LECCE UNIVERSITY

Information technology: an opportunity for growth

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1. The world economy in the nineties

During the last decade the world economy saw a rapid, at times even tumultuous, expansion in financial activity; it received impulses generated by the openness of markets, major organizational changes, and the increasingly pervasive use of new technology, particularly information technology.

Although economic growth was generally rapid, it nonetheless varied across the globe, as it had in earlier decades.

The performance of the Japanese economy, which in the fifties and sixties had at times expanded at rates of more than 10 per cent, was unsatisfactory. With the capacity to produce industrial goods far in excess of domestic demand, Japan was faced in the nineties with an international market that no longer absorbed all its excess output; its share of world markets declined, in part owing to competition from emerging economies.

There was an increase in the supply of goods from other Asian countries with lower labour costs, more modest living standards, less developed welfare systems and lower taxation than the major industrial countries.

Japan's GDP growth fell to an average of less than 2 per cent in the nineties, compared with 6 per cent for the newly industrialized countries.

The latter's growth was halted by the 1997 crisis. This was reflected, and in some cases had its origin, in monetary and financial variables.

The problems have been largely overcome in Asia, where activity has recovered vigorously. In some other areas the crisis is not entirely over, while in others — notably Russia — uncertainty still reigns. The last decade saw fairly strong growth in Latin America, albeit marked by repeated interruptions due to financial and political storms and by pronounced disparities between countries. The two most populous countries of Asia, China and India, recorded remarkable economic expansion.

Growth in Europe in the last decade was slower than in the past and unsatisfactory in relation to productive capacity, with adverse effects on employment. The difficulties that had already become apparent during the eighties were accentuated in the nineties. Between 1989 and 1999 the average annual rate of growth for the fifteen EU member states was 1.7 per cent, compared with 2.2 per cent in the eighties and 5.7 per cent in the sixties. Employment in manufacturing fell sharply and the overall rate of unemployment, which in 1980 had stood at about 7 per cent, climbed to 9.4 per cent. The hopes that the central and eastern European economies would expand rapidly, kindled in the aftermath of the collapse of the Communist regimes, were disappointed.

The position of North America in the world economy is particularly interesting. In the last decade, with the collapse of the Soviet bloc, the United States, which had long been the leading industrial power, consolidated its economic, political and military primacy.

The enormous growth in global finance and its cyclical fluctuations were constantly based on the dollar. Another currency that played a decisive role in the second half of the decade was the yen, sustained by the foreign credits that were still being accumulated in the nineties.

With its high levels of technology and productivity and its high standard of living on the one hand and its growing foreign debt on the other, the US economy seemed set for a period of stagnation in the nineties.

Looking at the development of economies in relative terms, those that are more backward could be expected to make faster progress following the application of production techniques and the emulation of life-styles already tested elsewhere. The more developed nations, basking in a high standard of living and generalized well-being, could be expected to record slower gains in productivity, output and employment, while their financial strength would supposedly shift investment and production towards the emerging countries with lower labour costs.

This view implicitly assumes that technology, consumer tastes and the organization of production are basically given or evolve only slowly and steadily.

This model has been swept away by developments in the nineties.

The American economy is experiencing a new stage of development, based largely on the application of information technology to industry, trade and services. The emerging market economies have embarked on programmes of rapid industrialization, but in the wake of the crises financial capital has largely flowed back towards the leading industrial economy.

It is as if the United States were enjoying a re-run of the expansionary phase that ended in the early decades of the 1900s, the key features of which were large-scale industrialization and the concentration of activity in standardized products and very large enterprises.

In a context marked by highly flexible use of the factors of production and low taxation, the forces sustaining the growth of output, employment and consumption are a rapid rise in investment, especially in the services sector and with a substantial information and other advanced technology content, and a young and vigorous population supplemented by a constant and regulated flow of immigrants.

The long years of investment in research, initially carried out in universities and publicly funded centres and later increasingly by firms, has permitted the accumulation of a considerable stock of scientific discoveries, theories and new products that are now being channeled into current production and mass consumption.

