THE HISTORY OF TECHNOLOGY AND THE EUROPEAN UNITY

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This paper sets into parallel lines the birth and the evolution, in Europe, of a discipline—the History of Technology—and that of an idea which leads to the construction of the European Union. It shows the dependence of the History of Technology and of the idea of European unity on human thought, on cultural and spiritual contexts. At the same time highlights a wide range of chronological similarities, of a similar rhythm of evolution, maturation, and implementation.

In the Middles Ages, Europe was united by the Christian faith and monasteries played an important role in the preservation of technological memory. During the Renaissance period, the first projects dealing with the European political unification appear at the same time as the first technical publications: the "Theatrum Machinarum". In the second half of the nineteenth century, a debate emerges on the legal form of a united Europe and the evolution of technology ceases to be solely regarded as a genealogy of technology and is integrated in economic, social, historical analyses. Between the two world wars, Aristide Briand's project for a federal Europe, in which the syntagma "*European Union*" is used for the first time, and Lucien Febvre's manifesto for the creation of a new branch of history, the History of Technology, were both launched. After the Second World War, the idea of European unity came to be implemented, the European Union to be established, and the History of Technology to reach maturity and to be fully recognized as an academic discipline.

The history of technology, as well as the idea of European unity and its implementation have, in different ways, relationships with the accelerating evolution of our world. The transition, in the last decade, from industrial society to information society is one of these aspects. The crises we are facing – in economics and finances, energy and the environment – are the components and the prelude of a global crisis with an important moral dimension.

This crisis shows the limits of our economic and technological systems and calls the whole into question. The answers coming, till now, are totally insufficient. Fortunately things are starting to move and the European Union is leading the way on several subject matters. This is the case for energy, environment and climate changes as the EU's strategy Europe 2000 is proposing. Here the history of technology is playing its role, namely, at the level of technological assessment and technological forecasting.

But outside its involvement in technology and economy, the EU has also to ensure that the values claimed to be promoted are fulfilled at political and social levels. This as well inside the EU, in the countries wishing to integrate it and in the entire world.

The technological, economical, financial, social, political choices should be based primarily on moral values rather than on efficiency. The return to fundamentals is inevitable. By shedding light upon the past, history is in a privileged position and the European Union should ensure that all the values she is claiming to defend (peace, liberty, democracy, justice, solidarity) are rigorously considered. In a rapidly changing world burdened by crises, ethics must dominate efficiency.

This lecture is oriented, as reflected by the title, towards the history of technology and the unity of Europe. It will set into parallel lines the birth and the evolution in Europe of a discipline – the history of technology – and that of an idea and its implementation – the unity of Europe. It will show their dependence on human thought, on cultural and spiritual contexts and, at the same time, a wide range of chronological similarities. I divide my article chronologically into five parts: the Middle Ages; the Renaissance; the eighteenth and first half of the nineteenth centuries; the mid-nineteenth century to World War II; and, finally, post-World War II until the Treaty for the European Union signed in 1992. Each part deals with the evolution of European unity as well as with the history of technology in Europe.

Technology and its history, as well as the idea of European unity and the implementation of it, belong to the European culture and civilization. They emerged from two roots: Greek naturalism and rationalism on one side and Judeo Christian spirituality on the other side. It is in Greece that history defined as an inquiry about the past was born,

Figure 1. Carta Monastry founded in 1202.

and it is Christianity that provides the human being with liberty and responsibility.

1. The middle ages

The idea of the existence of a Europe based on Christianity and the possibility of its political unity appears as early as the first half of the Middle Ages. It was partially realised by Charlemagne, whose empire borders were the same as those of the Roman church. During the next centuries, Europe maintained a cultural unity thanks to religion and the Latin language.

The network of Cistercian monasteries (one of them is situated in Carta village, 80 km from Brasov (Fig. 1)) played a main role. They were places of technological innovation, of accelerating technical change and have been considered by a some scholars as the home of the technical revolution in the Middle Ages. Huges de Saint Victor, one of the major scholastics of the twelfth century wrote: 'human reason shines through invention of everything it is doing.' And, in addition to innovation, the Cistercians preserved technological memory, which is a primary goal of the history of technology. Thus in the Middle Ages, religion and its institutions ensured Europe a certain degree of cultural unity and technological memory.

