities.

In the more recent years, France has been largely involved in construction activities in African countries, especially those that used to be part of the French Empire with the status of colonies, protectorates or mandates. Also the 1970's saw a boom in the Middle East activity as a result of the oil crisis which made large sums of cash available to the OPEC countries.

A more detailed discussion about the international position of the French construction industry will be conducted throughout this chapter, that is its general evolution over time and the effect it has upon the present and future situation. Also, the history of French involvement in former colonies and the role of the EEC will be discussed. The last part will give a picture of the current situation and the trends that can be established from it.

3.1. Importance of the international market

Situation in 1985

The total amount of exportation from the French construction industry represents 62 billion Francs compared to 411 billion Francs of work done nationally. The international activity represents therefore about 13% of the total activity of the construction industry. The reason why this amount appears low is that much of thework done nationally corresponds to maintenance or "artisanal" construction that is done primarly by very small firms or "artisans".

The situation is somewhat different when looking at the percentage of foreign contracts awarded to the largest French firms versus the amount of domestic contracts awarded to those same firms. The nine largest firms, who have a 14% share of the total domestic market conduct 43% of their total work outside of France. They export 54.2 billion Francs of work which represents 87% of the total exports.

France's main activity takes place in Africa which represents 25 billion Francs of exportation, or 40% of the total foreign activity. It is by far the largest. The reason for this situation can be found in the fact that one third of Africa used to be under French influence and that there still exists today strong ties between African countries and France. The situation of the French construction industry in Africa will be developed extensively in section 3.2.1.

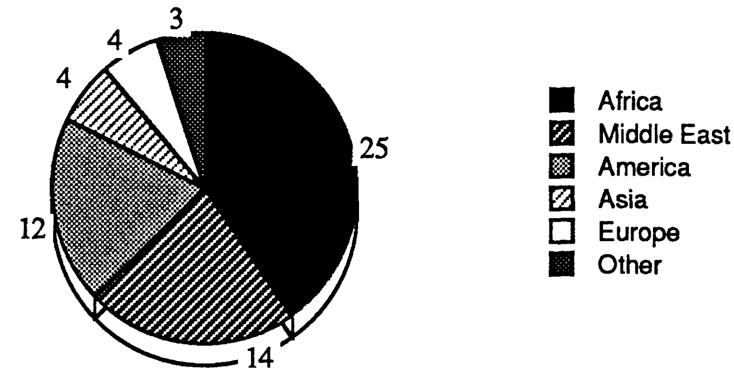
The Middle East is the second largest area of activity for the French construction industry with 23% of the total exports, although the importance of this part of the world is reducing considerably since the drop in oil prices. In 1982, Africa and the Middle East represented similar amounts of foreign contracts awarded, where as today the African market far outweights the Middle East market.

Another important market is that of America, where both North and Latin America combined represent 20% of the total exports. The tendency has been for both markets to augment their importance as the Middle East market has been slowing down.
Both the Middle East and the American market will be discussed in more detail later on in the chapter.

The share of the European market is rather low as it only represents 6% of the total exports. This appears to be rather low as it represents the closest market for the French construction industry. But this can be explained by the difficult competition with the countries that have other regulations, another language and also their own established construction industry. The situation of the French construction industry within the European market and also the role and influence of the EEC will be looked at in more detail in section 3.2.2.

The division of the exports by type of activity reflects the history and expertise of the French construction industry. 35% of the civil work is in fact the construction of bridges and dams, road construction represents 22%, an area in which the firms are conducting significant amounts of research.

Fig. 3.1.1. French construction industry exportations for 1985 in billion Francs



Total : 62 billion Francs

Building : 22 billion Francs

Structural work : 15
Finish work : 7

Civil work : 40 billion Francs

Bridges, dams,...: 14
Roads : 9

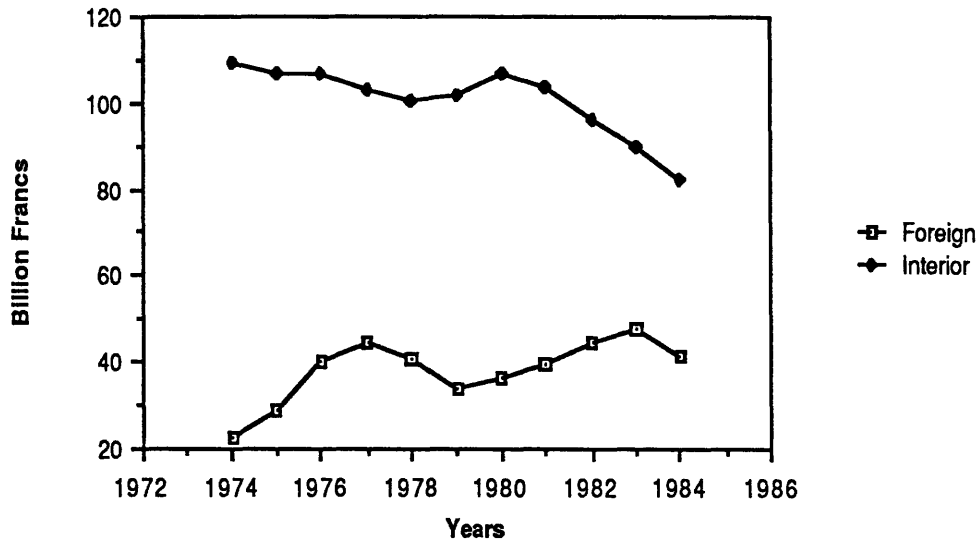
Electrical work : 5
Sewers, drainage : 5
Other : 7

Source: 7

Evolution in time

Over the last 15 years, the overall amount of foreign contracts awarded to French firms has been increasing from about 20 billion Francs in 1974 to 40 billion Francs in 1984 (constant Francs - base 1984). But this increase has not been regular and the foreign market has also seen decline in its activity twice through the period: from 1977 to 1979 and since 1983.
From 1974 to 1977, the foreign construction market rose by 125% from 20 to 45 billion Francs. This is related to the beginning of a drop for the domestic market. By 1975, the building/housing boom was coming to an end, therefore firms had to look for other markets. The French market being somewhat limited for major growth, the firms that had kept busy within the country, looked for other markets and expanded their range of action.
The years 1978 and 1979 correspond to a drop in this new international activity.
The international French construction industry took advantage of the 1979 oil crisis and increased its foreign volume of construction steadily until 1983.
Not only did OPEC countries have large amount of profits to invest, but also other countries such as Algeria, Indonesia and Nigeria started large modernization programs.
After 1983, the foreign contracts started to decrease. This situation was due to many phenomenae : first the oil producing countries saw their revenues decrease as the oil price dropped. Second, the demand for construction changed considerably. Third, new countries entered the foreign market with much cheaper labor.

Fig. 3.1.1 Evolution of the construction market in constant billion Francs base 1984



Source : 3

With the decrease in revenue from the oil producing countries, there is also a change in the countries in which the French construction industry is being awarded contracts. Africa always represented the largest export for French construction except in 1981 when it was passed by the Middle East. But since 1982, the volume of contracts with the Middle East has been declining constantly to go from $3.7 million in1982 to $0.8 million in 1985. Percentage wise it has dropped from 32.5% to 12%.

In 1984 the share of the Middle East climbed back to almost 30%, not because of an increase in volume of construction exported, but rather because of a strong drop in the African market that went from $4.1 million in1983 to $1.7 million in 1984. The 1983 level for this particular market was significantly inflated by major contract awards made in Algeria. This hid for the year the fact that in reality the situation for the exports had already started to decline.

Table 3.1.1 not only details the general drop in the construction exports from France to major areas of the world, but also shows the trend in the exports since the drop in the Middle East and African market. The Asian and Latin American market have been rather stable both from a percentage point of view (between 11 and 15% for Asia, between 5 and 10% for Latin America) and from a volume of contract awards point of view (around $1 million for Asia and between $0.3 and $0.9 million for Latin America). On the other hand, the latest numbers available for Europe and North America show that those are two areas where France is trying to expand. The European market saw its share increase from 4 to 12% of total exports while the North American market went from 13 to almost 20% from 1984 to 1985.

Table 3.1.1 Evolution in the award of foreign contracts to French firms from 1981 to 1985 (million dollars and percentage)

	1981		1982		1983		1984		1985	
	$	%	$	%	$	%	$	%	$	%
Africa	3.4	27	4.4	39	4.1	41	1.7	31.5	2.1	31.3
Middle East	n/a	n/a	3.7	32.5	2.3	23	1.6	29	0.8	12
Asia	2.5	20	1.3	11.4	1.1	11	0.9	16.7	1.0	15
Latin America	1.0	8	0.9	8	0.4	4	0.3	5.5	0.6	9
North America	n/a	n/a	n/a	n/a	n/a	n/a	0.7	13	1.3	19.4
US	n/a	n/a	n/a	n/a	0.6	6	0.6	11.3	n/a	n/a
Europe	n/a	n/a	n/a	n/a	n/a	n/a	0.2	3.7	0.8	12
Other	n/a	n/a	n/a	n/a	n/a	n/a	0.0	0.0	0.1	1.3
Total	12.5	100	11.4	100	10.0	100	5.4	100	6.7	100

Source: ENR

The foreign market has also seen an important change in the sectors it has been involved in. Going back to figure 3.1.1. and comparing the foreign and domestic situation , one could argue that the export value of the building industry is very low as it represents only 7% (22 billion FF versus 315 billion FF). However, this is a considerable increase over the past few years. In 10 years the value of building construction exports has been multiplied by ten : in constant francs, the 1973 value was only 2.4 billion and in 1981 it represented just 10.5 billion compared to the cuurent 22 billion.

3.2. History of the French international construction industry

3.2.1. France in former colonies

As just seen, a lot of work done internationally by French construction firms has been done in Africa, one third of which at one point of time was under French influence. Today the activity of certain main construction firms in those areas still represents a large percentage of their foreign work. For example, SAE does 17% of its total turnover in Africa which represents 30% of its foreign turnover; Dumez does 83% of its turnover in foreign countries and 30% of it comes from Africa, i.e. 36% of the total foreign work. (1985 results)

Before going into further detail about the current situation of the construction industry in former colonies, it is interesting to rapidly retrace the history of the colonies and the impact they had on the French economy. This will give an idea of the influence this previous situation had on the construction industry. this will then be followed by a closer look at the situation today of the French construction industry in Africa.

Overview of the French colonial activity.

The largest French zone of influence globally was in Africa were at one time over a third of the continent depended one way or another on the French government. France settled in the North Western portion of the continent with Algeria (1830), Tunisia (protectora in 1881) and Morocco (protectora in 1912), with Cameroon and Togo became mandates after WWI. The detail of the African colonies, their land area and their population is shown in table 3.2.1.1. This table shows that not only France had a large influence over the African continent, but also Africa was its main colonial area since it represented 92% of the total area of the colonies, 62% of the total population and it attracted 93.7% of the European colonial population.

In Africa, it appears that the most important colonies are those of Algeria which attracted almost 60% of the European population, Tunisia with 12%, Morrocco with 7.4% and Reunion and The Isles du Sud with 12.7%. The non-African colonies with some importance are Indo-China with the largest area but few Europeans where as American colonies such as Saint Pierre et Miquelon or Guiana had a large European population relative to the total population.

Table 3.2.1.1 Information about French colonies

Colony	Area Sq. mi.	Total pop. x1,000	Density per sq. mi.	Europ. pop. x1,000	%1	%2
AFRICA	3,609,632	34,214	9	1,33.4	3.9	93.7
Algeria	847,522	5,981	7	833.4	14	58.7
Northern territory	80,108	5,444	68	828.6	15	58.4
Southern territory	767,414	537	0.7	4.8	0.9	0.3
Tunisia	48,313	2,160	45	173.3	8	12.2
Morocco	160,232	5,556	35	104.7	2	7.4
West Africa	1,443,244	13,542	9	15.4	0.1	1.0
Senegal	74,131	1,358	18	7.9	0.6	0.5
Sudan, Upper Volta, Niger territory	962,549	7,094	7	2.5		0.1
Mauritania	154,440	289	2	0.3	0.1	
French Guinea	89,189	2,096	24	2.2	0.1	0.1
Ivory Coast	121,622	1,725	14	1.6		0.1
Dahomey	41,313	980	24	0.9		
Madagascar	228,707	3,599	16	22.7	0.6	1.6
Reunion and Isles du Sud	2,127	187	88	180.7	97	12.7
Somali Coast	8,494	65	8	0.3	0.5	

Colony	Area Sq. mi.	Total pop. x1,000	Density per sq. mi.	Europ. pop. x1,000	%1	%2
ASIA	270,794	20,438	75	23.5	0.1	1.6
French India	198	290	1,465	1.4	0.5	
Indo-China	270,596	20,148	74	22.1	0.1	
OCEANIA	8,745	88	10	16.4	18.6	1.3
New Caledonia	7,201	52	7	15.0	28.8	
French Establishment	1,544	36	23	1.4	3.9	
AMERICA	35,230	541	15	48.5	9.0	3.4
Saint Pierre et Miquelon	93	4	40	4	100	
Guadeloupe	687	243	354	15.7	6.5	
Martinique	380	251	661	2.7	1.0	
Guiana	34,070	47	1	26.1	55.5	

Note: %1 is the percentage of European population for the total population for the country,

%2 is the percentage of total European population

Source: 8 (1926 to 1930 figures for the population)

The North African colonies became the most important for the country for the following reason : its geographical location was ideal, close to the home country, with a temperate climate and, most of all, it gave France some control over the Southern part of the Mediterranean coast, right across from its coast. This was a major element for the protection of French commerce in the Mediterranean

The result is that the North African colonies saw 90% of the French population of the colonies and became also the largest recipient of French capital.

The first main construction related activities in the colonies were the development of roads, railroads, harbors and cities for the increase of commerce between the colonies and France. The most important investment is probably that of the railroad. The bonds issued often had some form of government support.

There wasn't at the time any real industrialization as the raw material and the food was transported directly to be treated in France. Also, Frenchmen were not eager to go to the colonies which caused many labor problems as the local labor was inexperienced. This has slowed down any rapid and large development of the colonies.

Another aspect of the slow growth of the colonies was the budget of the colonies. There were two distinct status applied : that of autonomy and that of assimilation. Autonomy meant that only the military budget came from France , where as under the assimilation rule, the country's receipt and expenditures were part of the national budget. Until 1920, the government civil spending for the colonies was rather low, the main spending being military. At this time, the idea of increased government civil spending started and 3 billion Francs in loans were made for public works in West Africa, Indo-China and Madagascar. Those loans were guaranteed by the French government.

The benefit of the colonies for France's economy is not evident as it appears that most of the spending was military oriented. The colonies did provide the country with some raw material, but the lack of enthusiasm from the French people toward the colonies slowed down or even inhibited any large scale development. Therefore, especially towards the construction industry, the main benefit of France from the colonies is that of having established privileged relations that continued to exist after the colonies reached independance. Another argument is that the colonies have served as a ground to try out and show to others new technologies and develop expertise in such areas as railroad construction.

Todays situation of the French construction industry in Africa

France's share of the foreign contracts won in Africa is relatively important as it represents 19% in 1983 and almost 14% in 1985 (Table 3.2.1.2). But most of all, France is heavily dependant on the African market since the 4.1. billion in dollars foreign contracts awarded in 1983, represent 41% of the French total foreign contracts. Even though this percentage has dropped considerably after 1983, down to 31% in 1985, the African market stays the most important one for the French construction industry and by a large amount since it is followed in 1985 by the Asian market which represents only 15% of the total foreign contracts awarded.

Compared to other countries involvement in Africa, France was the second in 1985, relative to the amount of its foreign contracts awarded in Africa, behind the US.
The situation in Africa has changed considerably from 1983 to 1985. The large presence of the Korean industry in 1983 reduced considerably in1985 as they went from $4.4 billion to $1.0 billion, but France also lost their 1983 first place for the amount of foreign contracts awarded, to the US, in 1985. France managed to keep its second place, even though the contract amount dropped almost by 50% from 1983 to 1985. They are now largely distanced by the Americans ($4.5 billion) and closely followed by the British ($2.0 billion) with their $2.1 billion share. The other country that largely increased its share of the African market is Japan, from $400 million in 1983 to $1.6 billion in 1985.

Table 3.2.1.2. Foreign contracts won in Africa

	1983			1985		
	# firms	Foreign contracts billion $	% of foreign contracts in Africa	# firms	Foreign contracts billion $	% of foreign contracts in Africa
Americans	20	2.4	11.2	25	4.5	29.1
French	18	4.1	19.1	14	2.1	13.9
Koreans	6	4.4	20.6	3	1.0	6.5
Italians	16	2.8	13.1	23	1.5	9.6
Turks	6	1.3	6.1	n/a	0.6	4.4
British	n/a	0.7	3.3	10	2.0	12.9
Japanese	n/a	0.4	1.9	14	1.6	10.8
Other	n/a	5.3	24.7	n/a	2.0	12.8
Total	n/a	21.4	100	n/a	15.3	100

Source: ENR

The situation in Africa for the French construction industry is becoming more and more difficult for two main reasons: one is that the total amount of foreign construction has dropped considerably due to the increase of debt of the African countries following their reduction of oil income which leads them to reduce their investment. The second is the general state of the construction market which has increased competition between firms and the previously close to monopoly situation of the French companies within certain African countries is being disputed. Such an example is the relation between Cameroon and France. For a long time, France had a monopoly on the business being done in the country, based on past relations and the fact that many young Cameroonians came to France for their studies. Today Cameroon, reacting to the situation, is trying to diversify its partners. Also students

go to other countries. There is a strong encouragement by the government for cooperation and investments from other countries such as Great Britain, the US, Israel and Germany. In 1985, France was still the first supplier, the first client and the first foreign investor with 67% of the foreign capital and 42% of the market. Today, the French position is slowly getting less and less secure as other countries are encouraged to enter Cameroon and as they are also willing to make more interesting offers, especially for the finanacing of projects.
But the integration will not be easy for them as they don't benefit from previous knowledge of the country and its people which is what gives France a plus. Even though Marples, a British firm, has been awarded the contract for the Bafoussam airport, 70% of the work will be done by French companies.

The major countries where France is involved are Algeria and Nigeria. In 1983, when $4.1 billion of foreign contracts were awarded in Africa to France, about $350 million came from Nigeria and $2.6 billion from Algeria. Those two countries therefore represent 72% of the total African foreign contracts, Algeria by itself representing more than 50%. This heavy dependence of France to the Algerian market explains largely the considerable drop in foreign contracts in Africa since after 1983, the Algerian government was faced with an increasing foreign debt and decided to slow down investment. As a result, Algerian contracts dropped from $26 billion Francs to $1 billion Francs from 1983 to 1984.

The strong position of the French construction industry in Africa is definitely tied to the former presence of France in the area and the numerous ties that existed between the former colonies and their mother country. However, if this privileged situation is still true with some countries such as Algeria, others are slowly reacting against it and what France has taken for granted for many years may disappear due to the increasing competition. Also, the discussion of the French presence in Africa showed that the construction industry is heavily dependant on the Algerian situation as this country represents the major source of foreign contracts. As for the future of this market, it will be more and more difficult due to both large debt problem and increasing competition.

3.2.2. European market share and role of the EEC

It is only in the recent years that the individual European construction firms are looking at Europe as their home market, this actually following the shrinkage of the world market. The creation of the EEC did not affect the volume of foreign contracts awarded in the construction industry. There continued to be small exchange, but no major changes. Two reasons for such a situation can be proposed :

- it was a time where demand for the construction industry was strong enough, both at a national level and at the international level. Companies did not therefore see the need to compete against each other within the European boundaries.
- there were a lot of technical problems of working in other European countries, both linguistic and because of the various codes and regulations.

In 1985, France's involvement in the European construction market was not very important as it only represented 8.2% of the total amount of foreign contracts awarded and a sum of \$8oo million. From the ENR survey, table 3.2.2.1, it appears that the largest foreign contract award in Europe is that of the Americans with \$4.2 billion. They are followed by the Italians with \$1.8 billion. It is interesting to notice that almost half of the foreign work done in Europe is done by a non-European country, i.e. the US. This situation is still the consequence of the earlier lack of interest of European firms in the European market, as has been mentioned before.

Table 3.2.2.1. Foreign contracts won in Europe in 1985

	# of firms	% of foreign contracts	foreign contracts billion $
Americans	22	42.3	4.2
Italians	15	17.9	1.8
Germans	9	8.6	0.9
French	11	8.2	0.8
Dutch	9	5.7	0.6

Source : ENR

As it appears, the foreign activity of French firms, as well as European firms, is rather limited within the European market. But the slow down of the world construction activity has pushed European firms to cooperate and, even though long term agreements are difficult, French firms have formed joint ventures with other firms, most of the time on a project basis. For example, Spie Batignolles and Dragados (Spain) worked together on a foundry project in Indonesia, Dumez and Impregilo (Italy) cooperated for the construction of a dam on the Argentina/Paraguay border and Fougerolles and Philip Holzman (Germany) are both involved together with the construction of the particle accelerator for the CERN in Geneva. On a larger basis, Bouygues and Trafalgar House created a common subsidiary: Saur. The presence in other European countries of French construction firms will be developed through collaboration agreements that have already taken place such as between the British firm Bovis and SAE.

The creation of the EEC has had only a very small impact on the strict construction activity within Europe, although an attempt has been made through the publication of a directive: directive 71/305 which asks the governments to have bids for over 1 million ECU (1974) appear in the Official Journal of the EEC, so that all firms can be aware of what is being offered and eventually bid on it.

Another EEC measure was more oriented toward the development of construction activity in Africa. The "Fonds Europeens de Developpement" is a convention between 18 African countries and the EEC which gives financial aid to member countries. This was strongly supported by the French government to keep its commercial ties with its former African colonies.

The EEC can probably be considered to have a much stronger influence on construction related activities such as research rather than on the actual volume of construction.

There are different groups that operate at an international level to promote or help cooperation:

1. The Committee on Housing, Building and Planning deals with the improvement of housing in Europe and it tries to increase the minimum standards.

   Its work includes the publication of an annual statistical bulletin on housing, the study of common problems, the elaboration of special reports dealing with economic and financial aspects of the housing industry.

   One battle is to try to push for the unification of technical regulations through the setup of international terminology and international verification methods.

2. The European committee for Standardization created in 1960, part of the EEC and EFTA, has as a goal the elimination of the difference in standards between the two groups of countries.

3. The International Union of Testing and Research Laboratories for Materials and Structures (RILEM). Its principal concern is to harmonize testing methods used in research and for the quality control of various building and civil engineering products. It is a cooperative organisation of laboratories, with headquarters located in Paris.

4. The International Council for Building Research, Studies and Documentation (CIB). The members are building and civil engineering research institutions such as large publicly controlled institutions (BRE in Great Britain, CSTB in France), industrial and commercial research organisations.