There is close cooperation between research and production; an increasing flow of new workers is sustaining the demand for traditional industrial products.

The recent successes of the US economy can be summarized in annual GDP growth of 3.8 per cent between 1994 and 1999, an annual increase in investment of 9 per cent and, above all, an annual rise in employment of 2.3 per cent and an unemployment rate that is currently about 4 per cent.

The application of information technology to production brings down unit costs by increasing productivity; inflation is held in check by the reduction in costs. The inflow of saving from abroad keeps the cost of financial capital at acceptable levels and fosters the accumulation of productive capital.

The rate of growth of per capita GDP in the United States has risen to 2.8 per cent since the mid-nineties, compared with a rate of just under 2 per cent in the preceding decade. This can be attributed to the acceleration in total factor productivity as a result of technological and organizational innovation and the widespread use of information technology.

The limits to productive expansion posed by the supply of labour have so far been overcome, thanks to the availability of young, educated and trained workers and to immigration.

Even if this advancement of the frontiers of production should prove a one-off event, the gradualness with which new applications of technology are implemented would still ensure a protracted rise in the annual rate of GDP growth.

It is not easy to say in advance how long the transition will last. Economic development itself fosters new ways of applying scientific knowledge to production; basic research is continuing apace and the economy's potential is being shifted upwards.

2. An opportunity for growth

Following the Second World War, reconstruction was begun in Europe with funds from the Marshall Plan. In the fifties and sixties the countries of the so-called economic miracle — Japan, Germany and Italy — experienced a period of exceptional growth.

In Italy, that phase of growth was based on a set of favourable conditions, including political and institutional factors.

The expansion of industry depended decisively on the application in important sectors of technologies and new production methods imported from the most advanced economies.

The expansion was sustained by the opening up of the economy to international trade and the abundance of labour, coming in part from the lowest-income sectors, especially agriculture.

The growth of the population, with births far outnumbering deaths, its low average age and the gradual rise in employment and disposable income for broader and broader strata of society increased the demand for industrial goods.

In the late sixties and early seventies, trade-union demands led to a redistribution of income from companies to payroll employees, thereby fanning inflation; newly-enacted legislation reduced the productivity of invested capital. The oil crisis of the early seventies had further heavy repercussions on inflation and growth. The four-fold jump in oil prices had a

serious impact on important branches of industry and required far-reaching restructuring, with a resulting decline in employment in large industry.

The Italian economy grew by an annual average of 3.6 per cent in the seventies, compared with 5.7 per cent in the preceding decade.

In the eighties the annual average rate of GDP growth was 2.2 per cent. Interest rates turned positive again in real terms. The public debt exploded. As in other industrial countries, there were growing signs of demographic crisis.

The slowdown in economic growth became more pronounced in Italy and Europe in the nineties.

The gap between the regions of the North and South of Italy has not been closed.

Especially in the North-East, the period from the mid-seventies onwards has seen the extensive development of small and medium-sized enterprises that are dynamic, open to international competition, characterized by high investment and employment arrangements enabling them to cope with the changing demands of the economic cycle. Up to now this model has spread to only a limited extent to some parts of the Mezzogiorno, principally on the mainland.

The South has many more young people in the labour force than opportunities for their employment. The sudden termination of special investment programmes at the end of 1992 had severe repercussions on the area's economy. Infrastructure investment also declined as a consequence of budgetary adjustment; it has continued to suffer from a lack of project-development capacity at local level.

Social problems have been aggravated by the economy's difficulties and unemployment among young people; they are a serious obstacle to the development of a fabric of small industry and commerce.

Nonetheless, new forms of courageous entrepreneurship are emerging in several parts of the South.

It is worth asking whether, taking a leaf out of the book of the most advanced countries and especially the US economy, a massive dose of investment in education and computerization would not allow Italy, in the medium-term, to replicate the vigorous industrial growth of the fifties and sixties. Some of the favourable conditions of that period are present today: progress in international integration, the opening up of new markets, the availability of labour, and the return to a high level of investment profitability.