2. The renaissance

In the fifteenth century, the Reformation and the birth of structured states weakened the unity of Europe, which had already been affected by the Schism of 1054 between Catholics and Orthodox Christianity. But Europe's cultural unity was maintained thanks to intellectuals, who often moved from one country to another and who kept tight links between each other. This was the case of the Bishop Johannes Honterus of Brasov. After a stay in Basel at the same time as Erasmus (Fig. 2) – symbol of Europe in this period – Honterus introduced both the Reformation and printing to Transylvania in 1535. He also authored *Rudimenta Cosmografica*, published in 39 editions in several major European cities.

Figure 2. Erasmus of Rotterdam 1466 – 1536.

It is during the fifteenth century, that the word 'Europe' started to be used frequently, and the idea of European unity generated various projects. These were based on two approaches: that of independent and sovereign states in competition, constantly searching equilibrium based on alliances, and that of an united Europe emerging from the ideas expressed by intellectuals and politicians. Erasmus advanced, at the beginning of the sixteenth century in his *Plaidoyer pour la paix*, the idea of a large European area comprised of Christian states and based on tolerance and peace. In the seventeenth century, one of the best known projects is that of the Duke of Sully, Louis XIII's minister. Named *Le Grand Dessein*, it called for the establishment of a 'Very Christian Republic' managed by a 'Grand Council of Europe'.

The invention of moveable-type printing by Gutenberg (Fig. 3), in the middle of the fifteenth century, was a technical innovation with unprecedented impact. It allowed, during the next century, the publication of the first books dedicated to technology, collectively known as the 'Theatrum Machinarum'. These books followed the engineer's notebooks, which gathered information concerning different arts and crafts – the notebooks of Leonardo da Vinci are a well-known example. Among the Theatrum Machinarum, are *De Re Metalica* by Georgius Agricola, published in 1556, and the *Theatrum Machinarum* of Jacob Leopold, the last publication under this name, nine volumes published in Leipzig between 1724 and 1734.

Figure 3. Gutenberg Printing Press.

The Renaissance saw the rebirth of Greek rational thinking, which resulted in the separation between theology and philosophy followed by the separation of science from philosophy. This gave birth, at the end of the sixteenth century, to Galilean science, defined as knowledge through concept – logically structured knowledge, validated by experimental or mathematical procedures. Francis Bacon specified the rules of the experimental method in his *Novum Organum* published in 1624, and he drew attention to the application of knowledge in the field of technology. Since then, new schools of thought emerged, such as positivism, and new relations occurred between science and technology. Leonardo da Vinci foresaw them when he stated: 'I see the light of science and its benefits.

All this is linked to deep changes in values. Science, which searches for truth, starts its relation with technology, whose main value is efficiency. Unfortunately, efficiency marginalises morality and deontology. A century earlier, Nicolas Machiavelli had already published his *Il Principe*, in which the pragmatism and the cynicism of efficiency are pushed into the spotlight. Fortunately, the ethic of humanism was also beginning to emerge.

From the Renaissance onward, innovation also relied on the opportunities created by scientific progress. To promote them, the creation of specific establishments was considered. In England, Francis Bacon described, in his ideal land *The New Atlantis*, the Solomon houses, where scientists lived and worked. A few years later, in 1648 in France, René Descartes argued for the establishment of large exhibition halls, where technical objects and processes could be presented. Finally, in this same period, Academies of Sciences were created (in England in 1660 and in France in 1666) as well as the first patent systems. The Statute of Monopolies, was established in England, in 1623, while, in France, the role of the examination of technical inventions was granted, in 1699, to the Academy of Sciences. Obtaining a patent required real novelty, which meant a search for precedence; this linked patent systems to the history of technology.