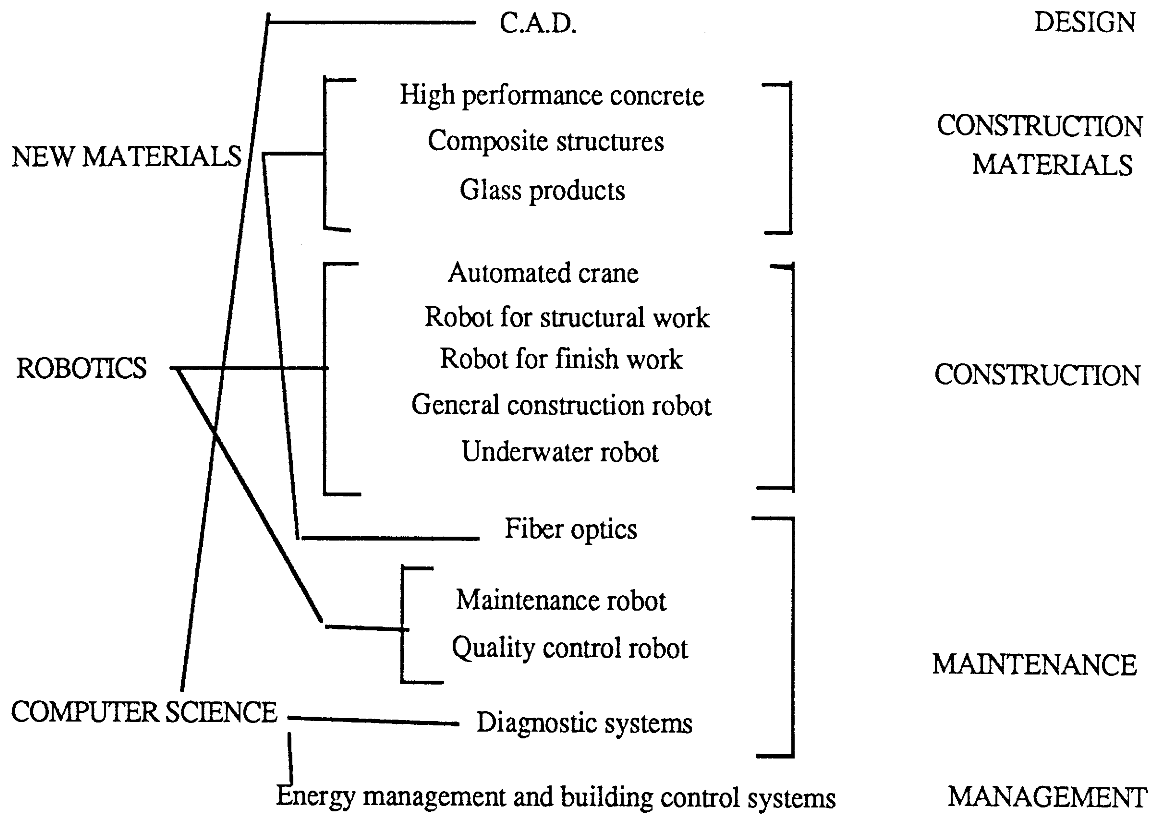
The more recent growing economic concern has led to increasing cooperation and consolidation among European countries, essentially at a research level. This cooperation has as an objective to increase the productivity and competitiveness of the European industries. The latest plan, EUREKA, has the following task : "master and exploit the technologies that are important for its future, and to build up its capability in crucial areas." (5)

EUREKA projects will affect the construction industry as the various projects that have been already agreed upon have direct application for the construction industry as a whole. Figure 3.2.2.1. details the areas of construction that are concerned.

France is especially involved in two areas which are :

- the prospect for construction techniques. A development of an "industrialized infrastructure system of urban construction techniques" (5)
- the development of robots for the construction industry. This should improve dangerous activities and increase productivity. The two forecasted applications are for load manipulating cranes and a platform robot to use when construction is being done on tall buildings

Fig. 3.2.2.1. Construction projects in EUREKA research program



3.2.3. Other presence of France

The French construction industry is present in all the geographic zones of the globe.

The Mideast has been in the past until 1983, a very important market for French firms as it provided 32.5% of the total foreign contracts in 1982.
The Mideast market boomed after the 1973 oil crisis as the oil producing countries had large amounts of money available for investment. Numerous firms that saw their activity decline in France the following years, because of the slowdown of investment and the end of the housing boom, became involved in the Mideast market which eventually became one as important, if not more than, the African market. This situation did not last very long as, as soon as 1983-1984, with the serious drop of oil prices, those same countries had to reduce considerably their investment. For French firms, this meant a decline from $2.3 billion in foreign contracts awarded in 1983 to $0.8 billion in 1985 (table 3.2.3.1).

The Asian market appears to be relatively stable in the last few years as the amount of foreign contracts awarded has stayed around $1 billion from 1982 to 1985. This represents a percentage of total foreign contracts that varies between 10 to 16.7% (in 1984). In 1985, the $1 billion contract award represented 15% of France's foreign contract awards and 5.6% of the foreign contracts awarded in Asia. This latest figure has dropped from 7.1% in 1983, suggesting that French activity is somewhat reducing in that area.

The Latin American market has slowed down after 1980 when the countries slowly adopted political measures that led to a major economic slow down. In 1982, the level of foreign contracts in that area was $900 million, which dropped to $400 million in1983 and $300 million in 1984. 1985 marked an increase since the amount of contracts awarded doubled, to reach $600 million. Also, table 3.2.3.1 shows that the percentage of French awarded contracts has increased from 6.3% of Latin American foreign contracts in 1983 to 9.1% in 1985. This could reflect a will of French firms to stay competitive and present in this geographical area as the construction market tightens.

As for the North American market which is increasing rapidly since the general slow down in 1982-1983, it represented $800 million of foreign contracts in 1985 or 19.4% of the total French foreign contracts, which is a larger amount than for the Mideast market that same year. This market appears today to be the largest and also the most stable, which makes it very attractive to foreign firms. The next chapter will present the French presence in the US, its importance and its evolution, therefore this part will not be developed further here.

Table 3.2.3.1. Foreign contracts won by France outside of Africa and Europe

	1983			1985		
	# firms	Foreign contracts billion $	% of foreign contracts for the area	# firms	Foreign contracts billion $	% of foreign contracts for the area
Mideast	14	2.3	7		0.8	3.8
Asia	11	1.1	7.1	14	1.0	5.6
Latin America	10	0.4	6.3	9	0.6	9.1
North America				8	1.3	12.3

Source : ENR

3.3 Current situation and trend for the future

The drop in oil price in 1982 has had an important effect on the French construction industry and the results of this drop can be separated into both direct and indirect effects.
The direct effect has been on the foreign contracts awarded by the Mideast countries. France was heavily dependent on those contracts has they represented up to 32% of its foreign awards, the 1985 level was down to 12% and is still expected to drop.
The indirect effect is that of increased competition among large construction firms. The large scale projects are becoming very rare and highly demanded.
Both those effects have forced the French companies to look for new markets and they also have influenced the large firms to look for diversification.

If French companies had traditionally favored their exportations toward developing countries, it appears that they now have to modify their strategies due to the increasing debt of those countries. Therefore, French construction companies have to develop their action geographically, commercially and judicially.
The companies that have been less affected are those that were already widely diversified both geographically and by sector of activities. This diversification is what most construction companies are aiming at today, but the highly competitive international situation makes it more difficult.

A major shift can be observed today in the construction market from Africa and the Middle East to Asia, North America and Europe. This requires that the companies modify their strategies and penetrate new markets. But the competition is strong.

The current efforts of French firms are toward areas and countries such as Asia, with China and India where they are still successful, Turkey and the US.

The firms are eagerly looking at diversifying themselves through an acquisition strategy and the previously untouched European market could be affected, as under the many pressures, companies are more and more looking at increasing their "home" market at the European level. What was in the past a difficult task because of the various barriers such as work practices, standards and languages, many firms would be willing to deal with to enter other established market and secure a share of the work at the European level, since this market is predicted to rise by 12 to 15% by 1991. Some companies are therefore eager to merge and acquire other firms in various European countries.

Although the Mideast market is much slower, this does not mean that French firms are completely ignoring it as the evaluation of oil prices is very variable and the situation in the Mideast countries could change.

Commercially, French firms have to find ways to be competitive and benefit from all possible advantages. Therefore, not only are closer relations with clients from developing countries being developed, but also use of local polititcal help such as the exportation help given by Latin American countries is being investigated. It becomes therefore very important to have local subsidiaries that can export work and at the same time benefit from loans. That is how a French firm has worked in a country covered by the ALADI mechanism through its Argentina subsidiary and benefited from an Argentinan credit.

Technologically, it appears that the development of turnkey projects is being largely favored by many client countries. Also, French firms are concentrating on offers that include coordination, conception and technological assistance. This appears to be more profitable since it excludes competition from countries with cheap labor and also enables the firms to estimate and monitor costs more accurately.

Judicially, the firms will have to be more and more precise in their contract agreements in order to avoid major problems when countries are unable to pay or decide to terminate contracts already awarded.

Another approach to enlarge the construction activity has been the push for the creation of large infrastructure projects that would be supported by governments but largely privately financed. The European Commission is studying proposals from both Fiatimpresit and an Italian bank and the Fédération Internationale Européenne de la Construction (France) to coordinate public and private financing for such projects.

In front of the increasing competition, France's construction industry still benefits from a strong engineering capability which has been recognized worldwide. Still tody, France is among the most competent in such areas as large and complex buildings (hospitals, hotels), railroad construction, subways, dams and the set up of turnkey project for water and chemistry related plants.

The problem that the construction industry is faced with today is that technical knowledge is not enough to win in different international markets. It is more and more the commercial and financial ability that will make the difference between companies bidding on the same project. The other important aspect will be the capability of selling high technology as well as managing projects involving numerous subcontractors

Chapter 4: Presence of France in the US

At a time where the world construction market becomes more and more competitive due both to the increasing number of construction firms and to the slow down of the construction activity, firms are looking to develop markets that are important, stable and solvent. For firms' new ventures into developing new work, the US market is becoming especially attractive. The US domestic market represents a large percentage of the world market and is considered by many to be the worlds most stable. It is therefore no surprise to see that many countries are trying to enter this market either through direct competition or through acquisition of US firms. The following chapter will look at the importance of the French presence in the US and at what the French construction industry strategy has been.

French construction in the US is varied both geographically and by type of activity. Not only do major general contractors work in the US directly or through their subsidiaries, but French material manufacturing firms are also present in the US market. Each main sector of activity will be presented separately as they have different characteristics.

4.1 General contractors and A/E activity

France's share of construction in the US has increased from 6% of the total foreign contracts awarded to the top 250 international contractors in 1983 (0.6 billion) to 11.3% in 1984 and 19.4% (1.3 billion) in 1985. This followed the general situation within the US where foreign construction activity increased from $20 million in 1980 to $7.2 billion in 1985

The relative position of France compared to other countries within the North American market can be assessed by the percentage of foreign contract awards.

For all North American contracts won in 1985 by the top 250 international contractors, the French contractors came in fourth place with a share of 12.3%, behind the Americans, the Germans and the Japanese. Their share is over half of that of the American contractors. (Table 4.1.1.)

Table 4.1.1. North American foreign contract awards in 1985

Contractors nationality	% of North American contracts
American	23.0
Germans	19.8
Japanese	19.2
French	12.3
British	8.7
Other European	13.4
All other	3.6

Source: 1

Note: this only reflects the performance and market of the top 250 international contractors

But this is only one aspect of the importance of the US market. The other aspect is the amount of work provided to the various French companies. For 1985, Engineering News Record lists 18 French firms among the top 250 International Contractors who had an average of 44%, or $6.7 billion of their total contracts awarded in foreign countries. The US share was about $1 billion or almost 15% of the total foreign contracts awarded. This only represents an average, and more detailed information from companies annual reports show that among the 18 firms listed by ENR in 1985, some had 25% of their foreign contracts in the US, such as SAE (26%). (Table 4.1.2)

The movement of French firms into the US market has been spread over time, starting as early as 1950 with the creation of Campenon Bernard's division: the Prescon Corporation. this firm appears to be the first to move toward the US market and this in a specialized and novel area for the time: prestress concrete, materials and equipment.
The next movement toward the US was made in the 70's by firms investing in offshore oil work, when this activity became more and more important. Companies settling in the US all came to the Texas region, because of its wide open market at that time.
More recently, there has been another movement toward the US directed by both the need to reinvest Middle East profit and the desire to open doors into a new market which is felt to have wide possibilities as other markets become either too saturated or financially risky.

The leader in the general contracting activity for this latest development is SAE which has purchased three companies since 1980. SAE started its US activity through the acquisition, in 1978, of a Houston based general contractor. Now SAE holds the largest share of the US market for a French firm in that sector ($657.4 million of US contracts). It is also the French firm with the strongest involvement in the US as its four subsidiaries' contract awards

represent 26% of the total contract awards of the parent company. The four subsidiaries are general contractors, with some engineering, design and management capabilities. SAE's main activity in France is construction related, dealing primarly with commercial and residential buildings, civil work and varied canalization work. There is no strong diversification in the parent company and its US activity follows strictly.
Interesting to notice also is that SAE has a long history of foreign work in other geographical areas such as Africa, the Middle East, South East Asia and Latin America. In all those cases, its strategy had been to bid and work as a French company, competing as such against other international firms. But in the case of the US, and Australia where its only other foreign subsidiary is located, they have felt that to begin, the acquisition of already established firms was preferable to direct competition or creation of their own subsidiary. This enabled SAE to establish a strong position in the US, to better understand the American market, its rules and regulations, enabling them now to create new subsidiaries (such as SPC) more easily as they are already introduced and known.

French A/E activity in the US is rather limited and is relatively recent, with Bouygues appearing to have the largest share. In 1983, Bouygues acquired HDR, Inc., an Omaha based holding company that owns a large design firm, and is ranked 25th on Engineering News Record's Top 500 Design Firms in 1986. The acquisition has not been done to develop the A/E activity of Bouygues in the US, but rather to give the parent company a large network in the US from which it will be able to perform both design and construction. HDR brought 20 permanent offices in the US and a wide range of work from bridges to water treatment plants. The acquisition is a first step in the development of a large multidisciplinary group (Centerra Corporation - 1985) that will be able to handle turnkey projects. Bouygues' strategy is to propose to the owner a package that includes all aspects of construction from designing to financing. It had the construction capability which needed to be complemented with US engineering codes expertise and an established network. Again, the strategies in the US of a French firm follow very closely those applied by the parent company.

Table 4.1.2 US subsidiaries or affiliates of French general contractors

Parent company	Total 1985 contracts $ Million			Subsidiaries or affiliates in the US				
	Total	Foreign	US	Name	Location	Date	Sales $ Million	Activity
Bouygues	3,050	1,250 41%	122 4%	Bouygues Offshore	Houston			
				HDR	Omaha (Nebraska)	Acqu. 83	62	A/E
S.C.R.E.G. (Bouygues)	1,202	497 41.3%	180 15%	Nielsons, Inc.	Cortez, CO			Civil engineering
				Apex Offshore Inc.	Morgan City Louisiana		8	Metal plateforms manufacturer
S.A.E.	2,501	1,164 46.5%	657.4 26%	Spaw Glass	Houston	Acqu.1978	197	
				Continental Heller	Sacramento	Acqu.1980	131.5	
				Pinkerton & Laws	Atlanta	Acqu.1983	104	General Contractors
				Carlson	Boston	Acqu.1985	225	
				SPC	Atlanta	Created 87		

Parent company	Total 1985 contracts $ Million			Subsidiaries or affiliates in the US				
	Total	Foreign	US	Name	Location	Date	Sales $ Million	Activity
Spie Batignolles	2,442.6	1,212.3 49.6%	122 5%	Spie Group, Inc.				All purpose
				Trindel America Corp.	Tucker (Georgia)			Parking systems
				Spie Horizontal Drilling, Inc.				Oil & Gas division
				Clecim, Inc.	Oak Brook (Illinois)	Clecim France Acqu. 1985		rolling mills & hydraulic presse
				Note: Spie does not have US subsidiaries part of its civil engineering & constructiondivision In 1986, Spie has invested in the Comstock Group, the secong largest electrical engineering contractor in the US (20% of the shares)				
G.T.M.	2,075.7	619.3 30%		Gecos (ETPM USA, Inc.)	Houston			Offshore oil work
					Aransas Pass TX			Fabrication yard, pipe rolling mills
				Note: in 1985, GTM was signing joint venture agreement with American companies interested in the knowledge of GTMI				

Parent company	Total 1985 contracts $ Million			Subsidiaries or affiliates in the US				
	Total	Foreign	US	Name	Location	Date	Sales $ Million	Activity
Technip	750	600 80%	0%	Technip, Inc.	New York			Engineering, design & construction for chemical plants
Campenon Bernard	967	352 36.4%		Prescon Corp.	San Antonio		10	Designer & supplier of prestressed materials & equipment
				Freyssinet Corp., Inc. (FCI)	Tuckahoe, NJ			Manufacturing of post tensionning systems
Dumez	501	302 60%	95 19%	Payne & Keller	Houston		95	Construction & maintenance: petrochemical units
				Cascade Home	Houston	Acqu.83 Stopped end 85		

Parent company	Total 1985 contracts $ Million			Subsidiaries or affiliates in the US				
	Total	Foreign	US	Name	Location	Date	Sales $ Million	Activity
S.G.E.		45%	5%	Sabrice Corp.	Dallas			Building construction
Pierre Detoeuf				Nace Corp.				General contracting

4.2 Construction manufacturing

The presence of France in the US is not limited to design and contracting activities as one finds also construction material manufacturers' subsidiaries in the US. Their activities are varied, from road construction materials to precast construction and roofing materials (Table 4.2.1).

The largest French activity in the US is cement manufacturing, representing up to 20% of the sales of the parent company. This also represents a large share of the American market with General Portland being the second largest US cement manufacturer with total sales of $434 million in 1985.

The driving forces behind the increasing presence in the US of cement manufacturers are economic ones. It started in the mid 70's when the construction activity in France dropped considerably, following the first oil crisis. The American economy was one of the strongest in the world and was open to free entreprise.

There are three French cement manufacturers competing in the US market and they correspond to the three largest cement manufacturers in France (Table 4.2.2). This development of the presence in the US is a direct result of the constant reduction of sales that they have experienced (-8.7% in 1982, -7.3% in 1983, -6.4% in 1984). Cement manufacturers need to expand their market and are therefore looking toward the US with its boom in construction.

Table 4.2.1 US subsidiaries or affiliates for construction materials manufacturers.

Parent company	Total 1985 sales $ Million: Total	Foreign	US	Subsidiaries or affiliates in the US: Name	Location	Date	Sales $ Million	Activity
S.C.R.E.G. (Bouygues)	1,202	497 41.3%	180 15%	Ceramac America Inc.	San Angelo TX		40	Tile manufacturing
Colas	1,000	435 43.5%	94 9.4%	Barrett Paving Materials	Roseland NJ		94	Road construction materials
Terre Armée				Reinforced Earth Co.	Arlington VA			Engineering: earth reinforcing structures
Guiraude et Auffeve	72			Amega Corp.	Houston			Precast construction, commercial and industrial
				Amega Investments, Inc.	Houston			Real estate development and investment

Parent company	Total 1985 sales $ Million			Subsidiaries or affiliates in the US				
	Total	Foreign	US	Name	Location	Date	Sales $ Million	Activity
Outinord	21			Outinord, Inc.	Miami			Industrialized building systems
				Outinord-Universal Co.	Houston			
Isoletanche				Wescoat Corp.	Phoenix, AZ			Roofing, insulation
Siplast S.A.	62		20 30%	Siplast, Inc.	Arkadelphia Arkansas			Manufacturing of roofing materials
Ciments Lafarge	2,146	1,438 67%	434 20%	General Portland, Inc.	Dallas	1981	434	Cement manufacturer
Société des Ciments Français S.A.	2,780		410 15%	Coplay Cement Co.	Nazareth PA			Cement manufacturer
				Louisville Cement	IN	Acqu.85		
Vicat S.A.	1,036		52 5%	National Cement Co.	Ragland Alabama			Cement manufacturer

Table 4.2.2 First six French cement manufacturers

	Turnover after taxes Thousand Francs
Ciments Français	5,461,895
Ciments Lafarge	4,215,000
Vicat	2,034,798
Cedest	2,003,605
Ciments d'Origny	655,507
Ciments de Champagnole	156,728

Source: 9

The US activity of Ciments Lafarge was developed first through the Canadian subsidiary Lafarge Corporation. In 1981, General Portland became the US subsidiary of Ciments Lafarge and, in 1986, it received all US shares from Lafarge Corporation. For all cement manufacturers, the development of the US activity has been through the acquisition of existing plants. This gives them a foot in an expanding and more stable market. They can later use their assets as distribution network for their own products. This is illustrated by General Portland's activity. The company is subject like any other cement manufacturer to the growing competition of cheaply produced cement imported in the US. To compete, it can benefit from both the technical assistance and expertise of its parent company to produce cement locally more efficiently, but it can also import low-cost products produced in France.

Other construction manufacturers represented in the US are precast construction, tile manufacturers, roofing and insulation, and road construction materials. Unlike the case of cement manufacturers, there is no strong presence in the US for any of those groups. It corresponds more to an isolated presence of various companies that offer specific products.

4.3. Conclusions

Through this study, it appears that the US activity of French construction related firms has been carried out through the purchase of local firms more often than by direct competition, franchising or joint venture. This is especially true when the company tries to break into a market already established. Typical examples are Bouygues' recent expansion through the acquisition of HDR or Ciment Lafarge with the acquisition of various cement manufacturing plants. This strategy gives the firm an operating network from which it can develop and expand its activities as well as a knowledge of the sector and the activity.

Exceptions to this situation occur for specific technologies that have been introduced at their beginning such as prestress concrete where Freyssinet International created its own subsidiary, or for precast activity where Outinord expanded directly its activity in the US. Other exceptions happen, such as GTM's joint venture agreements with American firms that are interested in the knowledge of GTM International.

The presence of France in the US is rather recent in general and it appears that the level at which it stands in their development process is that of expanding their own activities through their bought subsidiaries that they had time to restructure accordingly.

Chapter 5: France - US trade in construction materials

The US represents a large market for import of construction materials and has a negative trade balance with these imports as much as 20 times the amount of exports. France's posotion in this import market will be presented for some specific construction materials.

Throughout this chapter, SITC classification for the basic construction materials has been used. In detail, the materials studied are:

273 - Stone, sand and gravel

661.2 - Portland cement, ciment fondu, slag cement, supersulphate exept glass and clay materials, cement and similar hydraulic cement, whether or not coloured or in the form of clinker

673 - Iron and steel bars, rods, angles, shapes and sections

673.1 - Wire rod of iron or steel

673.2 - Bars and rods (excluding wire rod), of iron or steel, hollow mining drill steel

673.3 - Angles, shapes and sections (excluding rails) and sheet piling, of iron or steel

674 - Universals, plates and sheet of iron and steel

Appendix 1 contains various graphs relative to each commodity and that show the trade evolution from 1978 to 1984.

As mentioned, the US is a large importer of construction materials and their trade balance for those products is negative. In general, for the materials concerned, the variation of imports has been rather steady until 1982. It then generally increases until 1984. At the same time, exports reached a high point in 1980-1981, and have since then reduced slowly. The increase of imports for the various commodities is an encouraging sign for potential exporters.

In general, France has a positive trade balance for the materials mentioned. Over the period from 1978 to 1984, there has been more exports for all of them, except for 673.2 and 673.3, eventhough 673 as a whole has been kept positive. The trend for exports has been to increase rather fast in value until 1980 and then the value of exports dropped considerably until 1983 when a small increase or levelling can be seen for most of them.
The volume of exports for the same materials has more less followed the movement of the value of exports, although there are cases, such as cement, where the value of exports decreases when volume increases.
For all the construction materials studied, France has a positive trade balance with the US. The level of exports varies up and down with the years with no real trend, always in the same bracket, except for iron and steel products that peaked in 1981 but have since receded to their previous level.

US imports from France can be related to both the total French exports and their share of the American import market. The importance of the French exports to the US relative to the total French exports varies between less than 1% to as much as 15% if considering the value of the exports. If only looking at the volume of the exports, this importance diminishes slightly to a maximum of 13%. Therefore, the US does not appear to be, from that point of view, an important trade partner. (Table 5.1)
France's share of US imports is rather small. For example, in 1984, the value of France's exports in the US represented about 5% of total US imports for iron and steel products, 3% for cement and 0.2% for stone, sand and gravel. The major competitors of France in the US market are countries such as Canada and Mexico that have the advantage of reduced transportation costs. But other countries such as Japan, Germany, Belgium and Luxemburg

for steel and iron products, and Spain for stone, sand and gravel have larger share of the US market in spite of the transportation factor. (Table 5.2)

This shows that some countries have felt that the US market is, or will be important and have therefore made efforts to overcome transportation handicaps and increase their imports to the US through other means such as a developed distribution network.