The strategy must focus on advanced services, new products, organizational arrangements and information technology, including its application to the clusters of small and medium-sized production units.

3. Information technology and the Bank of Italy

In Italy, the initial impetus to extensive use of information and communication products and services came from the banks. With the policy set by Guido Carli in the seventies, the Bank of Italy acted not only to regulate but also to promote this change.

The possibilities offered by electronic data processing had long been recognized; the first steps in automation were taken in the fifties. Today, it is completely natural to associate the activity of the central bank with information, which plays a key role in matters concerning money, foreign exchange and securities. Information technology is fundamental in the performance of supervision.

Italy was in the forefront in Europe in applying electronic calculation to economic analysis as early as the sixties with the development of the econometric model of the Italian economy.

The first econometric model was constructed in the mid-sixties at the Economic Research Department of the Bank of Italy. Since then it has been constantly updated and enriched. It is currently used to provide information and basic analyses for economic, budgetary and monetary policy-making, to simulate the Italian economy's performance in the international setting, to forecast the trend of income, prices, the balance of payments and employment.

The model has been used with success in a number of crucial moments for the Italian economy.

It was employed in the sixties in the formulation of public debt issuance policy. In 1974 it provided the basis for quantifying the macroeconomic stabilization policy agreed with the International Monetary Fund in order to cope with the oil crisis and the explosion in wages.

Recourse was also made to the model in adopting the measures to counter the severe crisis of the lira in 1976-77. It provided the quantitative information for the massive fiscal policy measures that brought the external accounts back into balance. It was employed in the early eighties to defend the exchange rate, and again in 1992-93 to provide guidance for another major budgetary correction.

Constructing and using the model requires analytical and technical skills on the part of the economists involved in processing the data and an up-to-date knowledge of the underlying economic reality in order to incorporate it and constrain it reliably in equations and numerical coefficients. Since the model is a highly complex instrument, the results must always be judged critically and assessed for actual use in decision-making.

A major effort is involved not only in the development and use of algorithms but also in the collection, electronic storage and processing of data.

At the start of the seventies, when the development of telecommunications made it possible to create data transmission networks, the Bank of Italy connected the EDP Centre in Rome with its branches throughout Italy. This made it possible to concentrate the banking system's accounts at the Bank, to reform its own accounts and the State Treasury Service, and to have prompt information on the in-payments and out-payments that the Bank effects every day on behalf of the Treasury in all the provinces.

In the sixties and seventies, the centralization of information on banks' credit exposures and the production of uniform credit statistics were the most demanding projects. At the end of the seventies important companies such as Monte Titoli and Società Interbancaria per l'Automazione were established in partnership with banks, with the aim of creating infrastructure and applications for the entire system.

The second half of the seventies and then the eighties saw the development of real-time data processing, relational databases, and the first cross-border links in the payment systems.

Information and communication technology applications were further expanded in the nineties. A new international network now links the central banks of the Eurosystem for the requirements of the common monetary policy; the European payment systems have been interconnected.

The networks led to a quantum jump in the transactions handled by banks and their automated branches; a further advance looms with the changeover from payment cards to the more efficient and secure technology of microchips.

The interbank network is also the carrier for the operations of the screen-based financial markets.

The infrastructure of the payment system and of the screen-based markets fosters competition, lowers the barriers to entry into local markets and constitutes a significant stock of technical capital for Italy as a financial centre, an important factor in global competition.

4. Advanced technologies and the development of the Mezzogiorno

Economic policy guidance in corporate choices may be decisive in strengthening the productive structure.

The conditions exist in Italy for significant progress in advanced sectors and quantum jumps in technology. The endowment of resources must be increased; in the long run this is not a given but the result of investment, which in turn generates saving.

Achieving the benefits that derive from raising the level of knowledge does not necessarily require firms to be large. It depends above all on workers' job-related skills.

Some sectors that are highly knowledge-intensive may also be highly labour-intensive; they are well suited to emerging areas with young and skilled labour resources. The Mezzogiorno, despite its low level of specialization in high-tech sectors, is marked by a significant and not episodic role in important branches of advanced industries.