3. The eighteenth and first half of the nineteenth centuries

In the eighteenth century, the century of the Enlightenment, the idea of Europe continued to be discussed by prominent intellectuals. Jean Jacques Rousseau, for example, argued for the existence of a European society based on a public opinion aware of having a common history, sharing the same values and, therefore, belonging to the same cultural community. One of the best known projects of this time was that of the Abbot of St Pierre entitled '*Projet pour rendre la paix perpétuelle en Europe*' (Project for a perpetual peace in Europe), which was published in 1713, followed by an additional summary in 1728. It foresaw an alliance between the sovereigns who would submit to the decisions of a 'European senate' provided with legislative and judicial powers. Then, in the first half of the nineteenth century, Napoleon tried to unify Europe by conquest, which created a strong reaction: 'The Holy Alliance' of 1815 between Austria, Russia and Prussia and the politics of congresses which followed it under the watchful eyes of Klemens von Metternich.

Thus, the idea of the European unity persisted, and the Comte de Saint Simon, student of d'Alembert, particularly marked it with his seal. He pursued it personally as well as through his collaborators and disciples, among them, Augustin Thierry and Auguste Comte. In 1814, Saint Simon published, with Augustin Thierry, an essay

entitled "*De la réorganisation de la Société européenne ou de la nécessité et des Moyens de rassembler les peuples de l'Europe en un seul corps politique, en conservant à chacun son indépendance nationale*" (About the reorganisation of the European society, or about the necessity and means to gather the peoples of Europe within a single political body, preserving for each of them their national independence) – the title that needs no further explanation.

Also during the first half of the nineteenth century, the idea of the European unity was embraced by the people at large. The revolutionary and republican movements of 1830-1840, which were led by Giuseppe Mazzini and Alexandre Ledru-Rollin and in which Italian, French, Germans, Polish, Romanians and other nationalities took part are a testimony to this. The people fought, as Mazzini wrote, for: 'The moral unity of Europe through the democratic republic which should lead to the federation of the peoples.' And, at the end of this period, on the 21st of August 1849, Victor Hugo delivered in Paris his famous speech in favour of what he called 'the United States of Europe'.

But the Europe of the Enlightenment and that of the first half of the nineteenth century was also that of the Industrial Revolution, this major turning point in Europe that resulted from an unparalleled speed up in technological change. Following the technological evolution which occurred in the seventeenth century, this is the period when the integration of technology into European culture really begins. In Paris, several well-known works were published, including *Machines Approuvées par MM. de l'Académie des Sciences*, in six volumes the first collection of technical inventions, and the famous *Encyclopédie ou Dictionnaire Raisonné des Sciences, des Arts et des Métiers* by d'Alembert and Diderot (Fig. 4). The latter, published between 1751 and 1772, is the most representative book of the eighteenth century, concerns all fields – arts, science, philosophy, politics, religion – and emphasizes that technology is part of culture. Meanwhile, in Germany, the first books dedicated to the history of technology also appeared. Johann Beckmann's *Beiträge zur Geschichte der Erfindungen* (Contributions to the History of Inventions) was published at the end of the eighteenth century, and *Geschichte der Wissenschaften bis an das Ende des 18 Jahrhunderts* (History of Knowledge till the End of the 18th century), by Johan Heinrich Poppe, was published at the beginning of the nineteenth century.

Technical memory also started to be preserved through objects and establishments. 'Cabinets' were created in all the main European countries during the eighteenth century, which sometimes included machine models. The first significant cabinet in this last category was created by the Swedish mining engineer, Christopher Polhem, at the beginning of the century. Among the establishments specifically created at this time and dedicated to technology was the Hôtel de Mortagne, initiated in Paris in 1750 by Jacques Vaucanson, well-known French inventor and inspector of the Manufactures Royales. In 1794, the Conservatoire des Arts et Métiers was established as a successor of the Hôtel de Mortagne, and as did its predecessor, it sought to fulfil three main objectives: improvement of machines, demonstration of their use and conservation of them.