This general study of basic construction materials can only give an overview of the situation. It shows that the US does not represent a very important market for the construction materials studied and also does not show any specific trend in the trade between France and the US for imports/exports.

This study was limited by the level (4-digit) at which the trade of the materials was looked at. It therefore does not allow any specific assessment about favoring one type of product versus another type within one classification.

Table 5.1 Summary of the trade situation for France and the US

SIC Codes	273	661.2	673	673.1	673.2	673.3	674
France - exports/imports							
$	1.4	10.1	1.3	3.1	1.1	0.8	1.6
Tons	2.5	8.1	1.3	2.9	1.1	0.8	1.3
US - exports/imports							
$	0.6	0.07	0.07	0.02	0.13	0.04	0.06
Tons		0.02	0.03	0.005	0.08	0.02	0.04
% French exports to US/total exports							
$	0.6	6.1	15.4	14.1	8.7	13.0	11.7
Tons	0.03	7.2	12.1	10.7	6.4	12.9	9.2
% French imports into US/total US imports							
$	0.2	2.7	5.2	8.6	4.8	3.0	5.9
Tons	0.01	2.5	4.5	7.6	3.6	2.9	5.0

Source: 1&2

Table 5.2 Level of imports into the US from various countries (% of total imports)

SIC Codes	273	661.2	673	673.1	673.2	673.3	674
Canada							
$	77.0	37.5	18.0	21.4	21.1	13.1	8.7
Tons	64.5	33.1	18.0	23.0	21.3	12.7	9.4
Mexico							
$	17.0	21.7					
tons	14.0	22.5					
Spain							
$	9.0	17.7	8.4	6.4	9.0	9.5	
Tons	6.5	19.8	10.1	8.4	9.3	11.8	
Italy							
$	0.8						
Tons	0.4						
Germany							
$							9.7
Tons							9.0
Japan							
$		2.2	27.0	27.5	19.6	33.0	35.5
tons		2...0	24.0	21.2	14.9	31.9	29.6
Brazil							
$			5.1				3.4
Tons			6.3				5.0
UK							
$			6.4	2.8	10.0	6.1	
Tons			5.0	2.6	7.9	4.7	
France							
$	0.2	2.7	5.2	8.6	4.8	3.0	5.9
Tons	0.01	2.5	4.5	7.6	3.6	2.9	5.0

Source: 1 &2

Note: the numbers not mentionned are to small to be considered

Chapter 6: Conclusions

6.1 Summary of the French construction industry

France has a long history of construction, being actively involved in this field since the mid nineteenth century. They have benefited from a long experience and a structured training that gave a technological edge in the early twentieth century. The situation has evolved since then, but today the French construction industry remains very active. It represents up to 7% of the GNP and many French firms are very competitive at the international level.

The structure of the French construction firms follows the model of the construction industry in general with the majority of the companies very small (less than 20 employees). This is due to the fact that a wide range of construction activity is related to trade jobs that have not been standardized or automated and are labor intensive.

The mode of operation of the industry in France varies somewhat from that in the US, both at an organizational level as subcontracting is not as popular in France and at the labor force level as it is not divided among various trade unions but rather belongs to various labor unions that operate at a national and inter-industry level.

France's involvement internationally is characterized by the importance of the African market, explained by its previous colonial relation with many of the African countries. Other important markets are Latin America, Asia and most recently the North American market in which the major construction firms as well as construction material manufacturers are trying to establish themselves. This American move was precipitated by the slowdown of the previously prosperous Middle East market and the increasing international competition that followed. For many, the American market is viewed as the most stable as well as one of the largest. Therefore various ways of penetration have been used, the most common being through acquisition of American firms.

6.2 Conclusions

The international activity of the French construction industry is nothing recent as France has had a long historical tradition in this area. The construction activity is based a great deal on engineering capability that French firms have connected with both civil and military jobs.
It is important for France to maintain its involvement in the international market. The domestic construction market is not large enough to satisfy the output of the many firms. The international construction market not only represents a larger demand but also provides for challenging projects needed for the industry to maintain its technological advance.
Also, the international market is needed to develop and implement the broad base of construction knowledge used in the domestic market that eventually reaches a saturation level (such as nuclear power plants or hydro-electric plants).
Most recent efforts of the French construction industry to develop internationally have focused on the North American market. It is particularly interesting to notice that the European market does not appear to be where expansion is pushed aggressively as most of the countries possess their own construction industry, and have a relatively modest market.
The strategies used by French construction firms to develop their international market vary from direct work in a foreign country to establishment of a subsidiary or even acquisition of companies in the country where they are interested in developing their activities. The latter strategy can be considered to be typical of European construction firms as American and Japanese construction firms essentially develop their market through the establishment of branches and subsidiaries in various countries.
The presence of French constractors in foreign countries could also be used in a future step to develop the export of different construction materials by promoting and extending French trade relative to those materials.

6.3 Future studies

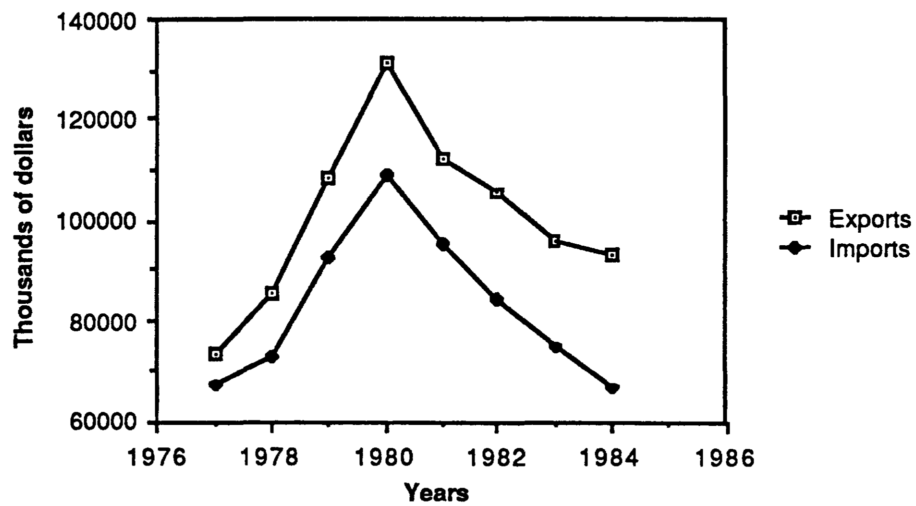
This thesis is only a general overview of the French construction activity which does not attempt to go into great details. There are many areas that would be interesting to develop further. For example, the structure and organization of the largest French construction firms and their expansion strategies could be studied, as many of them are diversifying themselves in non-construction related activities.

Appendix 1: Trade statistics between France and the US

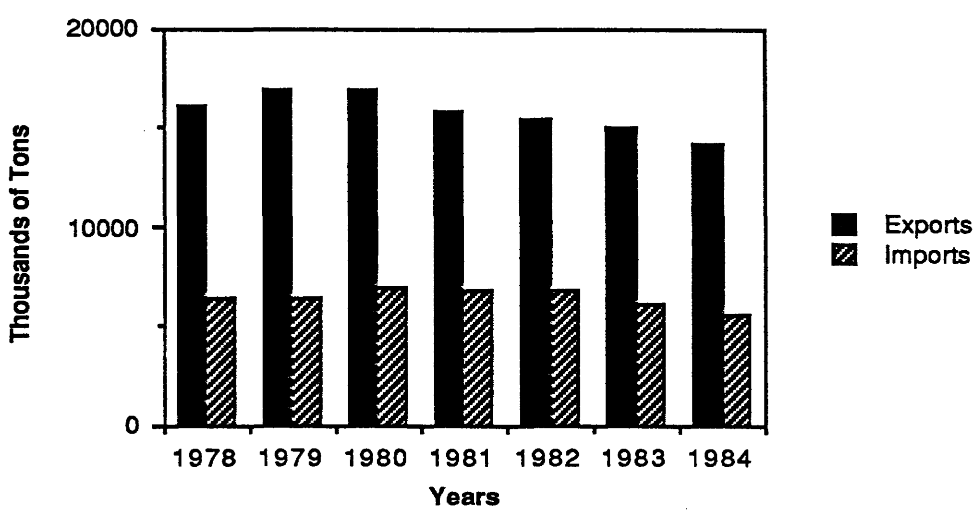
	273	661.2	673	673.1	673.2	673.3	674
France							
Imports and exports in $	p.146	p.151	p.154	p.160	p.166	p.172	p.177
Imports and exports in tons	p.146	p.151	p.154	p.160	p.166	p.172	p.177
Trade with the US in $	p.147	p.151	p.155	p.161	p.167	p.173	p.178
Trade with the US in tons	p.147	p.151	p.155	p.161	p.167	p.173	p.178
US							
Imports and exports in $	p.148	p.152	p.156	p.162	p.168	p.174	p.179
Imports and exports in tons	n/a	p.152	p.156	p.162	p.168	p.174	p.179
Trade with France in $	p.148	p.152	p.157	p.163	p.169	p.175	p.180
Trade with France in tons	n/a	p.152	p.157	p.163	p.169	p.175	p.180
Major countries importing to the US							
Value of imports	p.149	p.153	p.158	p.164	p.170	p.176	p.181
Volume of imports	p.150	p.154	p.159	p.165	p.171	p.176	p.182

273 - Stone, sand and gravel

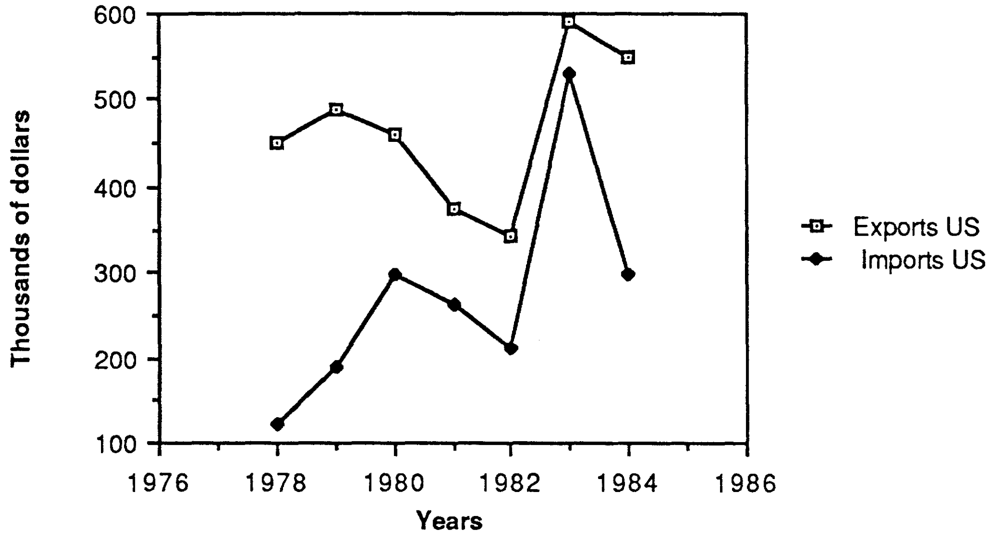
France - Imports and exports in thousands of dollars



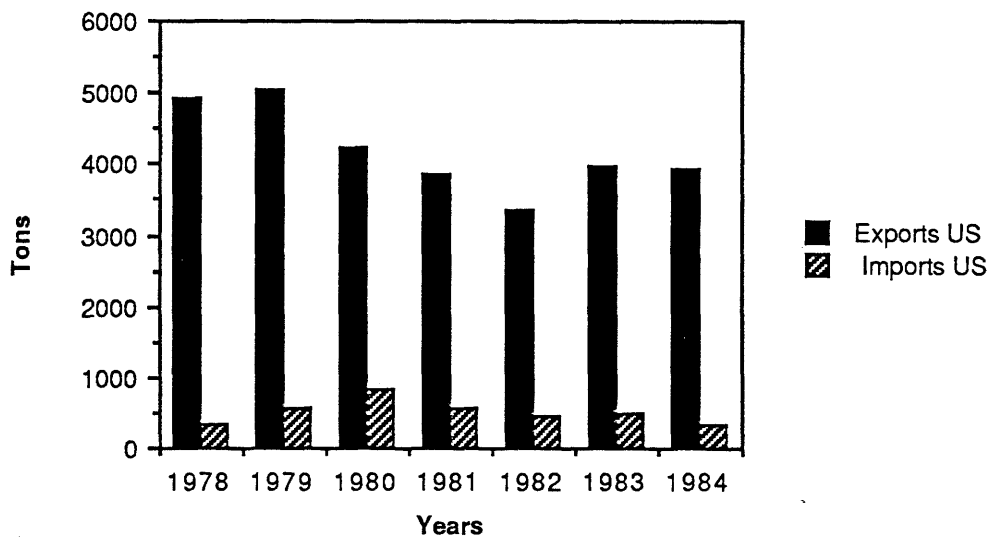
Imports and exports in thousands of tons (metric)



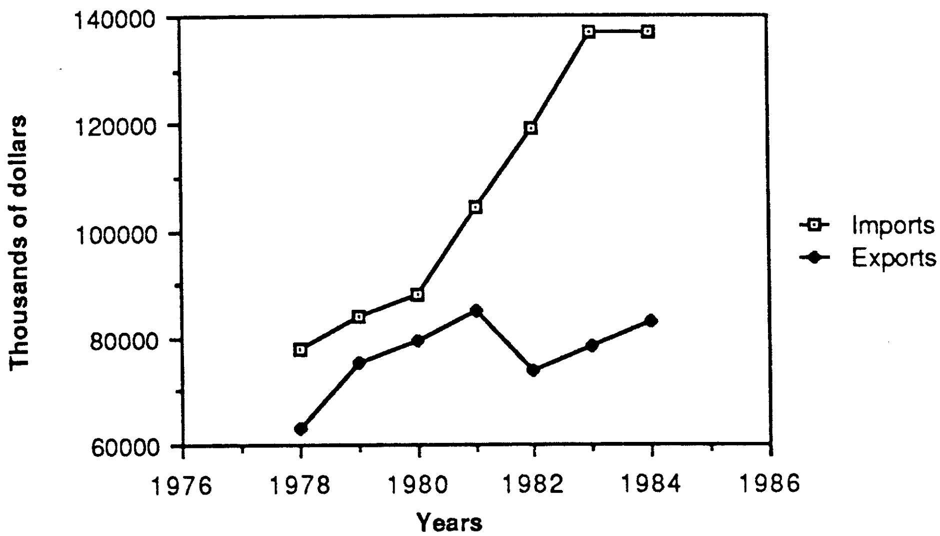
Trade with the US in thousands of dollars



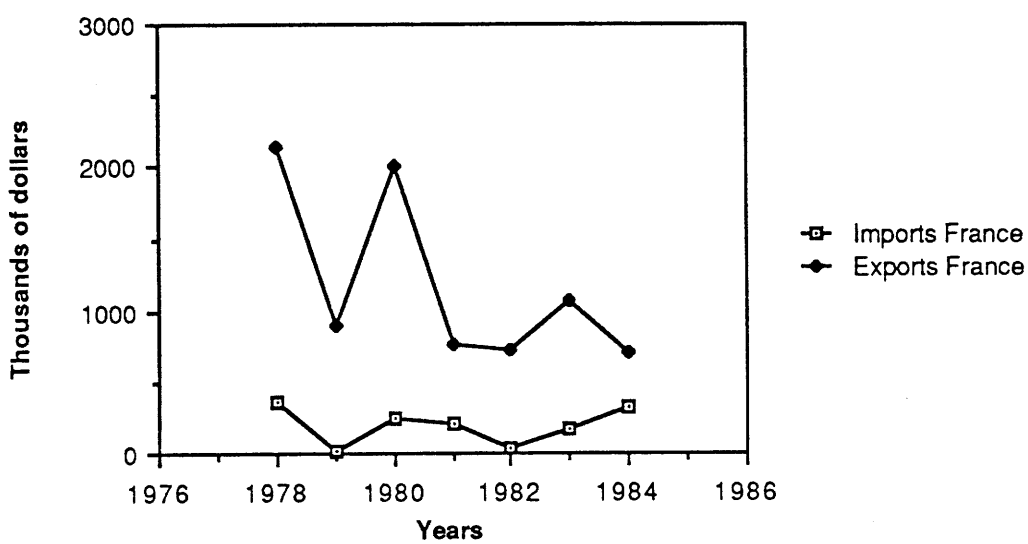
Trade with the US in tons (metric)



US - Imports and exports in thousands of dollars

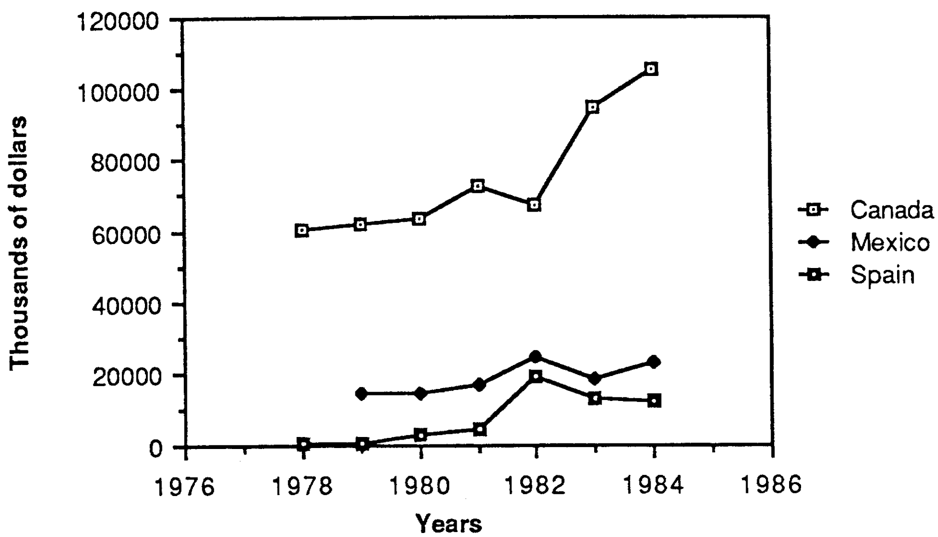


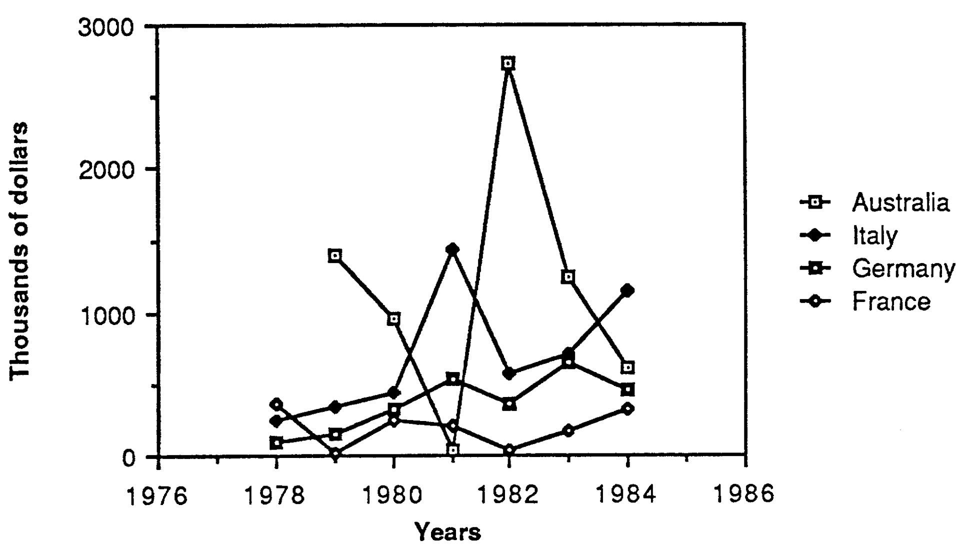
Trade with France in thousands of dollars



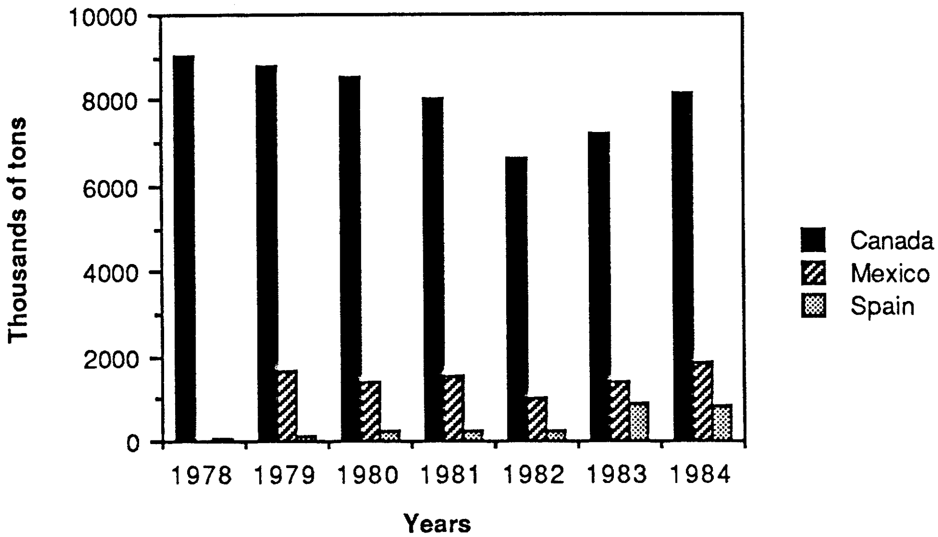
Major countries importing to the US

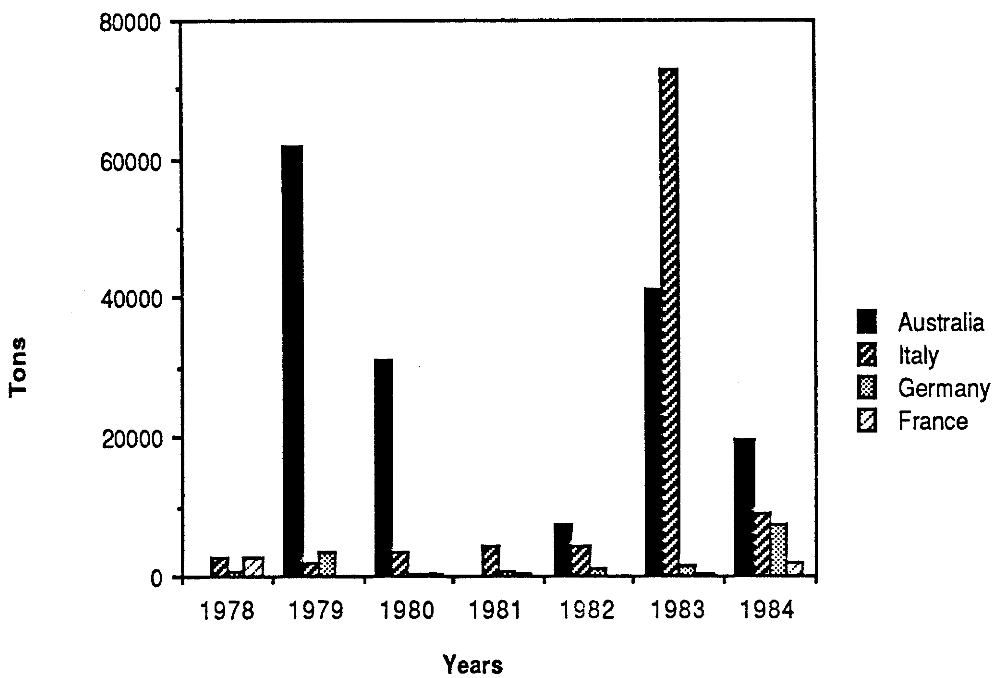
Value of imports in thousands of dollars