Growth presupposes fundamental choices to improve the efficiency of productive structures and local markets, as well as to increase the quantity and quality of public services. Supply-side policies are needed for the factors of production to increase their availability, the flexibility with which they can be employed and their productivity.

The development policy and regulatory action of the central government and local authorities must focus on public and private physical capital, social capital and human capital.

Social capital depends on the degree of trust among citizens and between citizens and institutions; adequate personal security and the efficient administration of justice must be assured.

The location in Campania of major Italian and foreign telecommunications companies is a long-standing tradition. The presence since the beginning of the nineties of an important microelectronics company in the province of Catania in Sicily has fostered the development of a technological pole that has had the effect of attracting further foreign investment to the area. Business services provided to enterprises have expanded rapidly in Puglia.

There still appears to be scope for the South to compete at the international and the European levels; there are no evident disadvantages associated with being a “latecomer”.

Business surveys show that, in addition to the possibility of obtaining subsidized finance, one of the main reasons for locating in the South is the availability of human resources with university degrees in scientific and technical disciplines.

The opportunities offered by the European Union’s structural funds have not yet been fully grasped, partly owing to shortcomings in project development and organization. The resources made available by the Community must be used to create the conditions for the expansion of knowledge-intensive sectors.

A lower cost of labour with the same qualifications may prove to be decisive.

Higher technical education, as a form of individual and collective investment in new technologies, is likely to facilitate the take-off of the most innovative sectors; it can also contribute to an acceleration in the growth of traditional sectors.

In a context marked by the geographical fragmentation of economic activities, electronic commerce, by annulling distance, could prove of fundamental importance for entry into new markets and for the establishment of new business relationships. The development of Internet-based business makes it possible to achieve large reductions in transaction costs. Firms are stimulated to arrange for parts of their production processes to be carried out externally and to restrict their activity to the performance of specialized functions.

The growth of electronic commerce depends on several factors: payment systems that are secure, reliable and widely accepted within the on-line economy; safeguards for the security and certainty of transactions; adequate regulation of on-line transactions; rules to protect privacy; and the achievement of a critical mass of transactions.

The availability of human capital able to make use of the new technologies is fundamental.

Recent surveys indicate that the volume of electronic commerce in Italy nearly quadrupled in 1999; nonetheless, the total annual value of on-line transactions is currently estimated at no more than 2.4 trillion lire. The bulk of this turnover, some 2 trillion lire, consists of business-to-business transactions.

Electronic commerce could prove to be a competitive necessity in view of the cost savings it permits.

The tourist industry of the Mezzogiorno is underdeveloped, especially in comparison with the potential of an area that is rich in natural attractions, that is one of the cradles of western culture and that conjures up a host of suggestive memories.

There is a growing demand for leisure and cultural activities in the economically developed countries, where consumer goods are increasingly abundant and life spans increasingly long.

The Mezzogiorno accounts for 41 per cent of Italy's surface area and 36 per cent of its population. The data available indicate that it accounts for 22 per cent of the country's hotel accommodation and 28 per cent of all the other forms of accommodation.

Tourism needs a suitable environment; natural and cultural resources must be easy to visit, security adequate and information widely and effectively disseminated. Cultural assets must be inserted into integrated systems bringing together museums, the theatre, music and art, and advanced services developed for their management.

The southern development programme envisages, with a view to protecting and capitalizing on Italy's artistic heritage and archeological parks, the use of information technology to strengthen international linkages, improve the work of restoration centres and laboratories, and facilitate cataloguing.

5. Italy and international competition

The Italian economy is dominated by small businesses. The 1996 Census showed that 95 per cent of Italian firms had fewer than ten employees, a figure unparalleled in the other leading European countries. The proportion of total employment accounted for by these firms is more than twice the European average.

The abundance of very small firms is coupled with a relative lack of large ones. In 1996 Italy had only 2,600 firms with 250 or more employees; they accounted for 20 per cent of total employment, compared with 37 per cent in France and 40 per cent in the United Kingdom. In Germany, 33 per cent of all employed persons worked for firms with more than 500 employees.