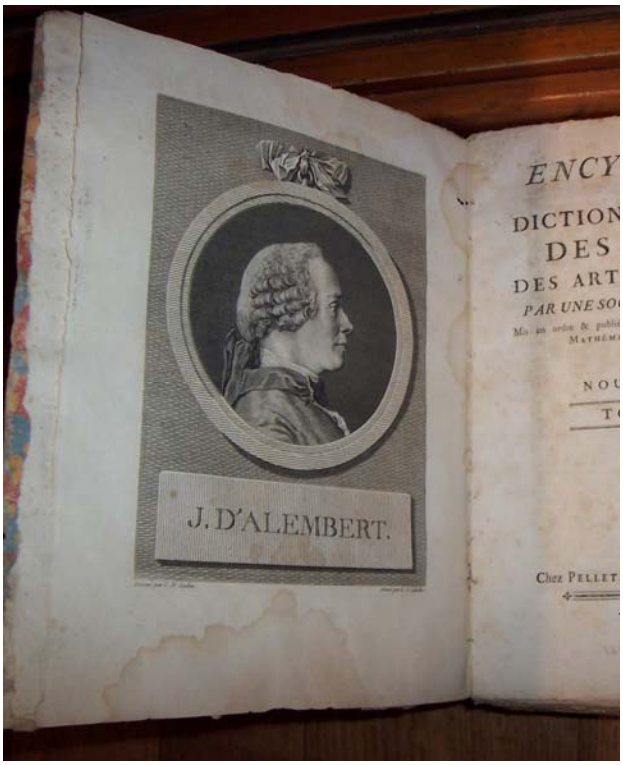

Figure 4. Encyclopedie de d'Alembert et Diderot.

Finally, during the first half of the nineteenth century, special attention was paid to technology, especially mechanics, through patents and patent offices. Created, on English and French models, new patent systems appeared in most of European countries: Prussia (1815), Netherlands (1817), Austrian empire (1820), Sweden (1834), Portugal (1837). Thus, the search for precedence expanded and thereby expanded the importance of the history of technology.

4. The mid-nineteenth century to world war II

The Revolution of 1848 spread of the idea of European unity during the last half of the nineteenth century. It was promoted by a few philosophers and thinkers of the time. The successors of Saint-Simon were on the front line, particularly Charles Lemmonier, the author of a book published in 1872 entitled *Les Etats-Unis d'Europe*, and Auguste Comte, the founding father of the Positivism, who argued for 'a Western Republic'. Comte's vision would gather together the five main European countries: France, Germany, England, Italy and

Spain to which the Netherlands, Belgium, Scandinavian countries, Portugal and Greece would be associated.

The philosopher Friedrich Nietzsche, who placed technology in the centre of his reflections, considered European unification as inevitable, and wrote in 1885: 'the small European states will become soon economically not sustainable, under the high pressure of the big trading and the large exchanges.' And, as the debate on the legal form of a united Europe expanded, the socialist Pierre-Joseph Proudhon, in France, and the philosopher Constantin Frantz, in Germany, argued in favour of federalism.

In another context and some years later, in 1906, the lawyer and Romanian politician, Aurel Popovici, proposed a project for the Austrian-Hungarian Empire entitled 'the United States of Great Austria'.

But, in fact, the second half of the nineteenth century is a time of unification in Germany, in Italy, and of the Romanian Principalities, all of which exacerbate nationalist feelings. After the war between France and Prussia in 1870 and until the end of the World War I, while the idea of European unity continues to be promoted by a few intellectuals, public opinion moves away from it under the influence of a romantic view of nationalism.

World War I marks the beginning of the decline of Europe, and it provides fodder for those who call for European unification. At the League of Nations in September 1929, France's President of Council of Ministers, Aristide Briand, delivered a speech proposing European unity. In the document concerning 'the organization of a federal union of Europe' that was written afterwards by Axel Léger (the future Saint-John Perse), the syntagma 'European Union' was used for the first time.

Meanwhile, from 1850 until World War II, the establishment of the history of technology as a discipline had a smoother path and advanced in several ways. An important one was through the establishment of large technical museums. The oldest one was the already mentioned Conservatoire des Arts et Métiers in Paris, which served as model for the Science Museum in London, founded in 1863 by Bennet Woodcroft, and the Deutsches Museum in Munich, founded in 1903 by Oscar von Miller. Several technical museums also were created in other European capitals, such as in Vienna and in Prague in 1908 and in Bucharest in 1909.