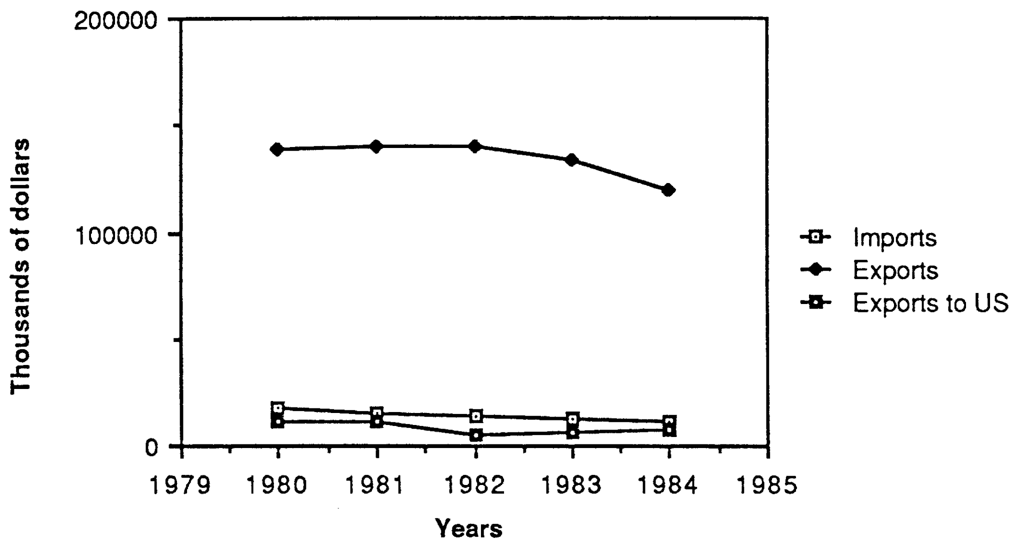
Volume of imports



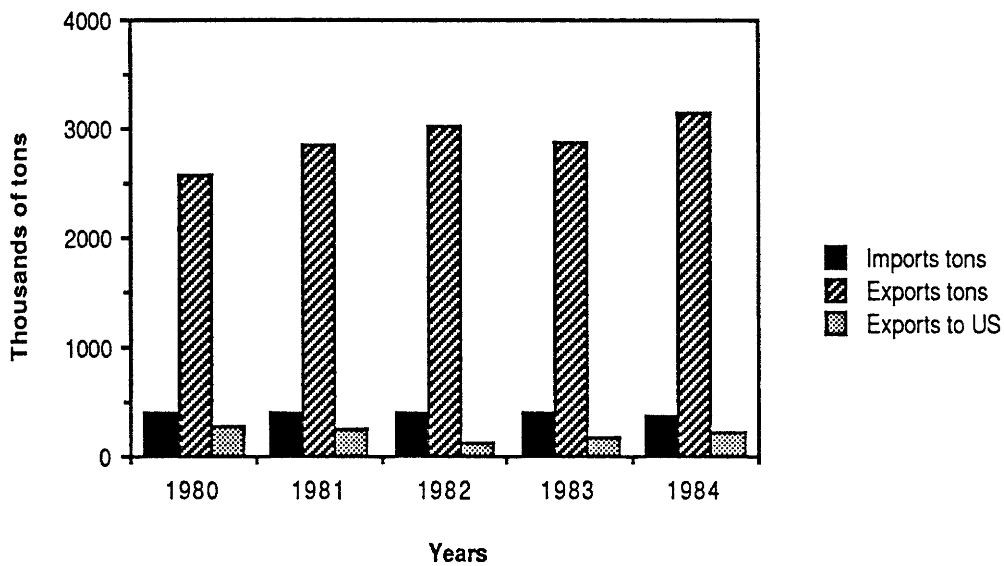


661.2 Cement

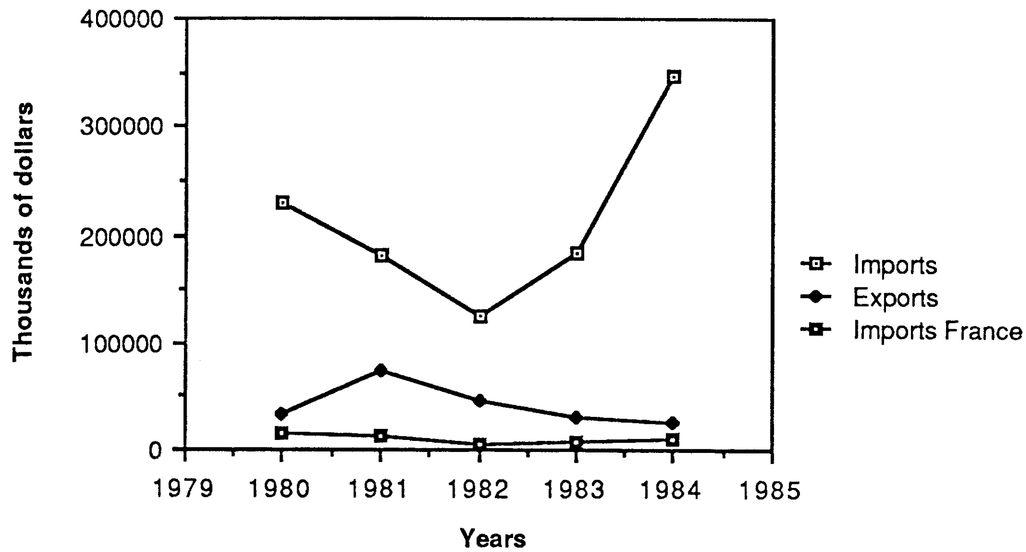
France - Imports and exports in thousands of dollars



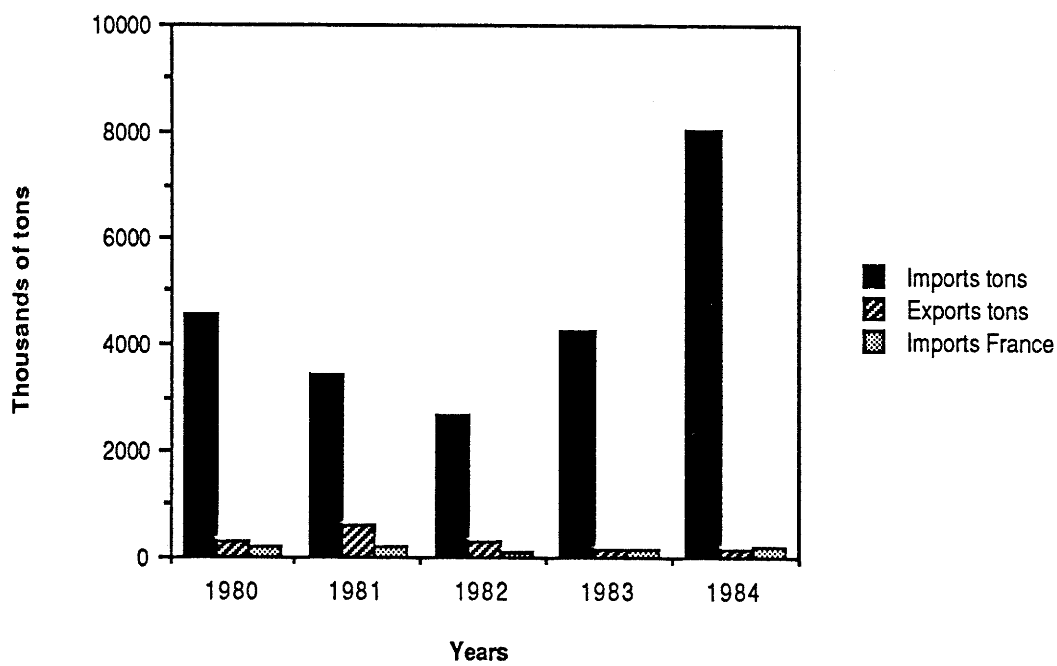
Imports and exports in thousands of tons (metric)



US - Imports and exports in thousands of dollars

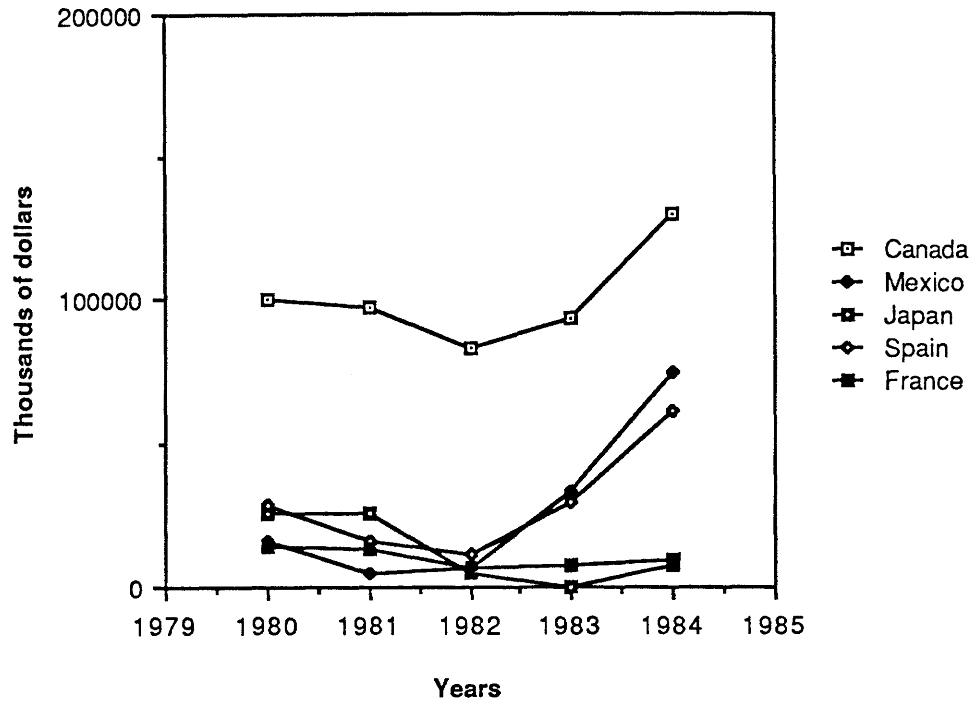


Imports and exports in thousands of tons (metric)

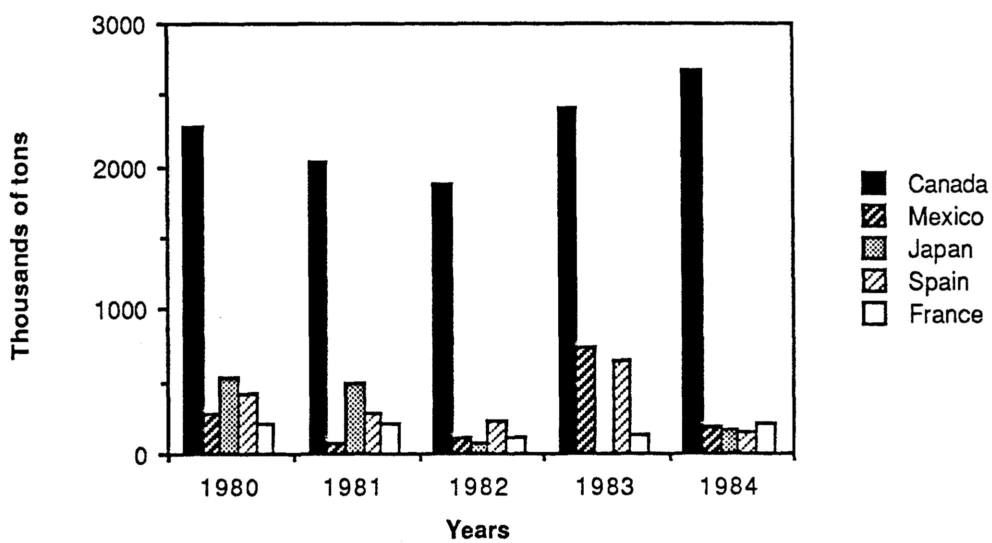


Major countries importing to the US

Value of imports

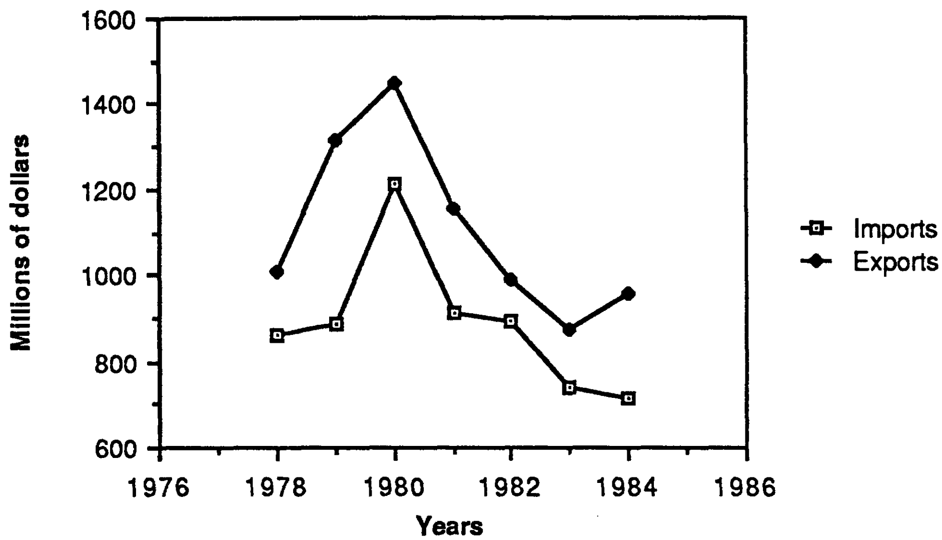


Volume of imports

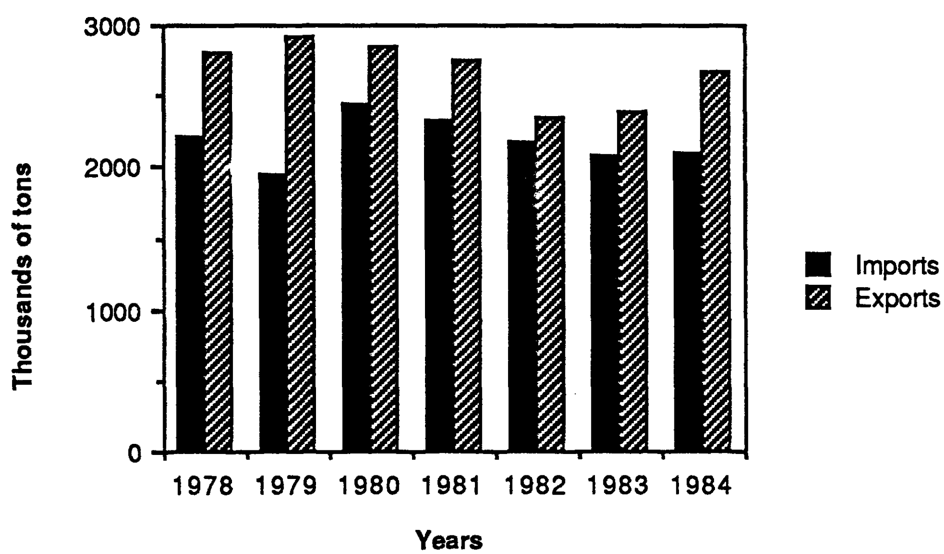


673 - Iron and steel bars, rods, angles, shapes and section

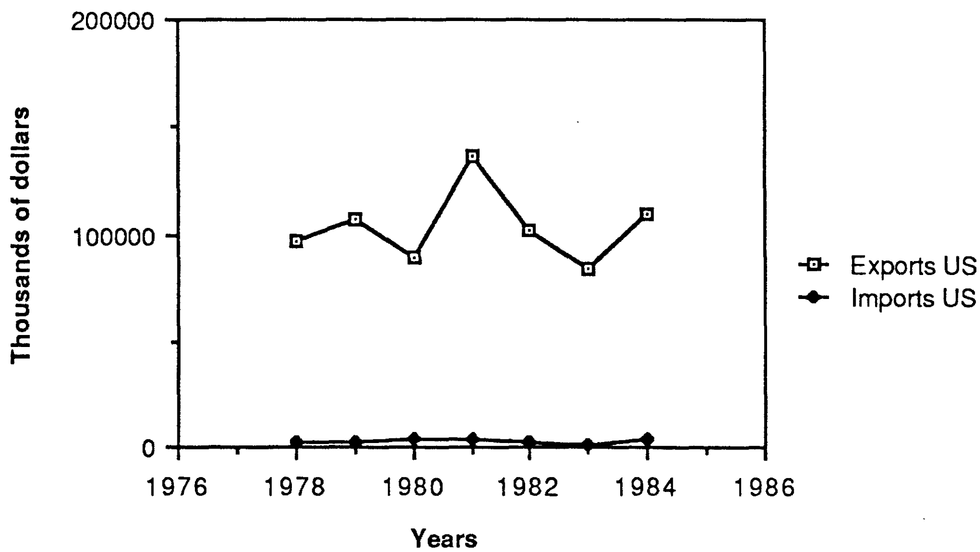
France - Imports and exports in millions of dollars



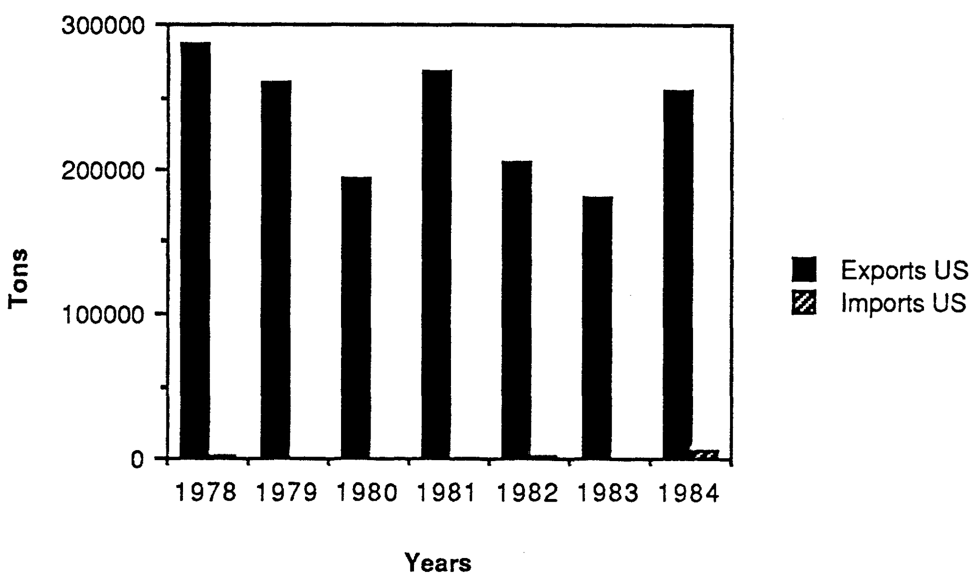
Imports and exports in thousands of tons (metric)



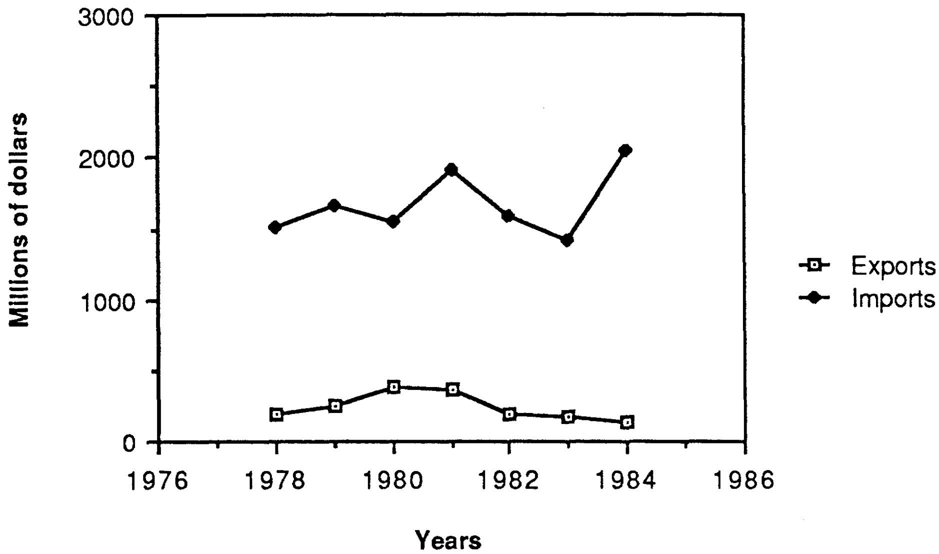
Trade with US in thousands of dollars



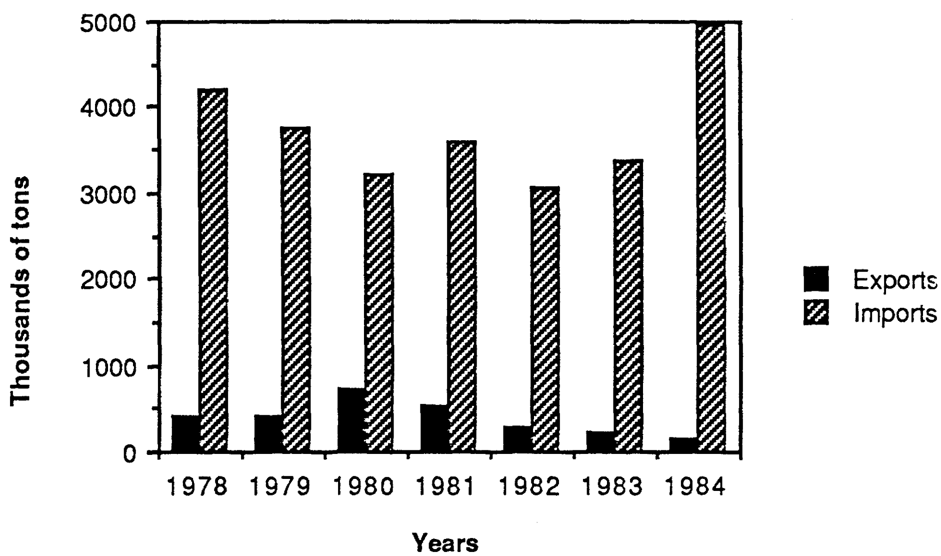
Trade with US in tons (metric)



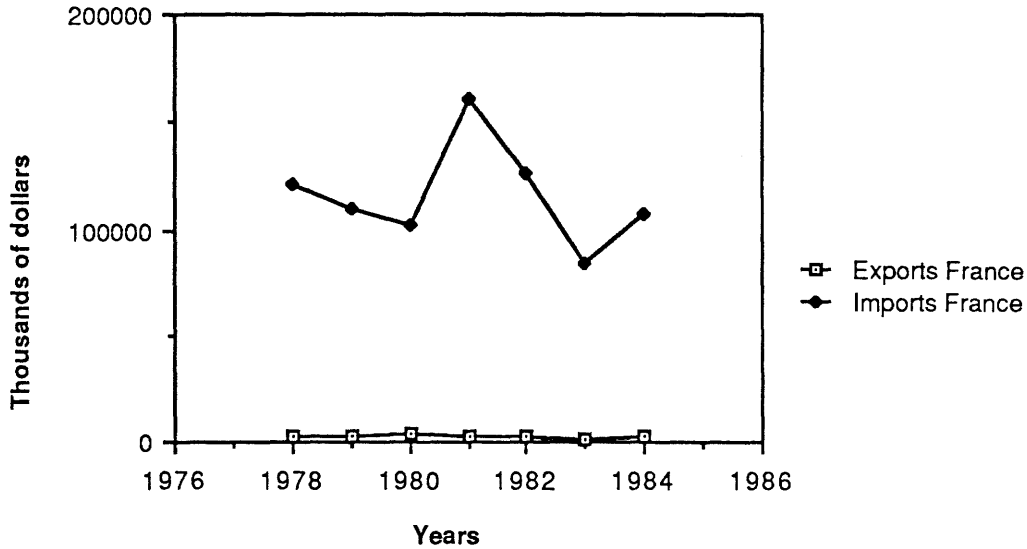
US - Imports and exports in millions of dollars