A large proportion of the Italian economy is specialized in the production of traditional consumer goods and services; the presence of technologically advanced industries is much smaller than elsewhere.

The sectors in which Italian manufacturing firms, and in particular small and medium-sized enterprises, are concentrated generate less technological spillover onto other segments of production. Their products tend to have a higher price elasticity than those that are more R&D-intensive.

Italy is one of the few countries in which the importance of traditional industries has increased. Medium-technology industries such as chemicals, electrical engineering, industrial machinery and transport equipment have contracted considerably in Italy, in contrast with the United States and the United Kingdom, but this has not been accompanied by an expansion in the information technology, telecommunications or pharmaceutical industries.

Italian exports reflect the composition of industry. The share of high-technology products is especially low by comparison with the average for the seven leading industrial countries. During the nineties world demand for high-technology goods expanded considerably; during the first half of the decade their share in total Italian exports remained unchanged at around 15 per cent, while in the United Kingdom, France and Germany it rose to 37, 28 and 23 per cent respectively; in the United States it remained above 40 per cent.

Italian research activity in large firms, universities, public research institutions and small high-technology businesses is on a very limited scale by international standards. On the other hand, there is a network of successful small firms, mostly located in industrial districts specializing in traditional products, whose pool of technological know-how expands through informal learning mechanisms in the performance of the various stages of production.

In the medium and long run, the growth potential of an industrial system depends on increasing the number of innovative enterprises. In advanced countries like Italy, where wages are very high by global standards, technological innovation can achieve a level of

competitiveness capable of meeting the challenge of countries marked by a lower level of development and low labour costs. Information and communication technology permits firms to do business successfully in the global market, sometimes with a quite modest level of investment.

Traditionally, a distinction has been made between product innovation and process innovation, but recent empirical studies show that most innovative firms are actually engaged on both fronts. And a third category has been added, "market innovation", which is of an essentially organizational nature. Extensive application of information and communication technology is an indispensable component of all these activities.

6. Research and education

The data on technological activities confirm the sources of Italian industrial weakness. The share of GDP accounted for by public and private-sector spending on research and development is about half the average of the other industrial countries. This type of spending, which constitutes an investment that earns a return only in the medium-to-long run, increased in relative terms in Italy during the eighties; in the early nineties there was a downturn, followed by a modest recovery in recent years. Italy stands out from many other advanced countries for the smaller share of R&D spending funded by businesses.

Patent applications both in the United States and in Europe are dominated by the United States, Germany, Japan and by small countries with major corporate groups, such as Switzerland, Sweden and the Netherlands. In both cases, Italy is towards the bottom of the rankings.

In the years to come, with increasingly open economies, the ability to compete will depend more and more on university education and vocational training and scientific research.

Despite the gains made in the last few decades, the average level of educational accomplishment in Italy remains lower than in the other leading industrial countries; the gap is wider still in terms of university graduates in the sciences. The situation could be improved by the spread of non-university post-secondary diplomas or short-course university degrees.

It is necessary to narrow the gap between southern Italy and the rest of the country in terms of human capital with university training.

The proportion of the employed and unemployed labour force aged from 25 to 34 — that is, the group best placed to bring about a significant advance in the use of the new information and communication technologies — with university degrees in 1998 was much more uniform among the main areas of the country: 10.7 per cent in the South, 11.7 per cent in the North and 12.7 per cent in the Centre. The Bank of Italy's survey of household income and wealth found that 35 per cent of southern university graduates took their degrees in the sciences, compared with 40 per cent in the Centre and 42 per cent in the North. The differences found for graduates in economics and statistics are of a similar order of magnitude.

Universities and research institutes play a fundamental role in basic research. In applied research, 85 per cent of expenditure is accounted for by businesses.