Technical skill and know-how also started to be conserved. For example, in the middle of the nineteenth century, the well-known French architect, Viollet-le-Duc, was using ancient know-how in the renovation of medieval buildings, such as the cathedral Notre-Dame in Paris and the city of Carcassonne, which are particularly notable.

Another way the history of technology advanced was via education and popularisation of technologies. Technical books often included large historical introductions and popular publications had an important historical dimension. An example is *Les merveilles de l'industrie* by Louis Figuier, published in 4 volumes in Paris between 1873 and 1876. Books dealing with the history of inventions and monographs of different branches of technology also appeared. For instance, in Germany, Franz Reuleaux, professor of mechanical engineering, published *Einfürung in die Geschichte der Erfindungen* (Introduction in the History of Inventions) in 1884, Ludwig Beck wrote a monograph on metallurgy, and Theodor Beck wrote one on building machines.

Real progress towards the creation of a history of technology, as it is defined today, took place with the integration of technology and its evolution within historical, economic, social, political and philosophical analysis. Technology became part of the general history. Indeed, as Bertrand Gille, one of the founding fathers of the discipline in France observed, the history of technology is nothing but history bounded by the material world.

The main philosophical systems of the nineteenth century, based on the history of reason left their mark on the history of technology. Positivism and Marxism were both influential. Positivism, developed and promoted by Auguste Comte in the second half of the nineteenth century, attributed the progress of the human mind to the development of hard sciences and took into account the totality of human knowledge. It argued that, thanks to science, everything could be explained and understood, and technology came to be considered as applied science. On its side, Marxism integrated technology into economic analysis and the explanation of historical evolution. One of the students of Auguste Comte, the sociologist Alfred Victor Espinas, published in 1897 a book entitled *Les Origines de la Technologie*, in which he emphasised the role of the history of technology in any historical and sociological analysis.

In this context, Paul Mantoux, professor of labour history at the Conservatoire National des Arts et Métiers published in 1906 his famous book *La Révolution Industrielle au 18ème siècle*, first introducing the concept of the Industrial Revolution. Three years later, the engineer Conrad Matschoss became professor at the Technische Hochschule Charlottenburg, where the first chair for the History of Technology was created. He was strongly supported by the society of German engineers, the

VDI, after having published in 1901 the book entitled *Die Geschichte der Dampfmachine* (The History of the Steam Engine), which is not only an internal history of technology but also deals with the impact of steam energy on the economy and society. Matschoss also founded the first periodical in the field: *Beiträge zur Geschichte der Technik und Industrie* (Contributions to the History of Technology and Industry).

Mantoux and Matschoss, represent the two roots of the history of technology: the one issued from the historical and sociological approach, filled with a left-oriented ideology, and the other issued from opening the black box of technology, close to the model of the history of sciences, especially that of the history of mathematics. These two approaches are promoted in the frame of Academic societies created in several European countries. In Germany, for instance, in 1901, the Society for Medicine, Science and Technology is founded, followed by the Georg Agricola Gesellschaft in 1926 and by establishment, in 1930, of a special section dedicated to the history of technology within the society of German engineers. Meanwile, in England, in 1920, the Newcomen Society was established; it is the oldest such society involved only in the history of technology.

While in Germany, scholars in the history of technology were often engineers, in France, they were mainly historians and sociologists. These last ones were gathered around the scientific journal *Annales d'Histoire Économique et Sociale*, created by Marcel Bloch and Lucien Febvre in Paris in 1929. Bloch's and Febvre's politically left-oriented Ecole des Annales promoted a history that turned towards the present, hence the interest in the history of technology. In a special issue of the Ecole des Annales journal, Lucien Febvre launched, in 1935, a manifesto for the establishment of a new branch of history: the history of technology. He identified three steps that had to occur to create this new branch: first, establishment of a technical history of technology, which needed to be done by engineers who have the necessary knowledge to open the black box of technology; second, construction of a history of science-technology relationships, which, for the same reasons, also had to be done by engineers and scientists; and, finally, the integration of these two histories into a global one, in which economic, social, and political histories would exist.