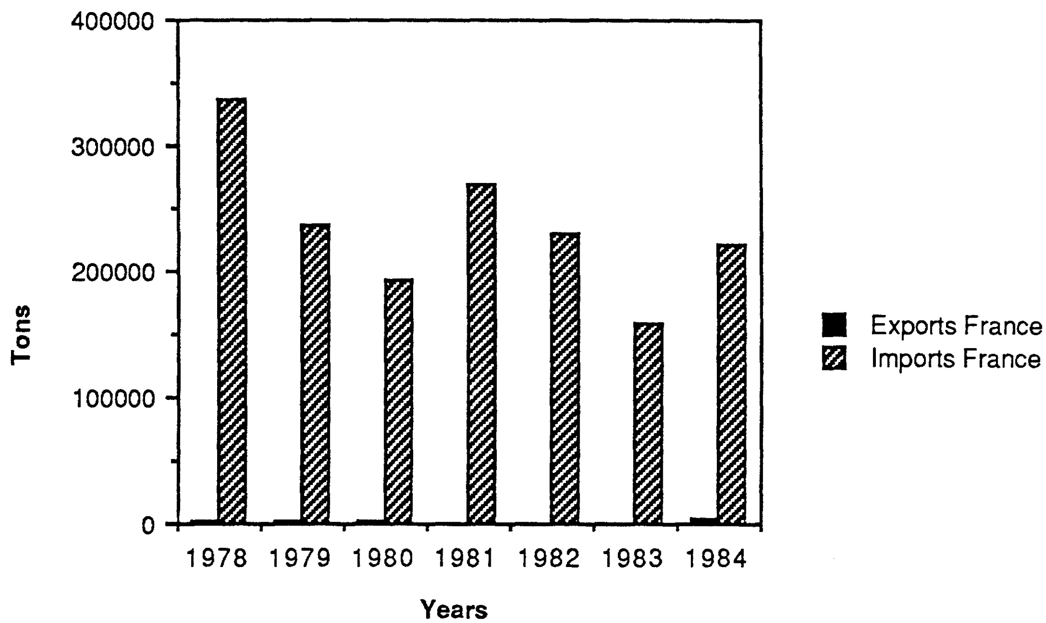
Imports and exports in thousands of tons (metric)



Trade with France in thousands of dollars

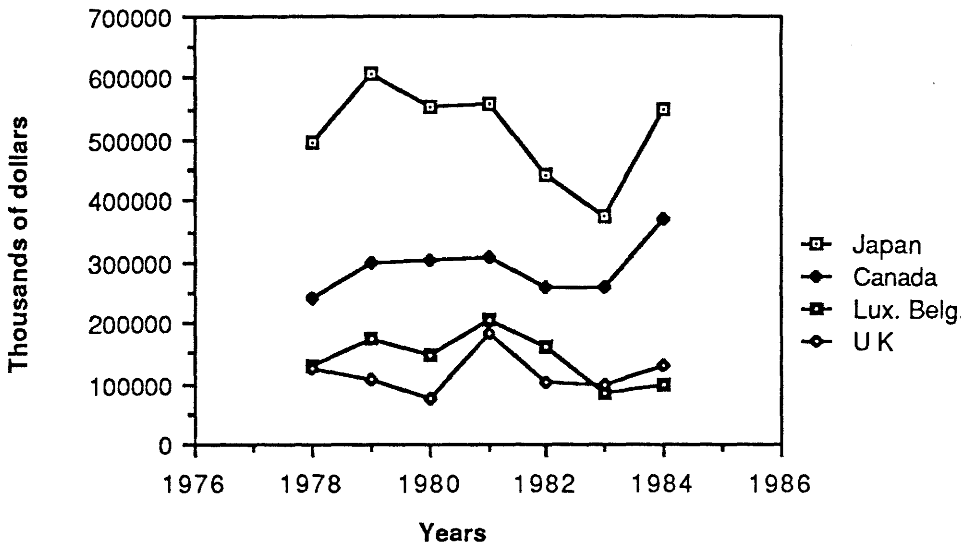


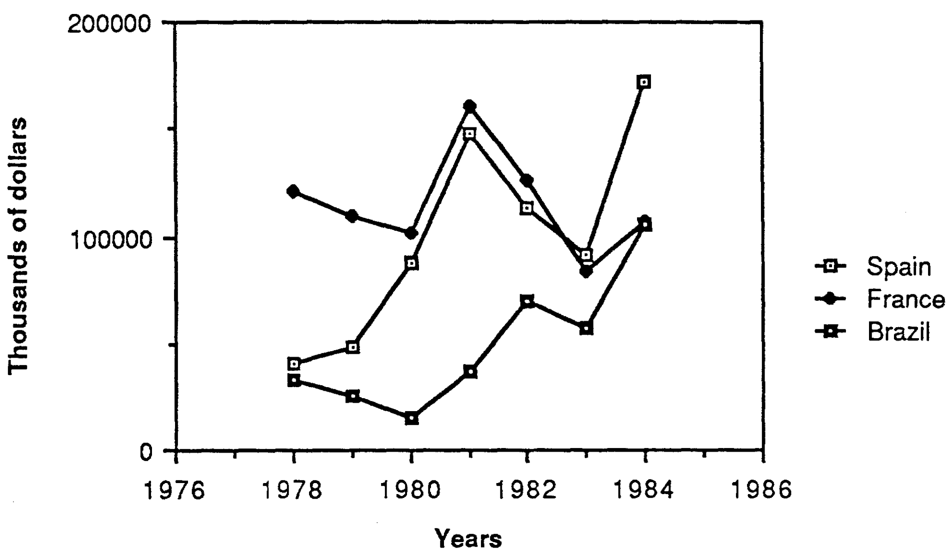
Trade with France in tons (metric)



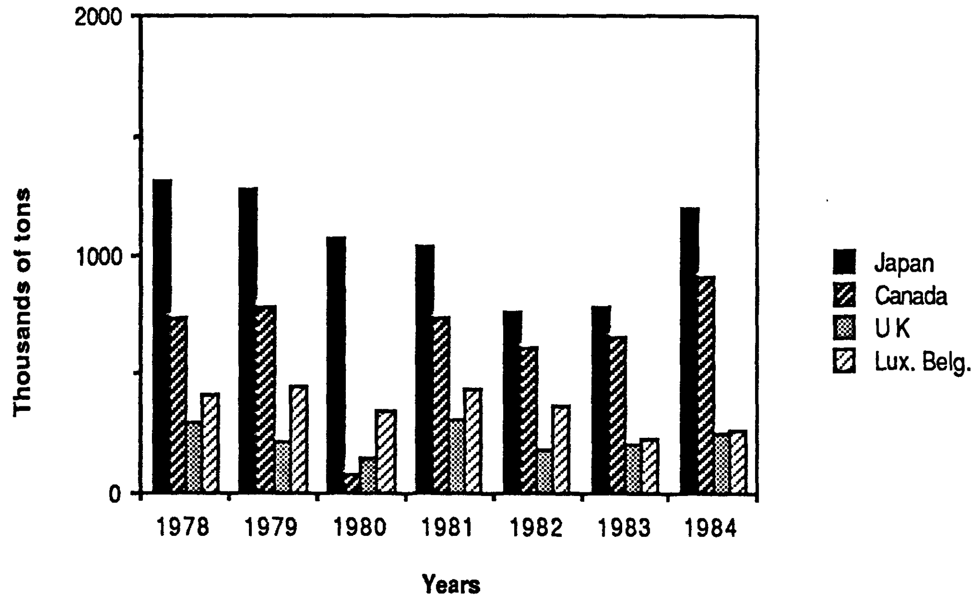
Major countries importing to the US

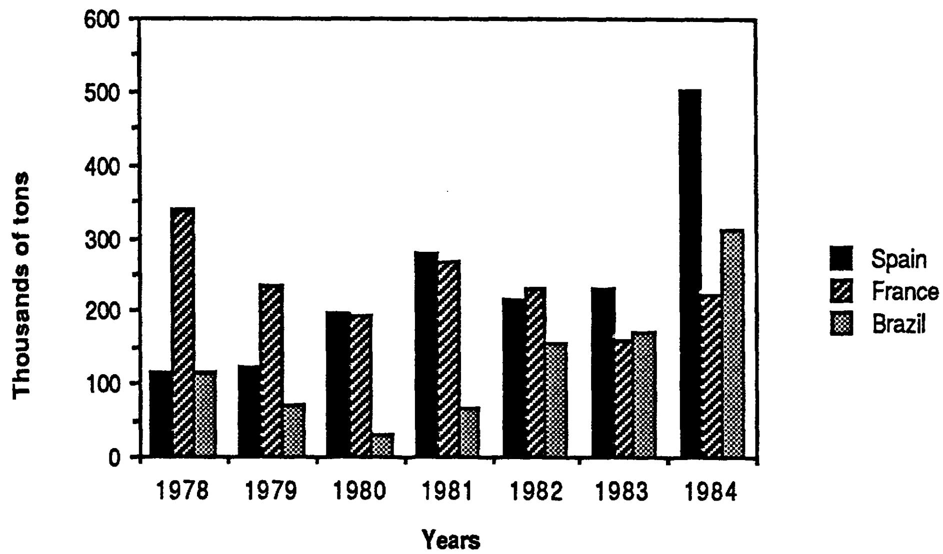
Value of imports in thousands of dollars





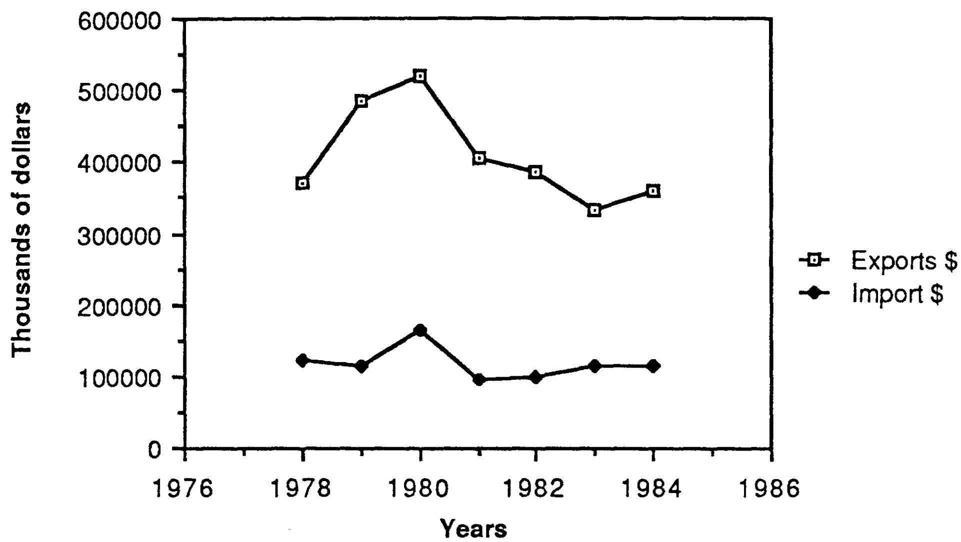
Volume of imports in thousands of tons



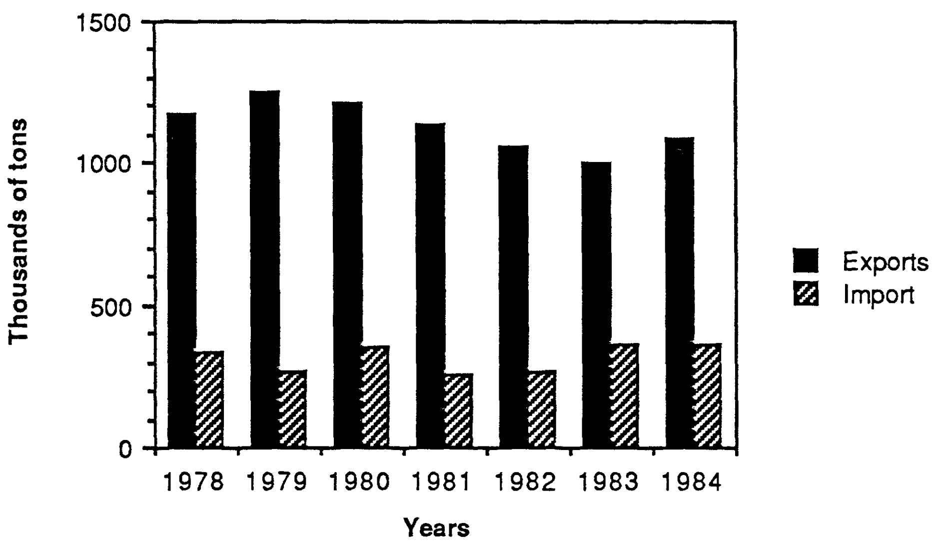


673.1 - Wire rod of iron or steel

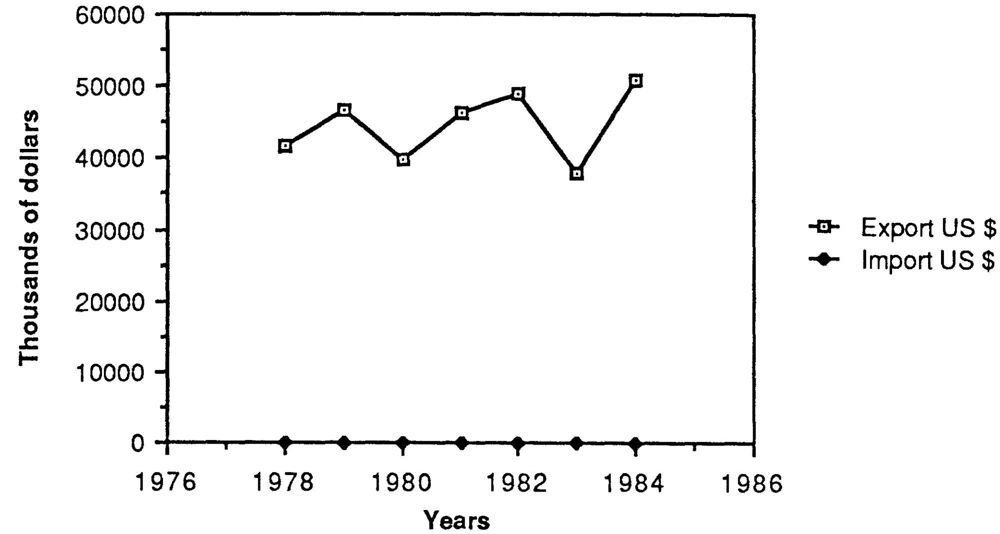
France - Imports and exports in thousands of dollars



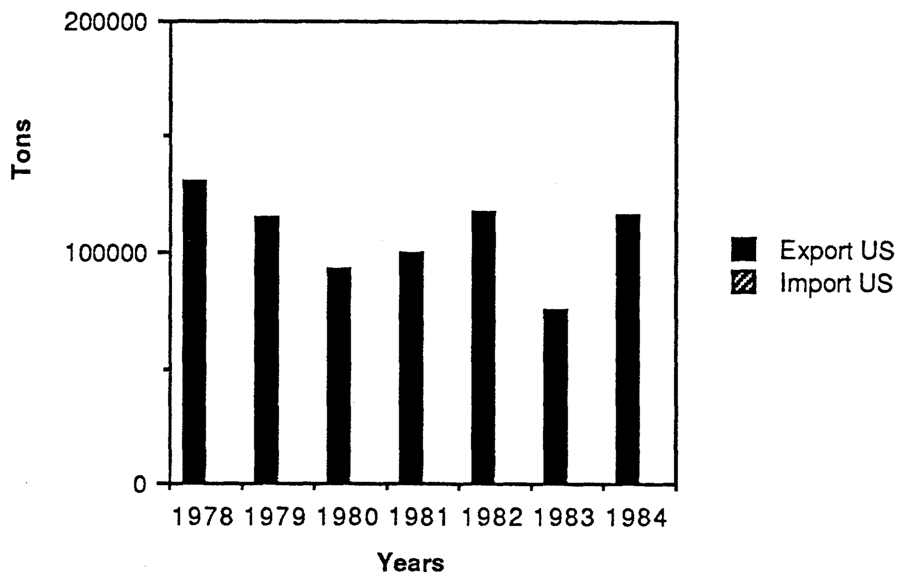
Imports and exports in tons (metric)



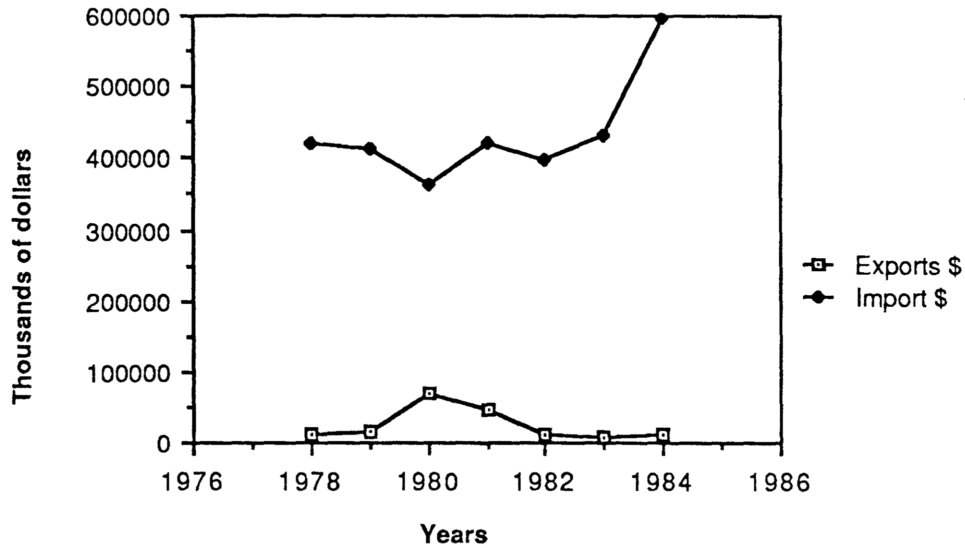
Trade with the US in thousands of dollars



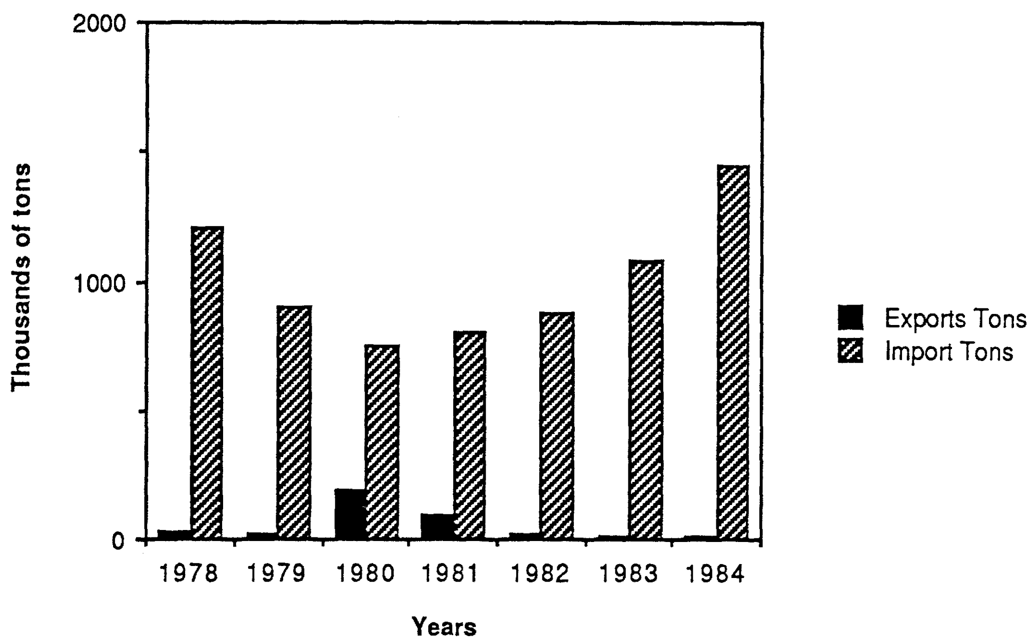
Trade with the US in tons (metric)



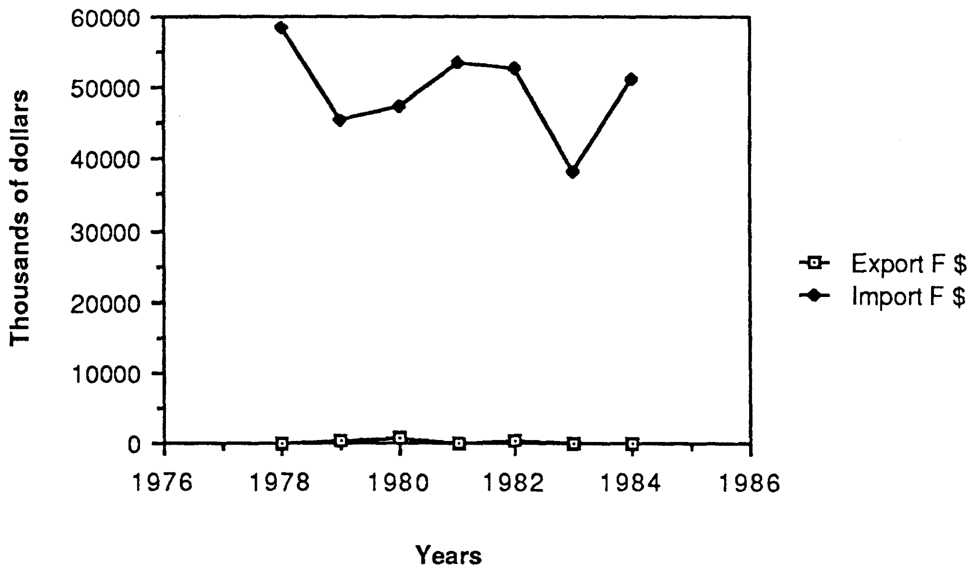
US - Imports and exports in thousands of dollars



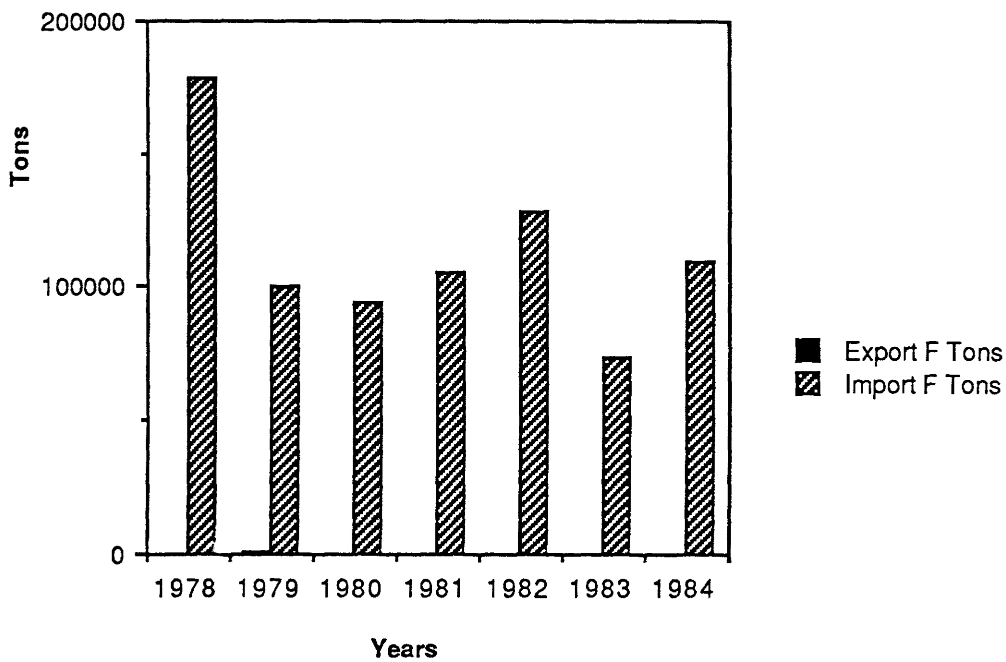
Imports and exports in thousands of tons (metric)