It is necessary to enhance cooperation between universities and firms. An appropriate degree of dispersion in the location of universities and in their specialization is needed to provide true equality of opportunity for young people. Universities and research institutes must be large enough to exploit economies of scale. The educational and training system must turn out the specialists that the market needs and must contribute increasingly to growth and innovation.

A survey conducted by Istat has found that only 6.7 per cent of students graduating in engineering in 1995 were still unemployed in 1998, compared with 38 per cent of those with degrees in law, 34 per cent of those with degrees in letters, and 25 to 30 per cent of those with degrees in languages and psychology.

We need to direct young people towards the fields of study that correspond to the requirements of the world of work, enhance the independence and organizational flexibility of educational and research institutions, increase competition, raise the quality of educational services and improve the performance of the educational system.

The European Union has long recognized the importance of innovation as a means of boosting the competitiveness and growth of industry. Since 1982 Framework Programmes have been used to implement Community policies for research and technology. In general these programmes are directed to applied rather than basic research.

In some countries, such as the United States, France and the United Kingdom, public spending on defence is the main driving force in electronics, information technology and telecommunications.

Radically innovative activity is increasingly systematic and requires adequate resources and organizational capabilities. Technological progress is the fruit of cooperation between a multiplicity of actors. To grasp the opportunities provided by the global circulation of knowledge, there is a need at the national level for efficient organizations able to foster the culture of research and innovation.

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Globalization depends decisively on information technology and telecommunications. It benefits the world economy by facilitating the expansion of investment and the growth of employment where conditions are favourable.

Global finance increases profitability and efficiency; it is a driving force in investment and research, especially in sectors at the frontiers of technology; it facilitates turnover in

corporate control. In the communications field mergers involving major international groups are being prepared. The new companies will operate in the broader multimedia sector, with worldwide implications for economic activity, culture and society.

The central banks of the leading countries and the international monetary institutions are making major efforts to prevent the financial crises that occur periodically in the least stable economies, with sometimes devastating consequences.

We are still far from bringing these phenomena under control.

It is necessary to increase the competitiveness of the Italian economy, especially in the South. Italy has relatively few large enterprises, which can devote more resources to the development of new technologies. Some 220,000 small and medium-sized Italian firms, accounting for around 40 per cent of employment in industry, are located in 200 industrial districts. This local clustering of production allows information, goods and specialized workers to circulate more easily, thereby reproducing to some degree the advantages of the large enterprise.

Widespread and systematic application of information technology can strengthen Italy's productive system. It can lead to a new configuration of the *tableau économique*, of the intersectoral coefficients and relationships that characterize an economy. Samuelson's nonsubstitution theorem of 1949 suggests that the way they are configured is the result not of rigid technological relationships but of a process of optimization within each firm and each sector and between different firms and different sectors.

The new configuration, as can also be seen from the experience with industrial districts, will be marked by a higher level of productivity in the economy as a whole.

This appears to be an analytical framework capable of explaining the large rise in the productivity and potential output of the US economy in the nineties.

The reshaping of the existing arrangements within firms and sectors may prove complex and critical for the weaker and less competitive branches of industry. It is up to each firm to decide which techniques to employ and how to organize its production and structure its relationships with other firms and the market.

It is up to the public sphere to stimulate the reorganization process and govern its effects on the national economy.

Favourable conditions must be created in terms of taxation and, with a view to more extensive application of information technology, especially in terms of labour flexibility.

The ultimate factor in all progress is, in fact, man himself, his ability to look ahead, to plan and to implement.

Cooperation between universities and industry is crucial in the development of new forms of organization and the use of technology imported from more advanced economies.

Italy must invest in human capital, in the intelligence of young people eager to make good, of which the South has a plentiful supply.

The construction of the knowledge society of tomorrow must be directed towards giving work, a future, to young people.

Humanistic culture, an Italian hallmark and especially rich in this part of the country, ensures a *forma mentis* open to creativity and the acquisition of specialized technical know-how.

The gap between the two Italies must be closed. A step increase in the South's productivity and competitiveness, for which efficient public administration, an adequate level of security and acceptable social conditions are also necessary, will bring great gains for the economy and Italian society as a whole.