In the 1930s, in Europe, the history of technology was pushed ahead by its development in the United States. The book by Lewis Mumford, *Technics and Civilization*, published in 1932, enjoyed a great success in the old continent. It focused on two dominant technologies, energy and materials, through which Mumford identified three historical periods of *eo*, *paleo*, and *neo* technologies. He also proposed a new periodisation based on technologies that would be developed in Europe after World War II.

Finally, the philosophers of the first half of the twentieth century were just as concerned by technology and its evolution as their predecessors. Standing out among them was the German Oswald Spengler, who published *Der Mensch und die Technik* (The man and the technology) in 1931. His work is one of the most representative of the time, in which he considered that technology, the expression of the Faustian will of power which characterises the European culture, was transforming man into a slave of machines and would create an ecological disaster.

5. Post-world war II

In the climate of the Cold War, which starts immediately after World War II, the idea of European unity became a matter for political movements and an essential aspect of European nations' policies. After several events and achievements, such as Churchill's speech in Zurich in 1946, the creation of the Western Union Defence Organisation and of the Organisation for European Economic Cooperation in spring 1948, the establishment of NATO and of the European Council in spring 1949, the Robert Schuman declaration of the 9th of May 1950 and the European Coal and Steel Community treaty that was signed in Paris in April 1951. The latter was the first supranational European structure, and its High Authority is independent from all interventions by European governments.

Since then and until the signature, in Maastricht, of the Treaty for the European Union (TEU) in February 1992, Europe followed a difficult path, one filled with doubts, scepticism and even failures. But, unity finally was successful, thanks to the pragmatism of the policy of small steps initiated by Jean Monnet. This process brought forward the values of peace, liberty, democracy, justice, and solidarity – values which were promoted by Christian democrats who were leaders in building European unity, such as Robert Schuman, Konrad Adenauer and Alcide de Gasperi. And, they were joined by socio-democrats, such as the Belgian Paul-Henri Spaak.

On the way to the Maastricht treaty, the road to unity was marked by a series of milestones dates, such as the Treaty of Rome (1957) and the Single European Act (1986). During the two first decades

following the European Coal and Steel Community treaty, focus was on deepening the construction of European Communities but, starting with the end of 1960, the enlargement of the communities became important. After the fall of the Berlin wall, a large debate occurred about the definition of the European Union (EU) and its borders. It was agreed that to be a member of the EU, states had to belong geographically to Europe and their policies and actions had to be based on the values of peace, liberty, democracy, justice and solidarity.

But since so much has been written on the creation of the EU, I will leave the story at this point to focus on history of technology in Europe during the post-war years, a time when it became an academically recognized field.

The position that the history of technology attained in Europe is due to European academics and researchers as well as to their collaboration with American colleagues. Today American scholars play a particularly major role in the development of the discipline and are at the forefront of progress, as evidenced by the Society for History of Technology and its quarterly journal *Technology and Culture*. But several European scholars played a prominent role in defining and structuring the field. They included, in England, Charles Singer, first president of the International Union of History and Philosophy of Sciences, who directed the well-known treatise *A History of Technology*, and Rupert Hall, professor at the Imperial College - London; in France, Maurice Daumas, professor at CNAM and director of the Musée National des Techniques and Bertrand Gille, research director at the Ecole des Hautes Etudes en Sciences Sociales, professor at College de France; in Germany, Friedrich Klemm, director of the Library and of the Research Center in History of Science and Technology of the Deutsche Museum and professor at Munich University. Many other European scholars also contributed, and they are attached to the establishments already mentioned as well as to technical universities in Munich, Berlin, Aachen, Darmstadt, Eindhoven, Stockholm, Vienna and elsewhere. They also are found in universities such as Oxford, Paris-Sorbonne, Nantes, Bochum, Hamburg, Barcelona and to technical museums such as the Science Museum London, and Technisches Museum Wien. And they are in the universities and museums of East European countries, such as those in Prague, Dresden, Budapest and Bucharest.

In the post-war period, debates on a large number of topics concerning the history of technology have taken place, and I should like to comment briefly on some of them, particularly those concerning the field's identity and methodology and those of its relations with the history of science and economic history.