Trade with France in thousands of dollars

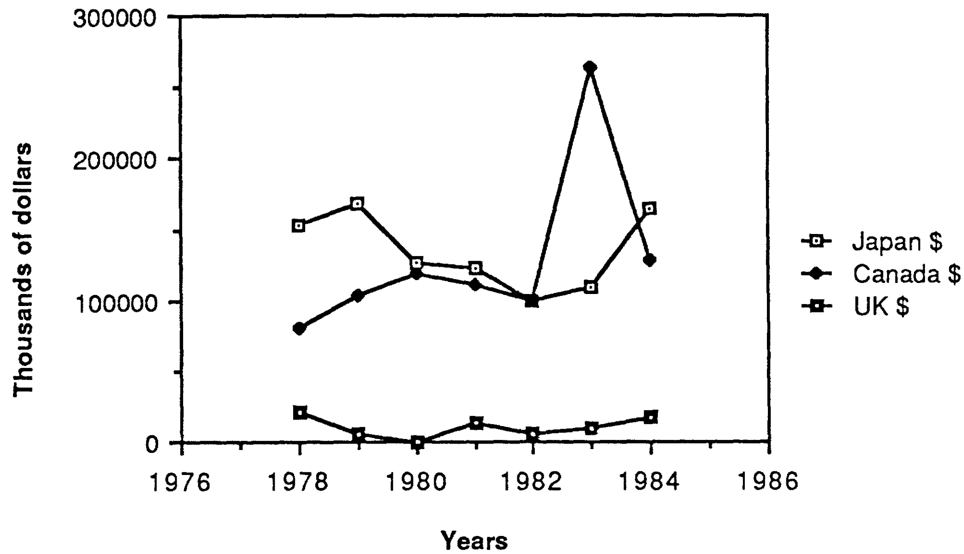


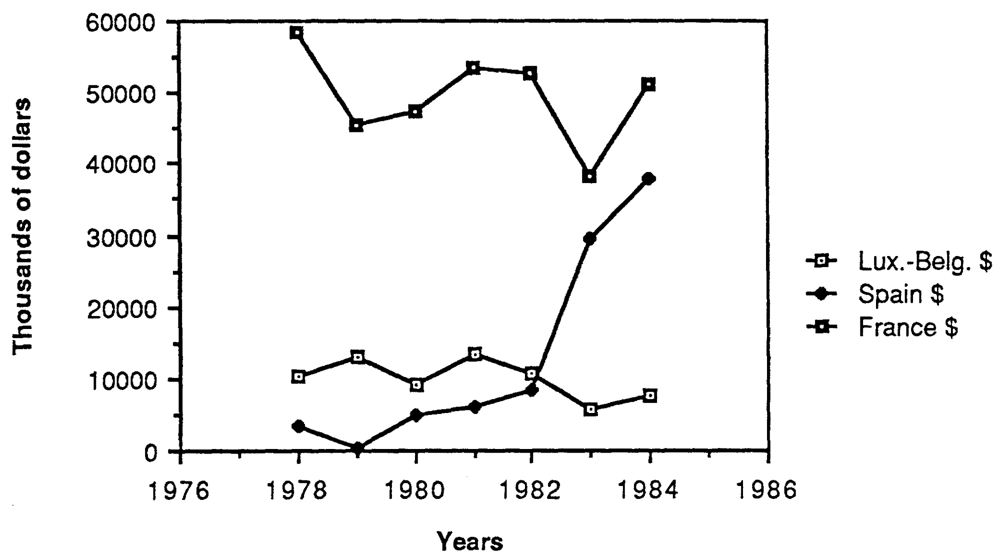
Trade with France in tons (metric)



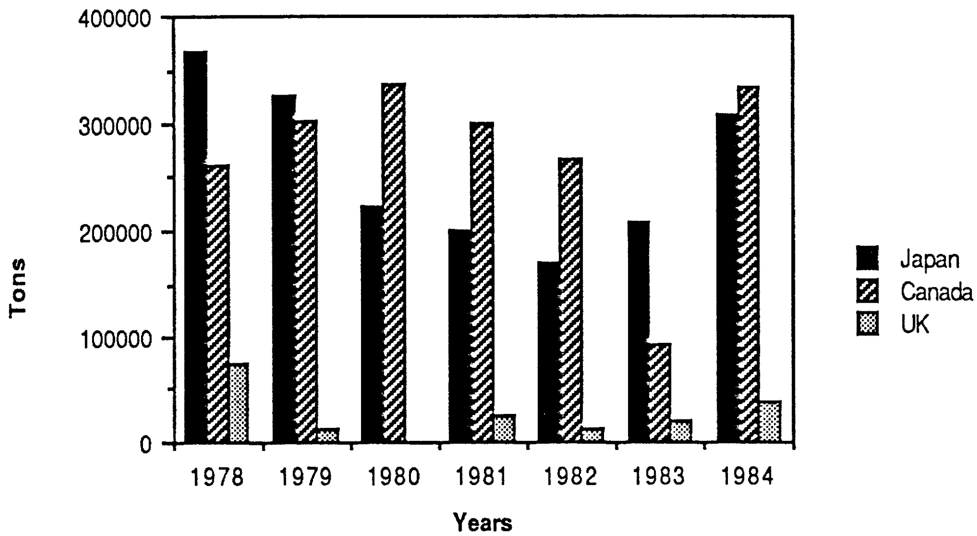
Major countries importing to the US

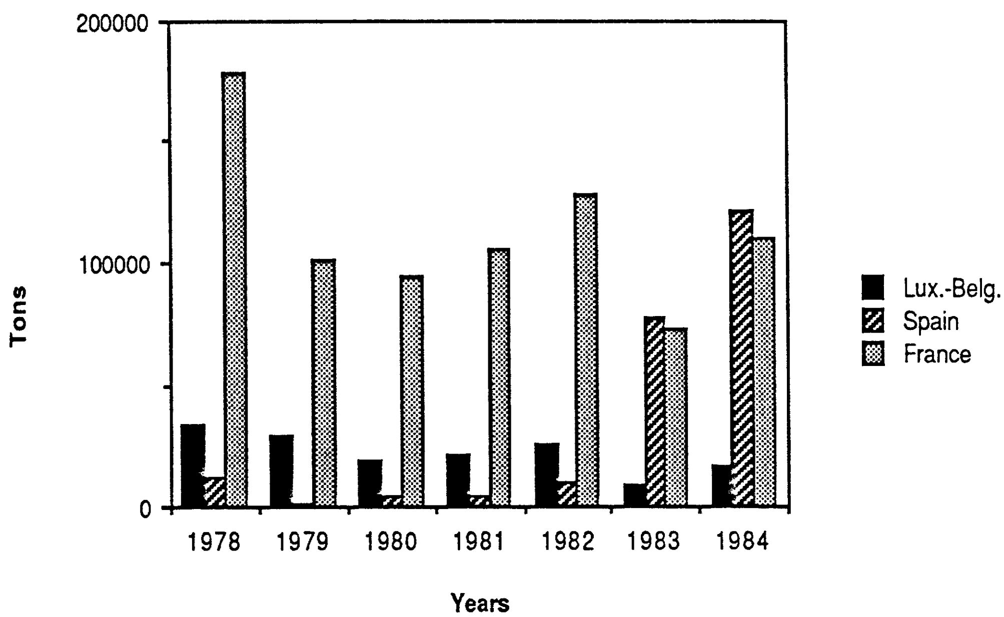
Value of imports in thousands of dollars





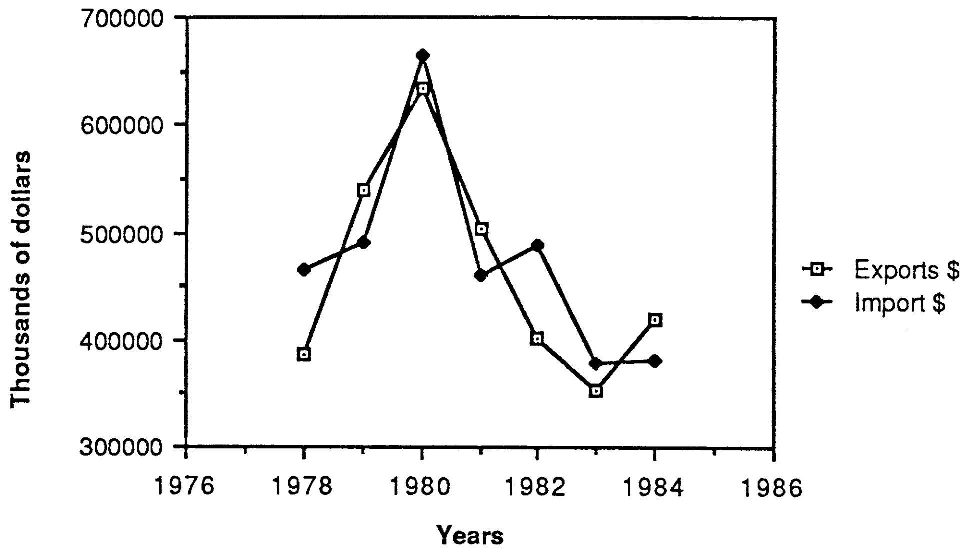
Volume of imports



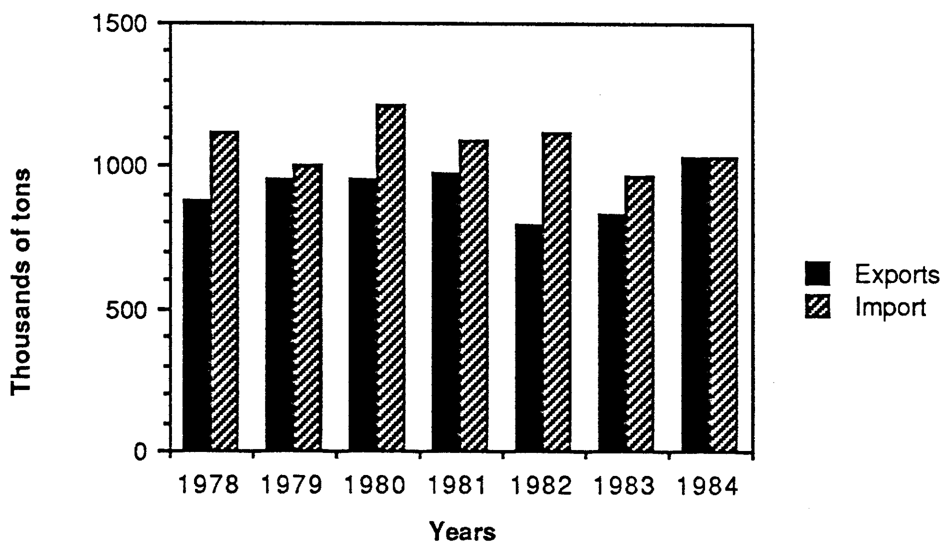


673.2 - Bars and rods (excluding wire rod), of iron or steel; hollow mining drill steel

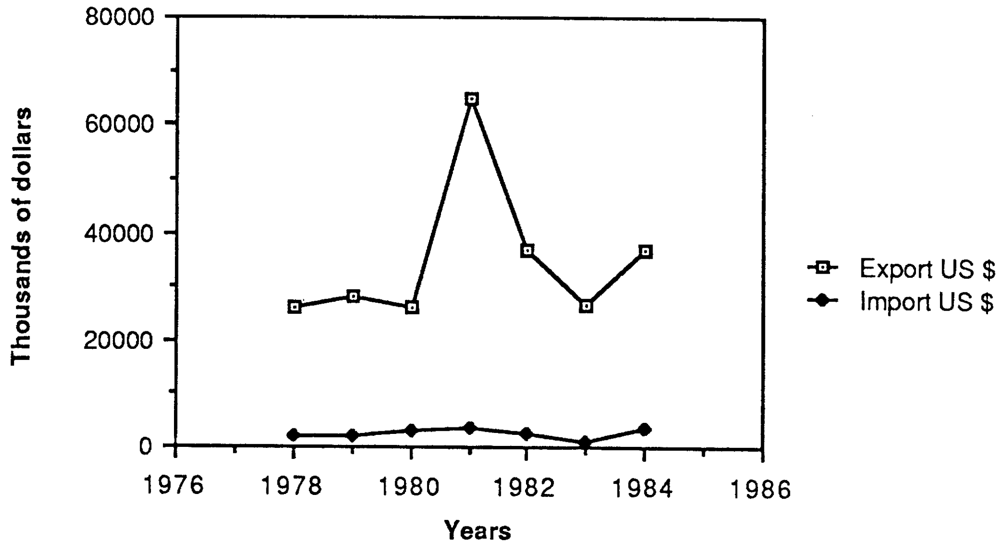
France - Imports and exports in thousands of dollars



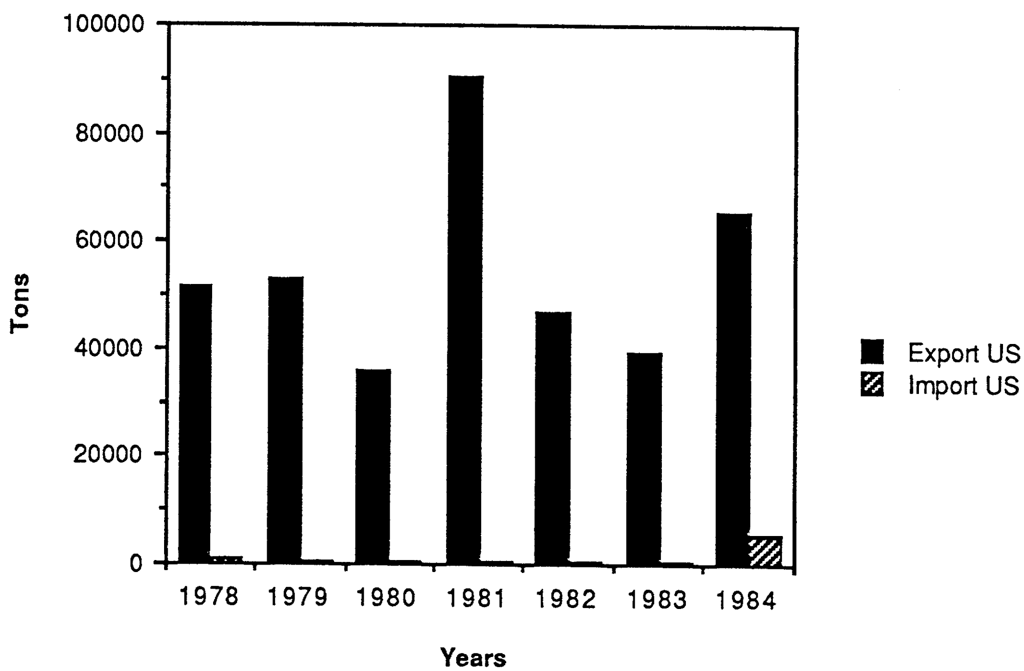
Imports and exports in thousands of tons (metric)



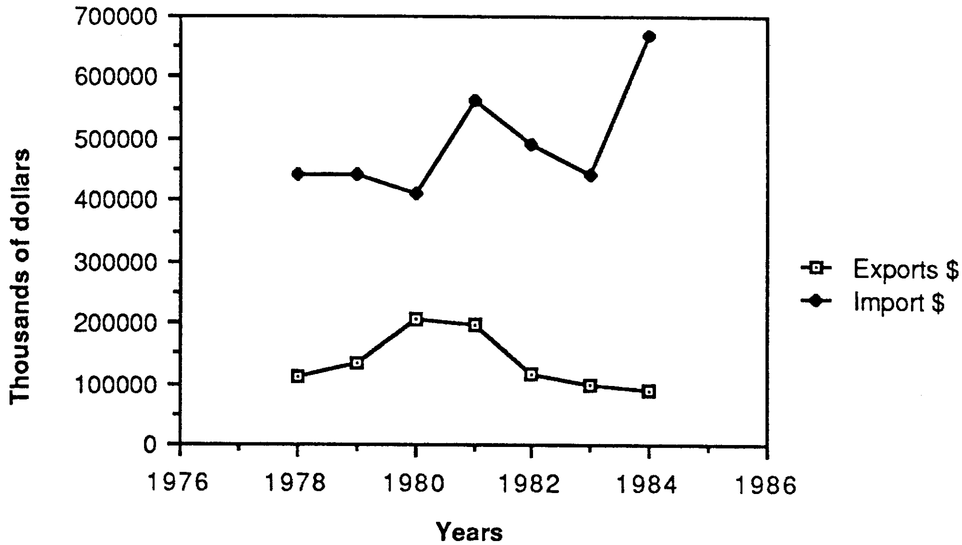
Trade with the US in thousands of dollars



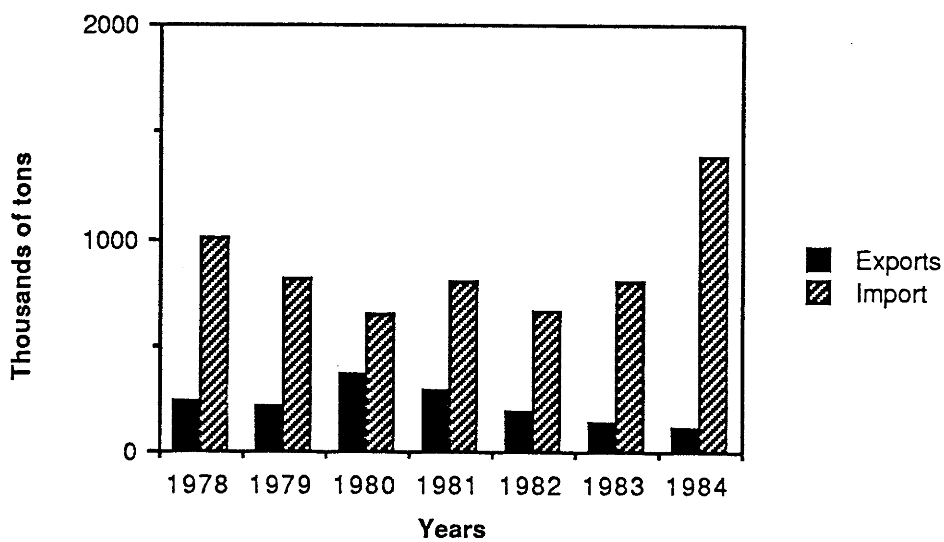
Trade with the US in tons (metric)



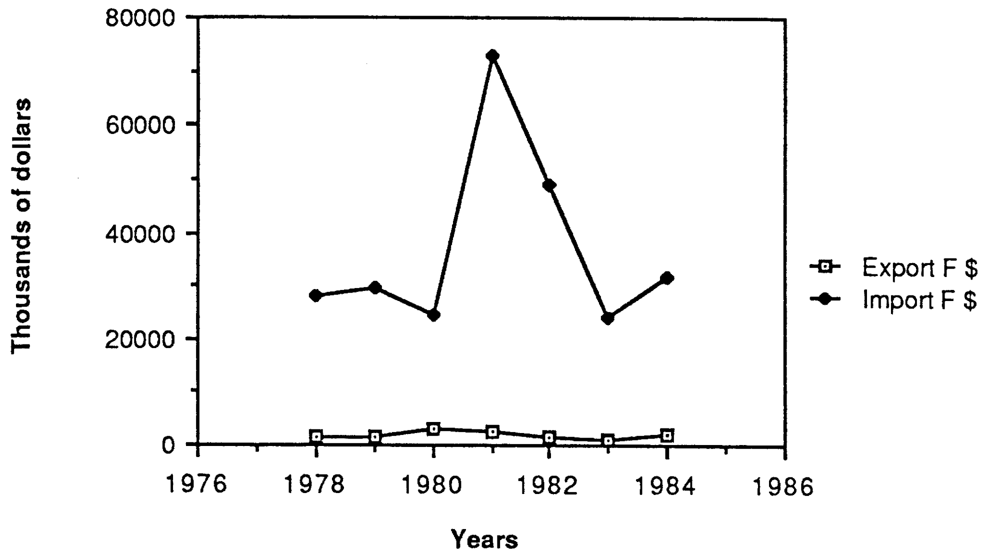
US - Imports and exports in thousands of dollars



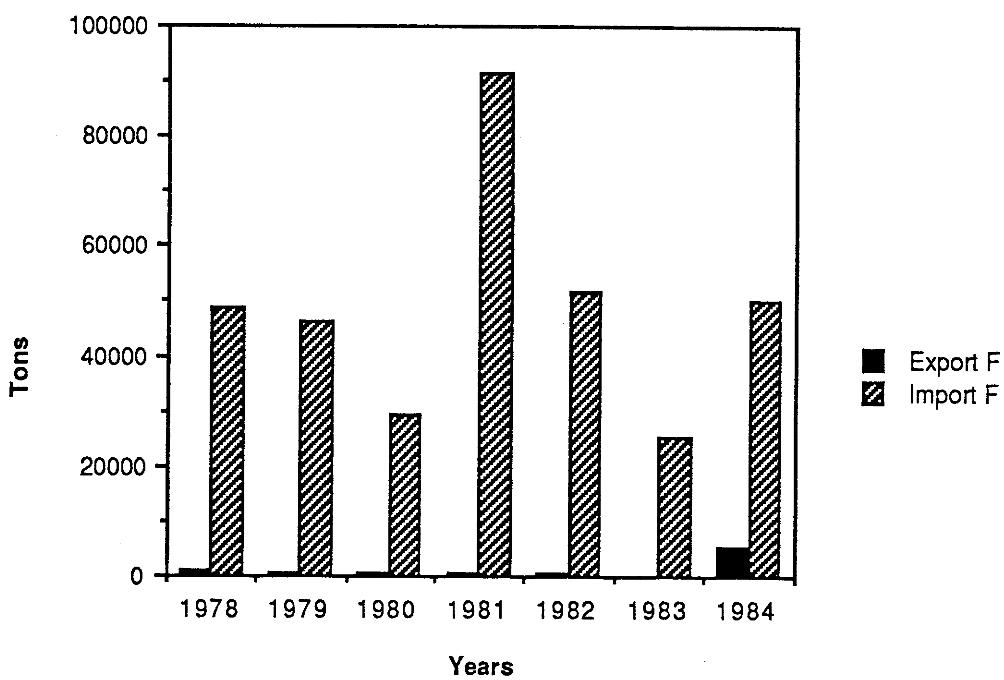
Imports and exports in thousands of tons (metric)



Trade with France in thousands of dollars

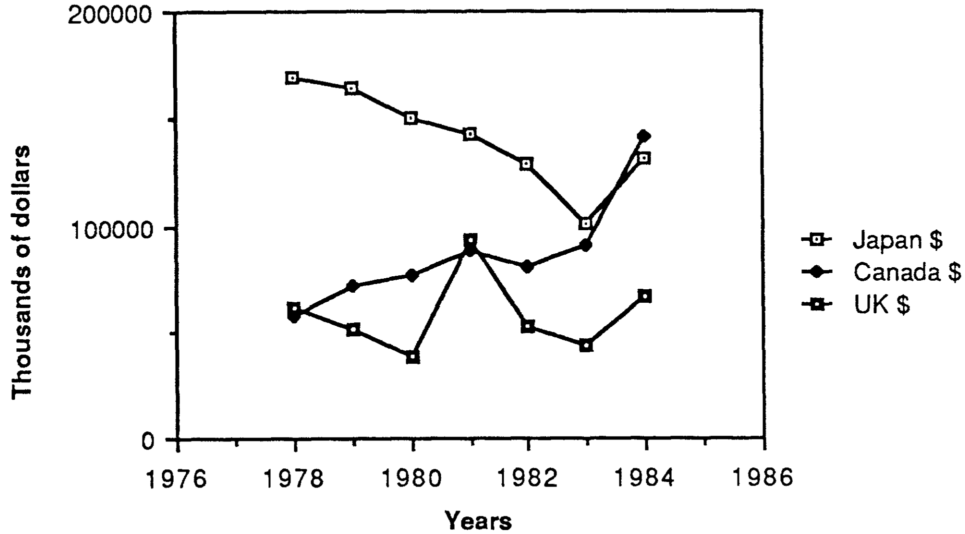


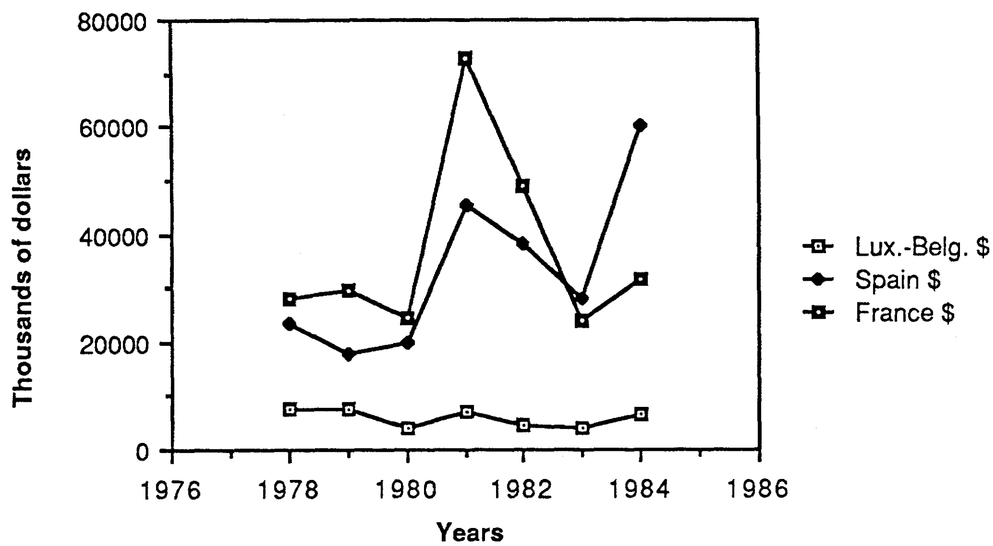
Trade with France in tons (metric)



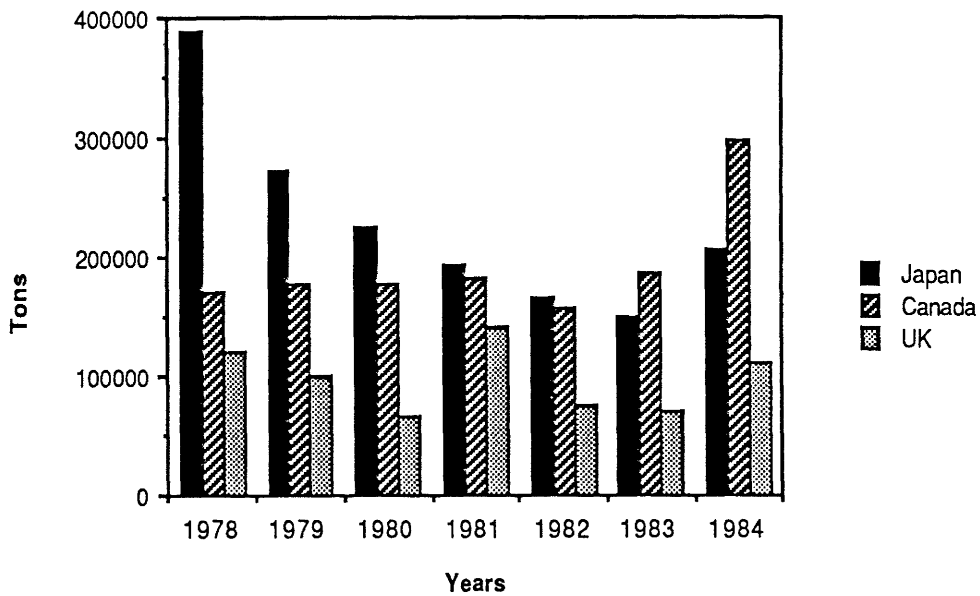
Major countries importing to the US

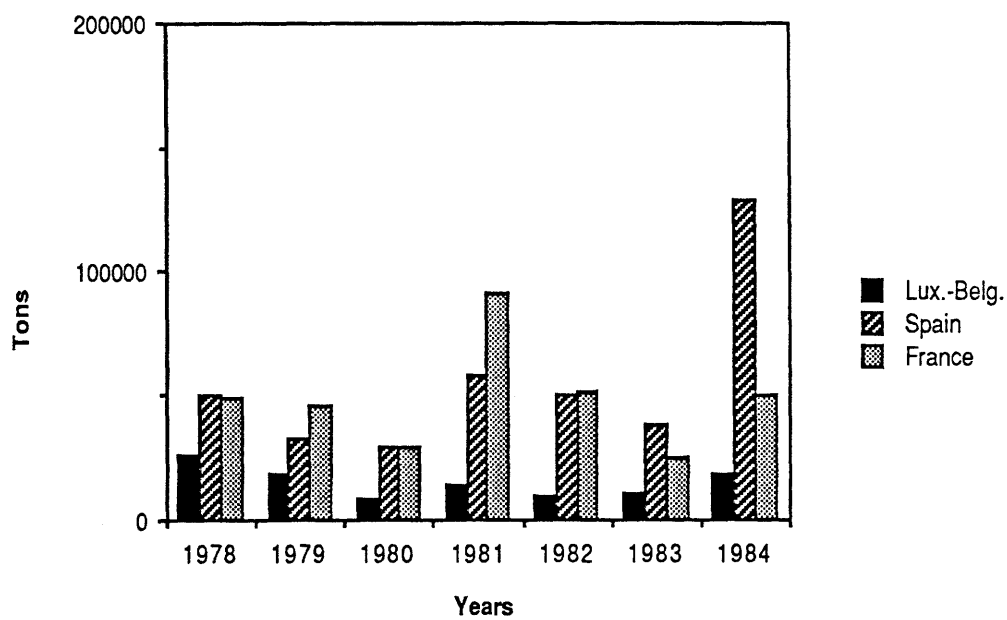
Value of imports





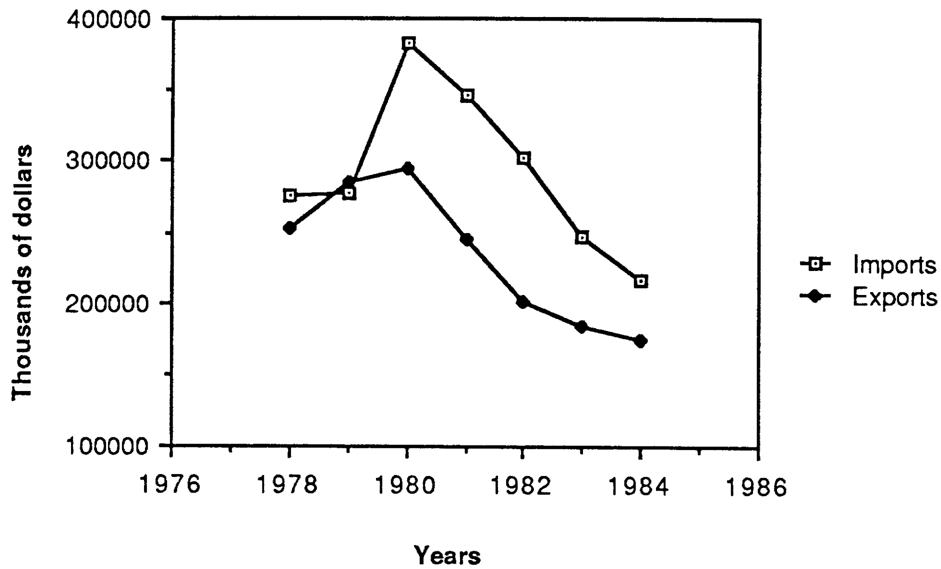
Volume of imports



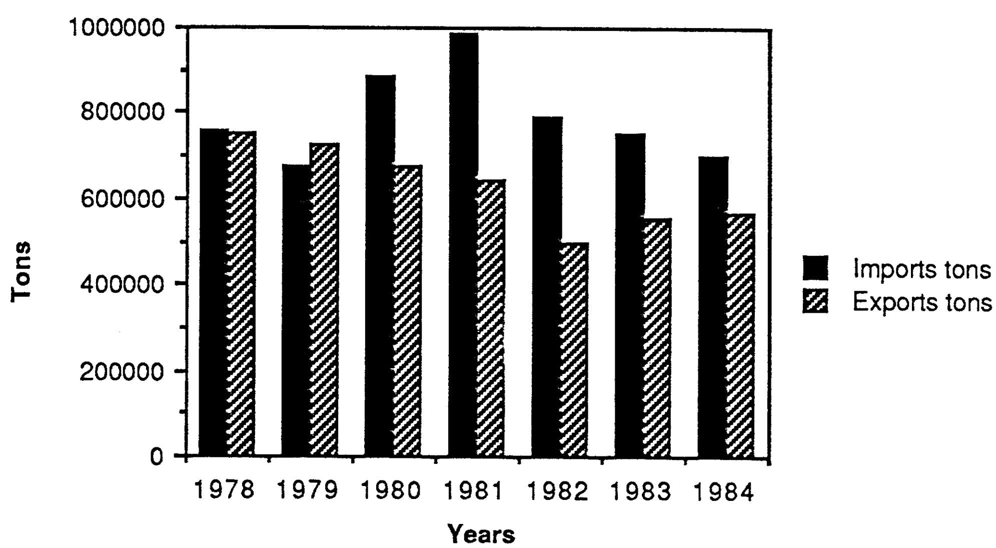


673.3 Angles, shapes and sections (excluding rails) and sheet piling, of iron or steel

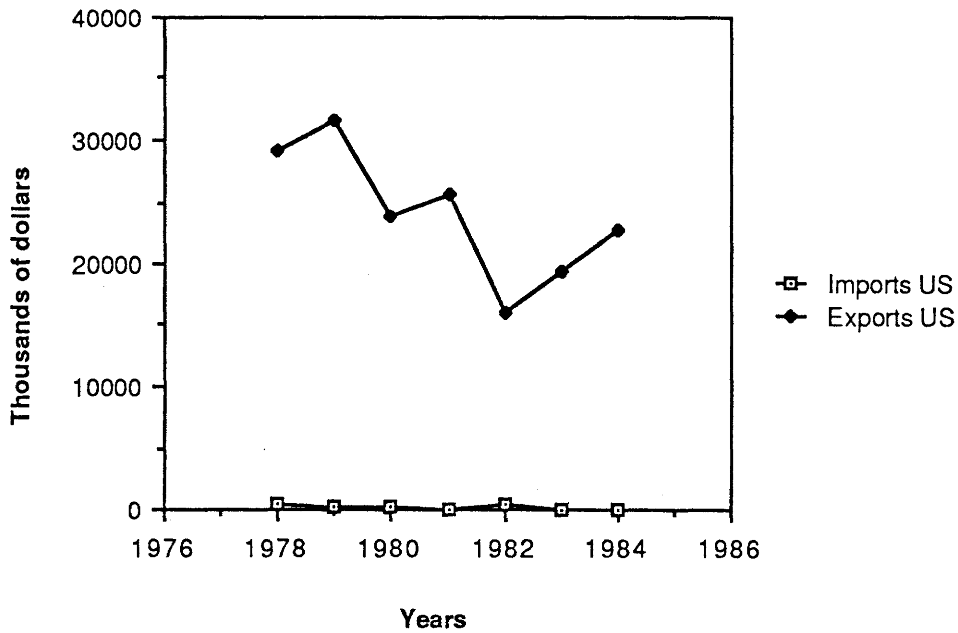
France - Imports and exports in thousands of dollars



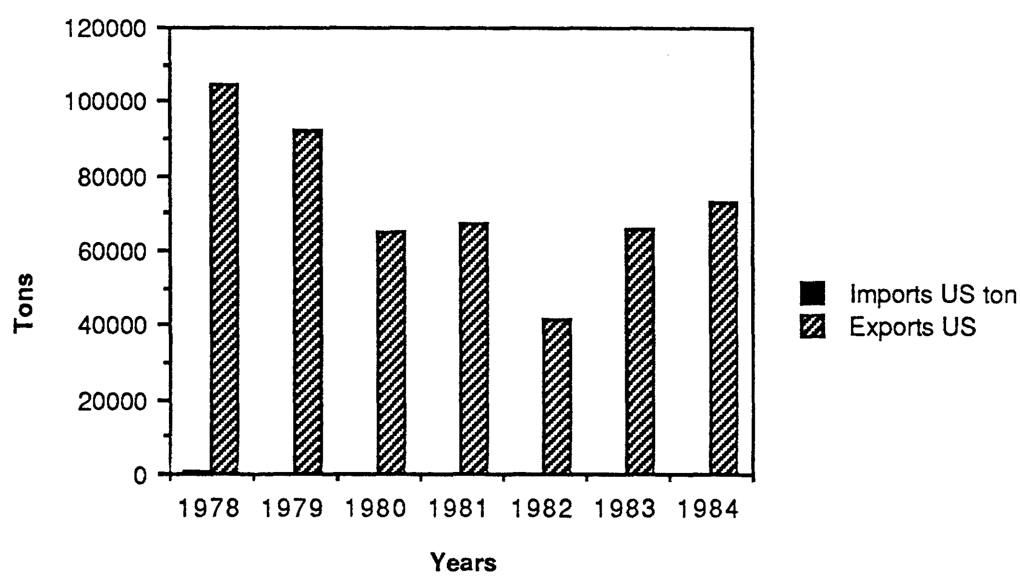
Imports and exports in tons (metric)



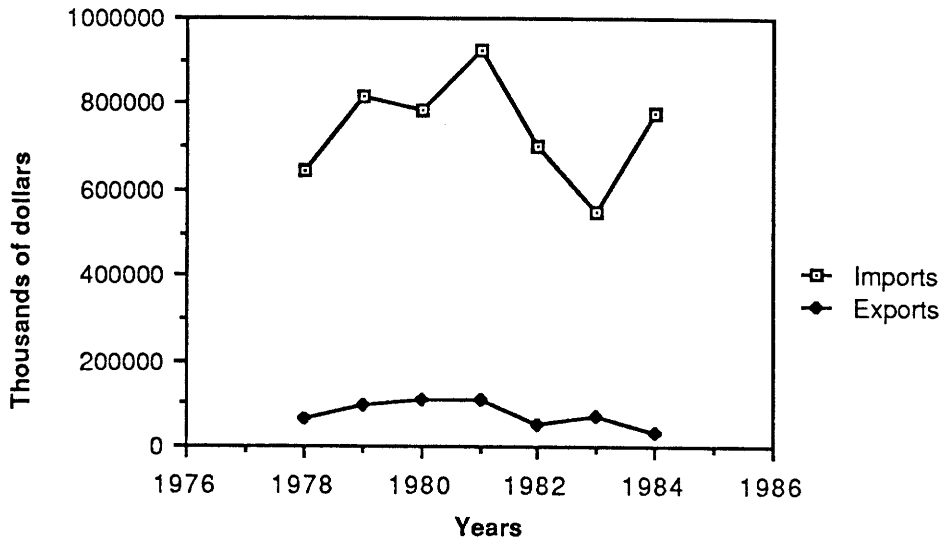
Trade with the US in thousands of dollars



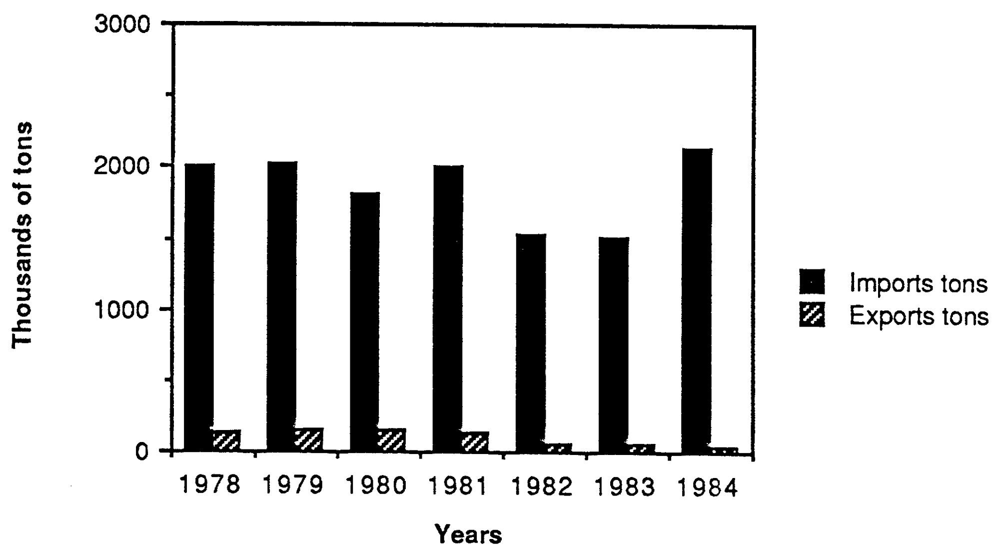
Trade with the US in tons (metric)



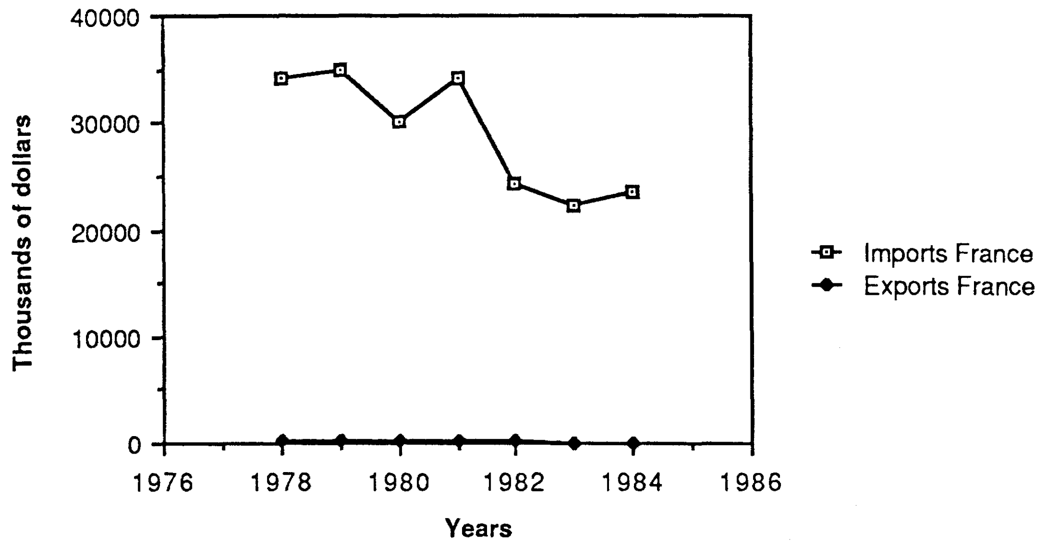
US - Imports and exports in thousands of dollars



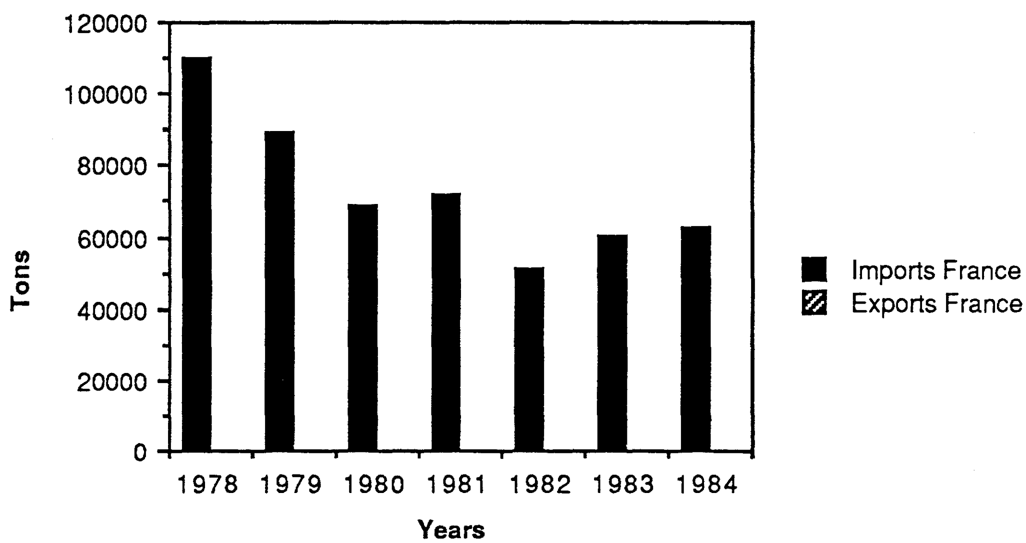
Imports and exports in thousands of tons (metric)



Trade with France in thousands of dollars

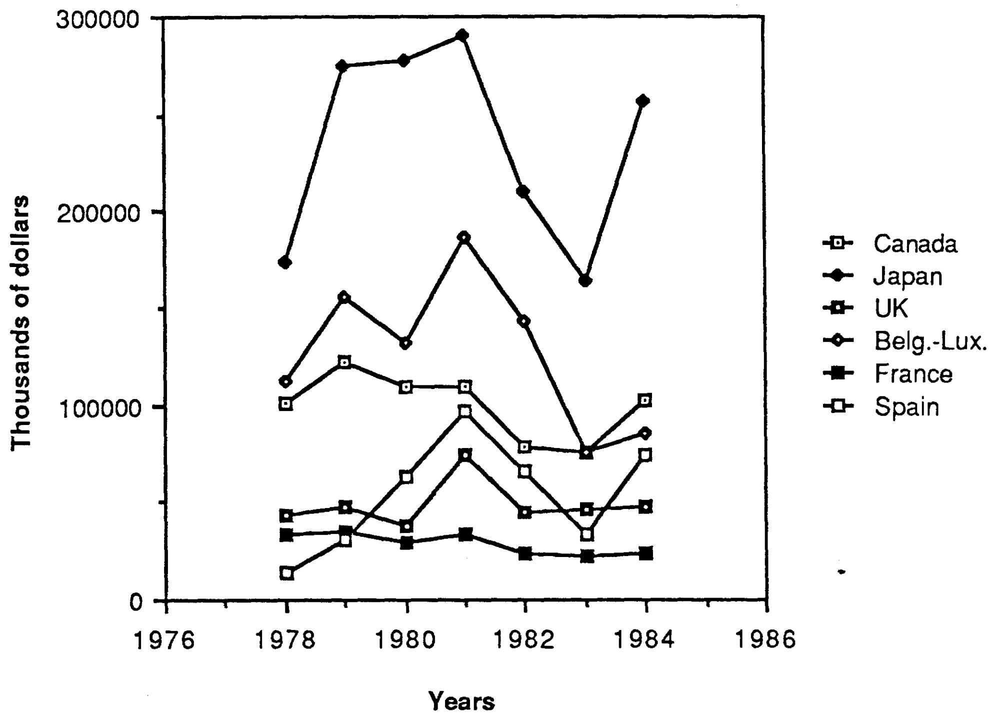


Trade with France in tons (metric)