Prior to the fall of the Berlin Wall, the question of whether or not to focus on the internal or external history of technology received different answers in Western Europe and in communist countries. In Western Europe, the question of which to focus on melted away, with everybody agreeing that both need to be closely integrated. Yet, the ongoing question remained as to how deeply one should explore the black box of a technology when its history is studied. The answer now seems to be to adapt the black box analysis to the needs of the history being studied. Meanwhile, in eastern European countries, it is the internal history that often made a real contribution to the development of the field, even though it was sectarian and often out of context. Some remains of this approach are still there, as in Romania, where the history of technology *per se* is not on the list of the disciplines in which a PhD can be obtained.

Regarding conceptualisation and methodology, structuralism became prominent. This theory states that the elements, the structures, have no separate existence and take on full significance only in their relationships to the other elements existing in the frame of the system. It was very popular in economics, and at the beginning of 1970, Bertrand Gilles proposed its use in history of technology. It is an important European contribution to the development of the field. The concept of the technical system, defined as the totality of the technical networks and of structures, simple and complex, coherent and compatible to each other, is a central concept in history of technology.

This concept also leads to that of periodisation in history. The classical division is usually maintained and the evolution of the technical system of each period is analysed and explained, an approach used by Bertrand Gilles and a few European historians of technology. But other scholars promoted a new periodisation that takes into account the dominant technologies as: energy, materials and information.

Maurice Daumas, for example, emphasised throughout history five technical systems or technical complexes, as he called them, and insisted on the interdependencies and coherences which existed between the technologies constituting the technical complex. He considered also that technological change occurs without ruptures and revolutions; it accelerates throughout history, following a curve that has had only one real turning point – at the time of the Industrial Revolution. A large number of historians (especially economic historians but also historians of technology) disagree

with this point of view, and consider that there are several turning points, if not breaking points, such as the one of the end of the nineteenth century or the one of the present time linked to information technologies.

Science technology relationships were also reconsidered in the post-war years. I must emphasize that, until the end of the nineteenth century, technology, with a few exceptions, preceded science. That even if, starting with the beginning of the twentieth century, technology and science are intimately linked, technology is far from being only applied science. Moreover, the field of science technology relationships gets richer and becomes more and more complex as new technologies emerge in different areas.

The relations between technology and economics after World War II are as rich and substantial as those between science and technology and continue to occupy the same privileged place they have had since the middle of the nineteenth century. The study of the innovation process strongly tied the history of technology to economic history, and I should emphasize that the acceleration of the technical change is related to growing investments. François Caron, professor of History of Economics at Sorbonne University considers that it is impossible to analyze separately the technical system and the economic one and proposes the concept of a 'model' which should bring together, in a single unity, the two systems. He emphasizes that several concepts used in the history of technology and economic history converge, such as 'bottle neck' and 'request of invention'. Economic history is a driving force for the history of technology.

Conclusion

In conclusion let me emphasise that the history of technology, as well as the idea of European unity and its implementation have, in different ways, relationships with the accelerating evolution of our world. The transition, in the last decade, from industrial society to information society is one of these aspects. The crises we are facing – in economics and finances, energy and the environment – are the components and the prelude of a global crisis with an important moral dimension.

This crisis shows the limits of our economic and technological systems and calls the whole into question. The answers coming, until now, are totally insufficient. Fortunately things are starting to move and the European Union is leading the way on several subject matters. This is the case for energy, environment and climate changes as the EU's strategy, Europe 2000, proposes. Here the history of technology is playing its role at the level of technological assessment and technological forecasting.

But outside its involvement in technology and economy, the EU has also to ensure that the values claimed to be promoted are fulfilled at political and social levels. In this respect the EU has had successes, but also failures. This is the case concerning the integration of the Central and Eastern European Countries. The adopted strategy was only focused on efficiency, without sufficiently taking into account their post-war history. In this way, the real power remained in several of these countries mainly in the hands of those who had it during the communist era. Besides the inacceptable moral aspect, it is a major cause of corruption and of the faulty operation of justice.

I am convinced that technological, economic, financial, social and political choices should be based primarily on moral values rather than on efficiency. The return to fundamentals is inevitable. By shedding light upon the past, history is in a privileged position, and the European Union should ensure that all the values she is claiming to defend (peace, liberty, democracy, justice, solidarity) are rigorously considered. In a rapidly changing world burdened by crises, ethics must dominate efficiency.

Bibliography

1. ***Badre, Denis***. *Quelle Frontière pour l'Europe? Paris, 1995.*
2. *Basalla, George. The Evolution of Technology. New York, 1989.*
3. ***Cardwell, D.S.L.*** *Turning Points in Western Technology. New York, 1972.*
4. ***Caron, François.*** *Les Deux Révolutions Industrielles du XX siècle. Paris, 1997.*
5. ***Caron, François.*** *La dynamique de l'innovation, Changement technique et changement social (XVI – XX s.). Paris, 2010.*
6. ***Casstels, Manuel***. *La société en réseaux. Paris, 2001.*
7. ***Cosandey, David***. *Le Secret de l'Occident. Paris, 1997.*
8. ***Daumas, Maurice***. *Histoire Générale des Techniques. 5 vols. Paris, 1962 – 1978.*
9. ***Daumas, Maurice***. *Les Grandes Étapes du Progrès Technique. Paris, 1981.*
10. ***Daumas, Maurice***. *Le Cheval de César. Paris, 1991.*

11. ***Debru, Claude****, ed. History of Science and Technology in Education and Training in Europe. Luxembourg, 1999.*
12. ***Durand, Jean-Dominique****. L'Europe de la Démocratie Chrétienne.Paris, 1995.*
13. ***Durousset, Maurice****. L'Union Européenne au XXIème Siècle. Paris, 2004.*
14. ***Ellul, Jacques****. Le Bluff Technologique. Paris, 1988.*
15. ***Flichy, Patrice****. L'Innovation Technique. Paris, 2003.*
16. ***Fontaine, Pascal****. L'Union Européenne. Paris, 1994.*
17. ***Gilles, Bertrand****. Histoire des Techniques. Paris, 1978.*
18. ***Herlea, Alexandre****, ed. Science – Technology Relationships. San Francisco, 1993.*
19. ***Herlea, Alexandre and Payen, Jacques****, eds. Bulletin de la Société Française d'Histoire des Sciences et des Techniques, No. 21-22-23, Paris, March, 1988.*
20. ***Kranzberg, Melvin and Pursell, Carroll W., Jr.,*** *eds. Technology in Western Civilization. 2 vols. New York, 1967.*
21. ***Lebeau, André.*** *L'Engrenage de la Technique. Paris, 2005.*
22. ***Lebeau, André.*** *Les Horizons Terrestres: Réflexions sur la Survie de l'Humanité. Paris, 2011.*
23. ***McNEIL, Ian,*** *(ed.). An Encyclopedia of the History of Technology. Routledge, 1990.*
24. ***Morin, Edgard.*** *Penser l'Europe. Paris, 1987.*
25. ***Mumford, Lewis.*** *Technics and Civilization. New York: Harcourt, 1934.*
26. ***Russ, Jacqueline.*** *L'Aventure de la Pensée Européenne. Paris, 1995.*
27. ***Salomon, Jean-Jacques, Schmeder, Geneviève.*** *Les Enjeux du Changement Technologique. Paris, 1986.*
28. ***Salomon, Jean-Jacques.*** *Prométhée Empêtré: La Résistance au Changement Technique. Paris, 1999.*
29. ***Salter, W.E.G.*** *Productivity and Technological Change. Cambridge, MA, 1960.*
30. ***Singer, Charles.*** *A History of Technology, 8 vols. Oxford University Press, 1956-84.*
31. ***Taguieff, Pierre-André.*** *Le Sens du Progrès. Paris, 2004.*
32. ***Voyenne, Bernard.*** *Histoire de l'Idée Européenne. Paris, 1964.*
33. ***Williams, Trevor I.*** *A History of Invention: From Stone Axes to Silicon Chips. New York, 2000.*

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