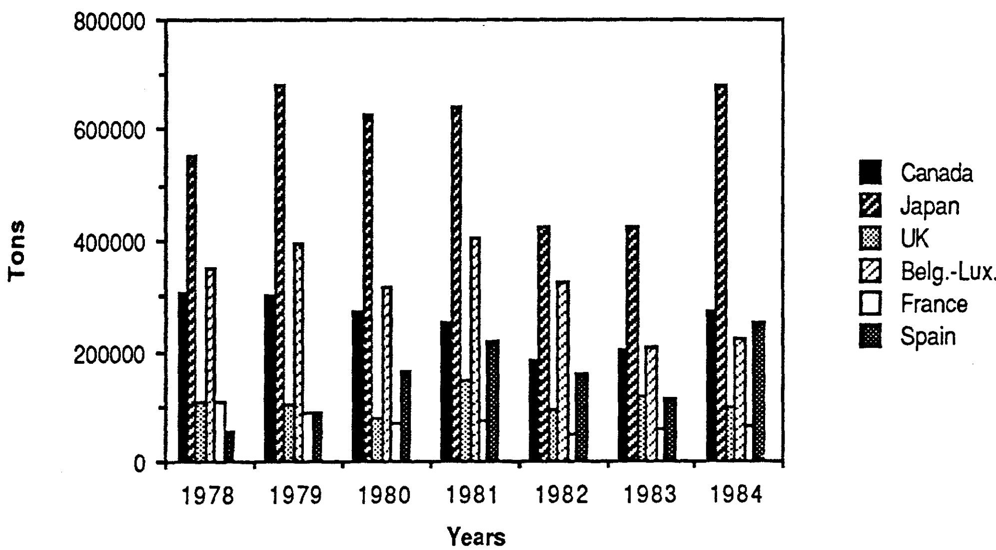


Major countries importing to the US

Value of imports

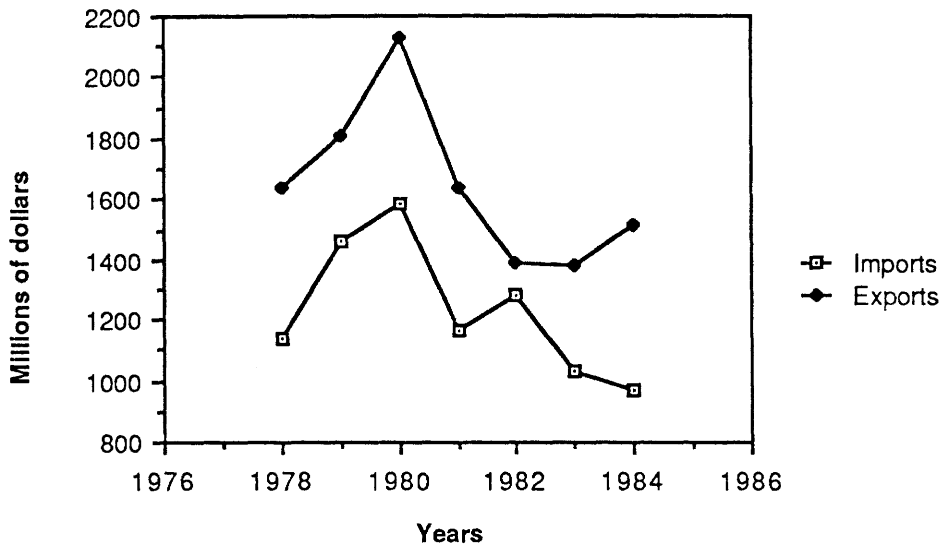


Volume of imports

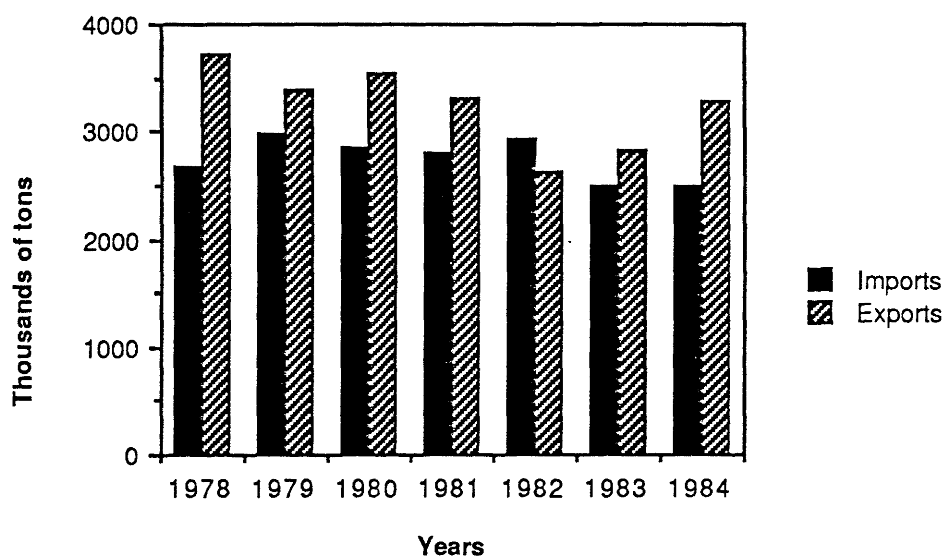


674 - Universals, plates and sheet of iron and steel

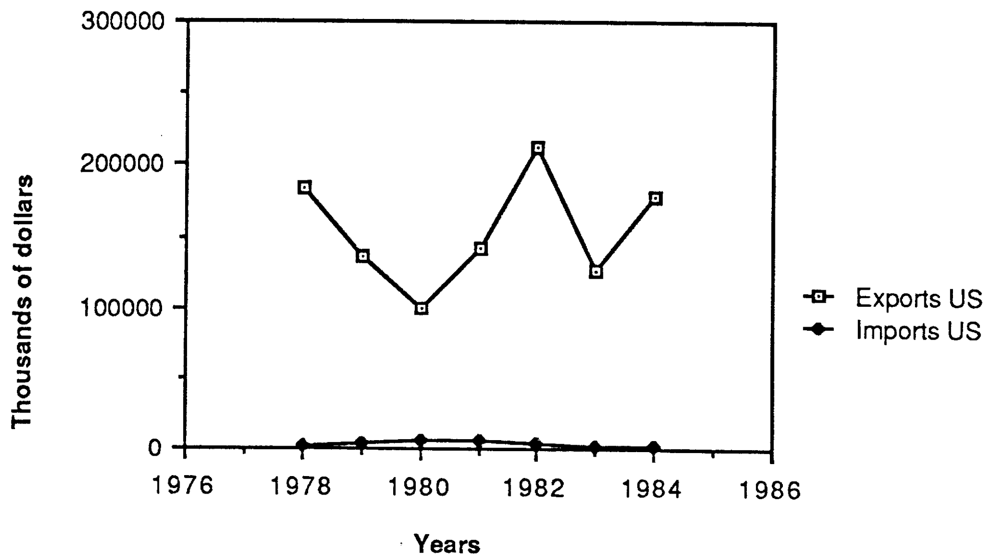
France - Imports and exports in millions of dollars



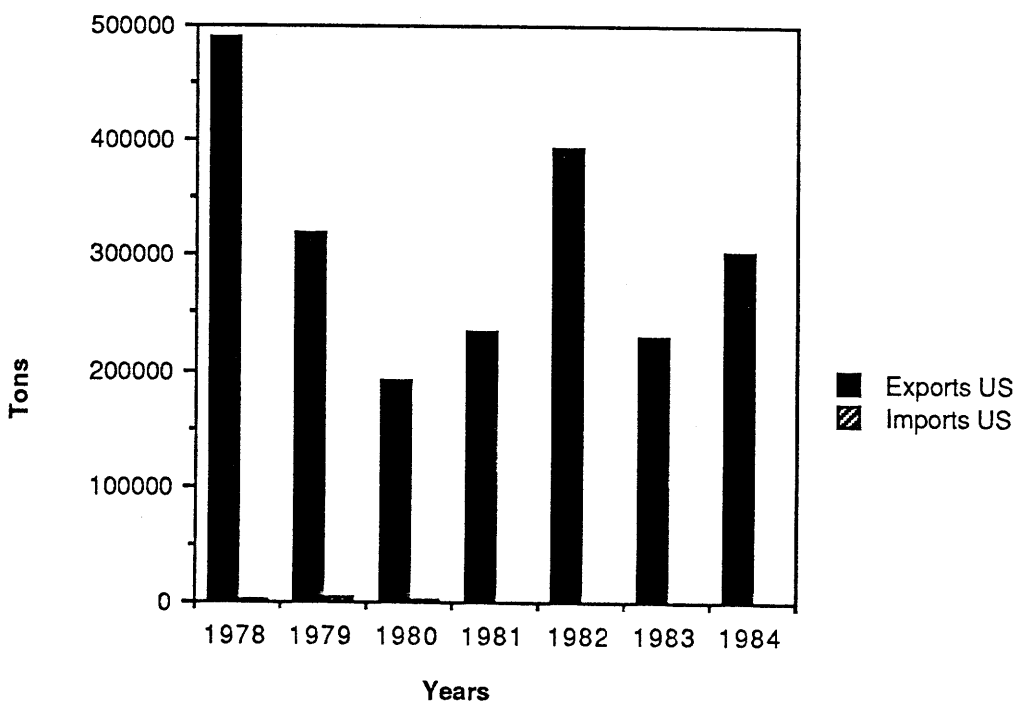
Imports and exports in thousands of tons (metric)



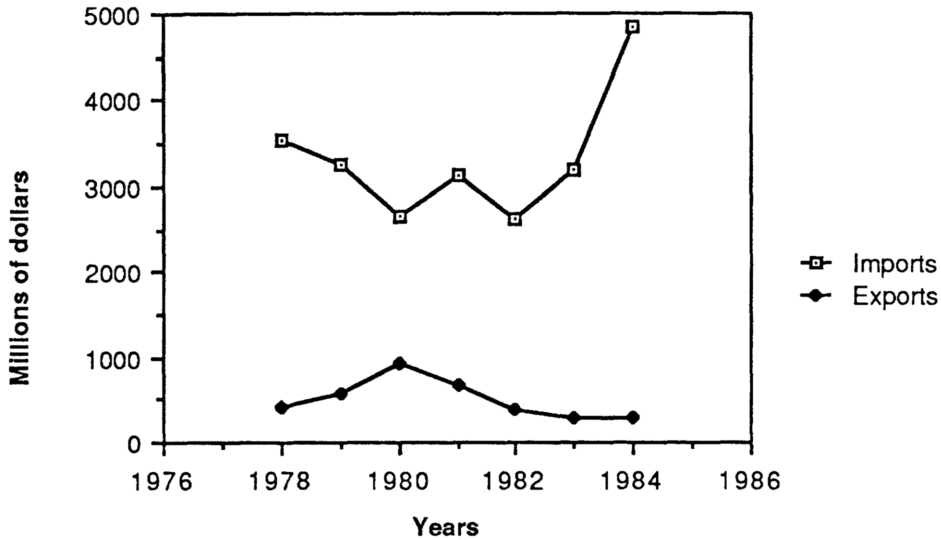
Trade with the US in thousands of dollars



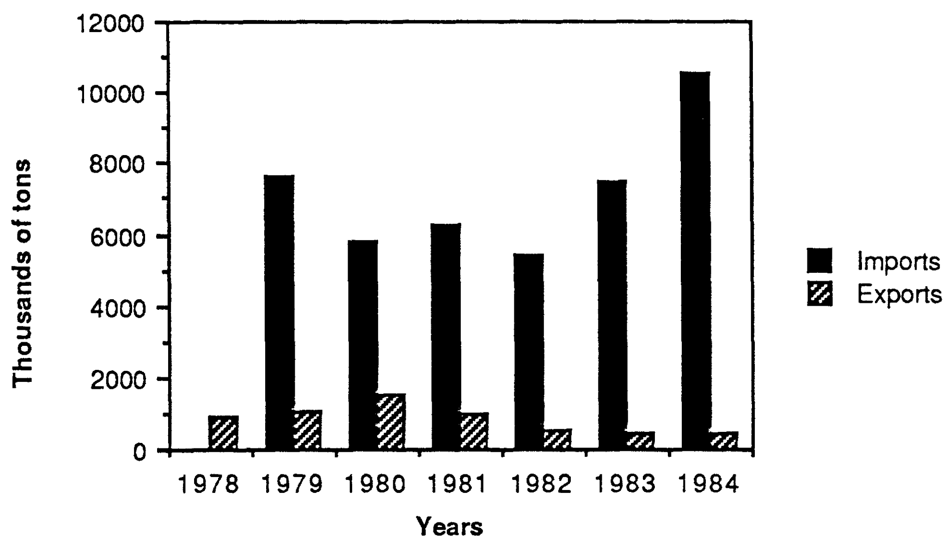
Trade with the US in tons (metric)



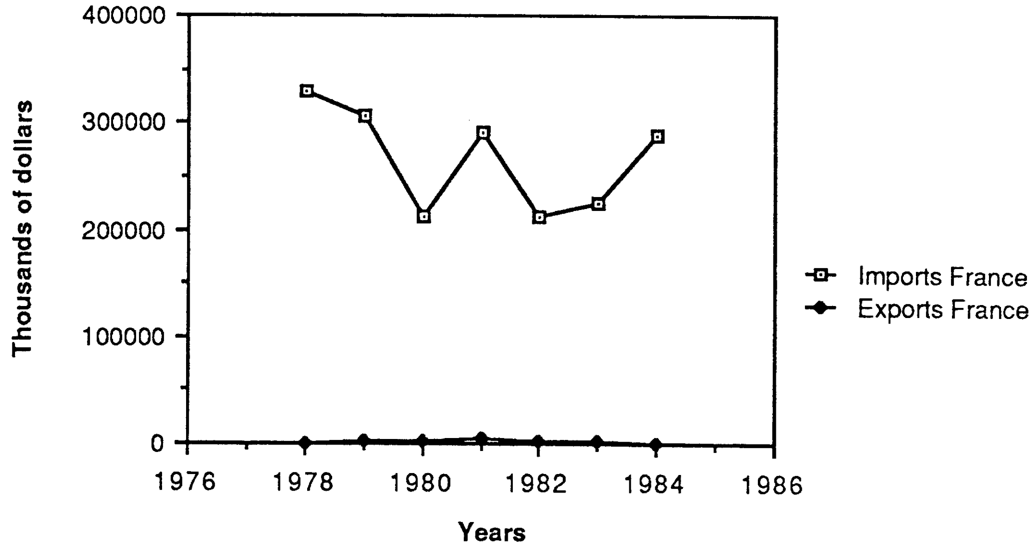
US - Imports and exports in millions of dollars



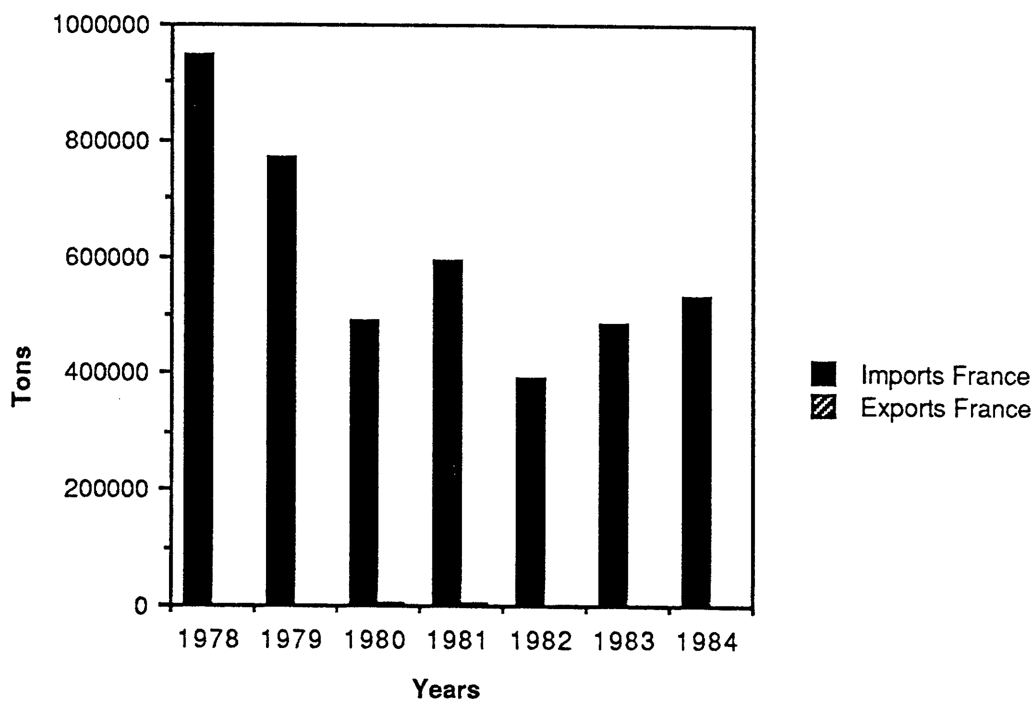
Imports and exports in thousands of tons (metric)



Trade with France in thousands of dollars

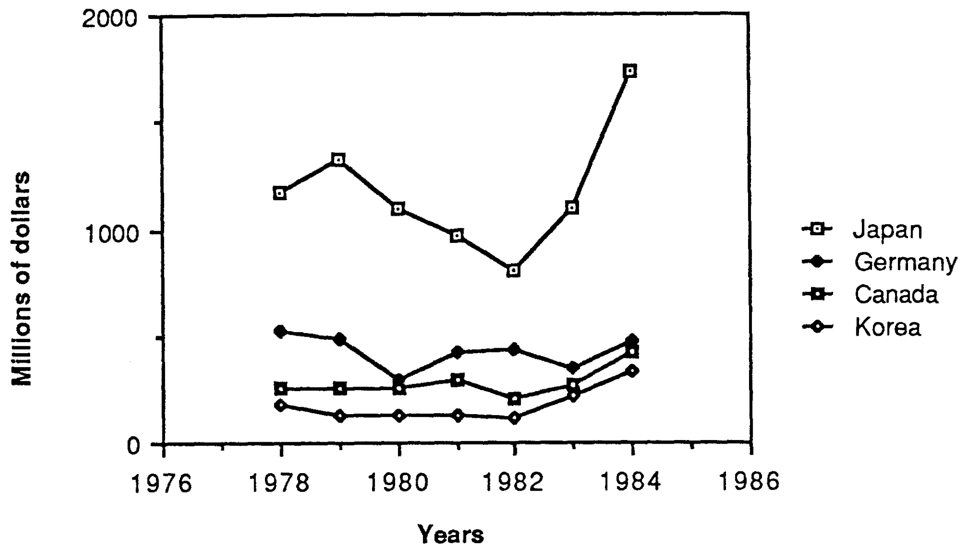


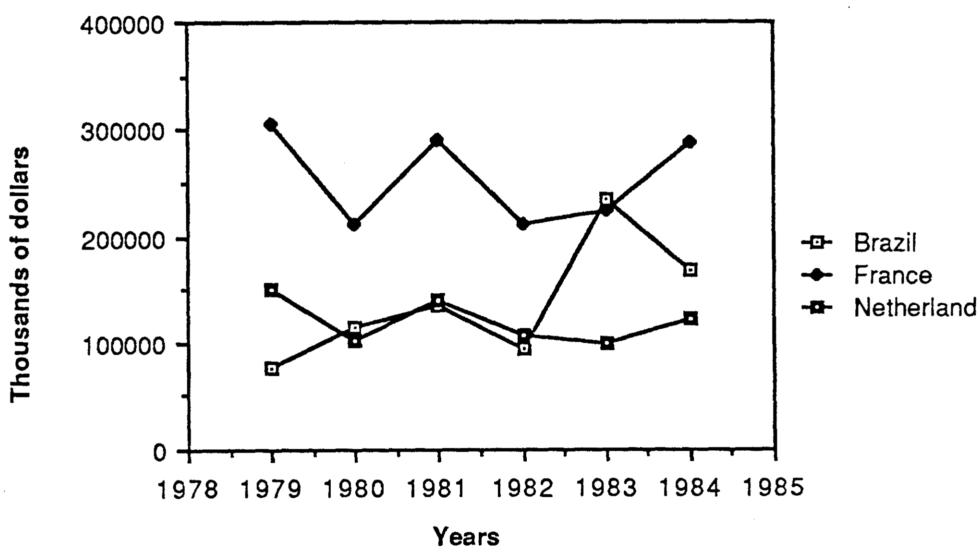
Trade with France in tons (metric)



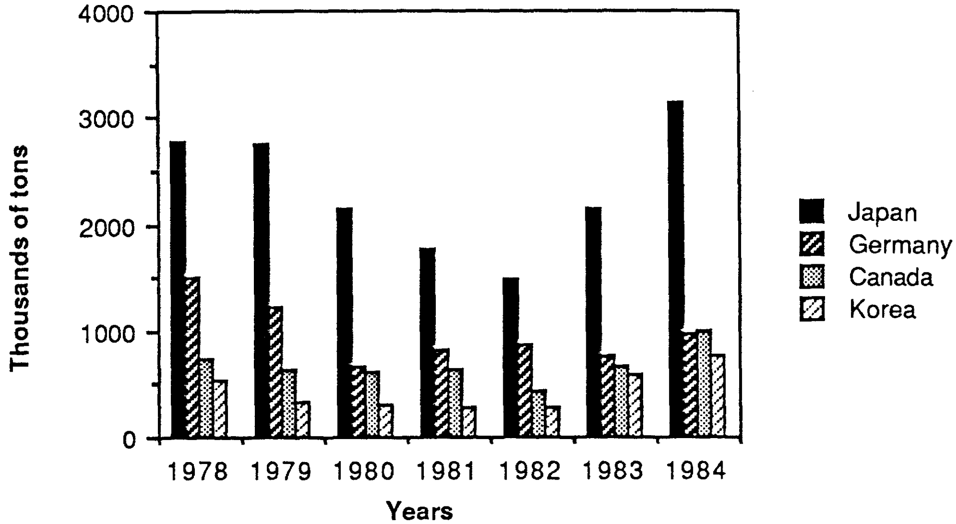
Major countries importing to the US

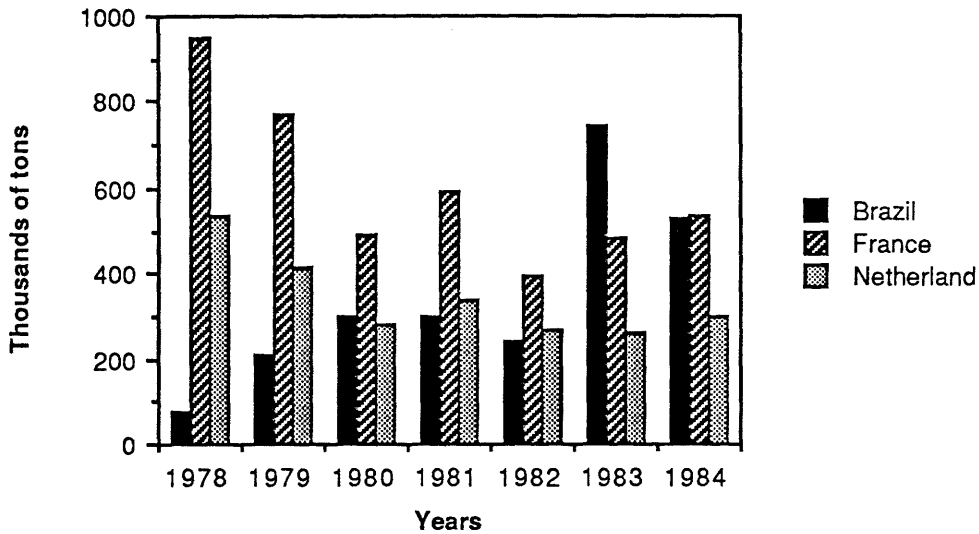
Value of imports





Volume of imports in thousands of tons





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