The Revolution in the Mechanical Engineering Industry

1. Postwar reconstruction

Italy's, it was observed,[1] is the only mechanical-engineering industry to achieve appreciable size without the underpinning of a technically and economically efficient steel industry[2] and with the far-reaching influence, in the course of its development, of political and contingent exigencies. "Two world wars and twenty years of a policy based on national prestige, further aggravated by autarky," had fostered faster development of the industry than of the economy as a whole. Thus, emerging from the war with excess capacity and manpower, it faced enormous problems stemming from war-related destruction, the drastic slump in government orders, the loss of export markets, obsolete technology and poor labour productivity in conditions of monetary instability and incomes sharply reduced by violent political and social conflict.[3]

Like the Italian economy as a whole, the mechanical engineering industry received substantial assistance in modernization from the Marshall Plan aid, with $225 million for purchases of industrial plant and equipment.[4] This appropriation, as we have seen, set in motion other, equally substantial investment. However, organized for war production as it was, the industry found it hard to convert to peacetime output, in part, the *Review* noted, because the government continued to do no more than cover the losses of the state-controlled and the most severely troubled private firms.[5] No detailed account of the state of the industry was available until May 1952, with the findings of a 15-member committe appointed in 1950, chaired by the Minister of Transportation Guido Corbellini, and flanked by a group of experts from the Stanford Research Institute.

The work of the two groups indicated that the output of the mechanical engineering industry was higher in 1951 than it had been on the eve of the war (the production index rose from 100 in 1938 to 123 in 1950 and 130 in 1951[6]), with no corresponding expansion of the work force. The Corbellini Committee found that this expansion of output without an increase in the work force was removing one of the most serious impediments suffocating the industry.

[1] E. Bonomi, "Situation of the mechanical industry in Italy", *Review*, VII, 1 (January 1953), p. 16
[2] *Ibid.*
[3] *Ibid.*, pp. 16-17.
[4] See Chapter I, Section 8.
[5] Bonomi, "Situation of the mechanical industry", p. 17.
[6] *Ibid.*, pp. 19-21.

2. The structure of the industry at the turn of the fifties

With a large number of tiny firms and the evident concentration of production at a few large enterprises, the Italian mechanical-engineering industry was radically different from the American model, according to which optimal organizational and productive efficiency coincided with medium-sized firms (250 to 500 workers) in specialized lines of production. In Corbellini's view, the Italian mechanical industry counted a good number of firms which, while producing on a large scale and employing many workers, deserved mention as examples of good industrial organization. The Stanford Institute experts acknowledged that 17 of the 115 firms visited were well equipped and operated rationally; and only 3 of these had fewer than 500 workers; the others all employed between 2,000 and 20,000.[7]

Both study groups lodged a series of criticisms, however. The large firms were blamed for: a) aggravating instead of simplifying their administrative problems, as a result of their complex structure, lack of administrative flexibility, and political and union pressures; b) producing a great variety of products with highly differentiated production processes and technologies, hence a broad lack of specialization at all levels, and often mediocre products; c) continuing, in some cases, the production of heavy industrial goods even after the war's end, with no plan for acquiring markets, for the sole purpose of winning state orders, while what the domestic market needed was consumer goods and light industrial products. More generally, the entire mechanical-engineering industry was criticized for its small-scale use of specialized suppliers of raw materials, semi-finished goods, equipment, instruments and machine tools, and the poor skills, by international standards, of managers, technicians and workers, even though critics acknowledged that the lack of training was partially made up for by the work force's natural intelligence, ability, adaptability and capacity to learn.

The organization of industrial plants also came in for criticism. Masonry buildings, while cheaper, needed to be replaced by metal frame structures. Location was often poor, preventing expansion; and in many cases there was inadequate cleaning, hygiene, lighting, heating – all factors that affect worker productivity. The internal placement of machinery was also criticized as not conducive to the handling or movement of materials. Neither of the two study groups, however, offered information on the age of the machinery in use. The 1939 census had reported that 52 per cent of Italy's 207,000 planing and grinding machines had been built before 1925 and 26 per cent between 1925 and 1934, and assuredly neither wartime expansion nor the machine tools brought in immediately after the war could have displaced all that 30- and 40-year-old equipment. Yet the American study group, while not failing to note that the machinery simply did not offer the precision attained elsewhere, found much

[7] *Ibid.*, pp. 21-22.

more to criticize in the way it was used.[8] They complained that the industry was generally lacking in all those accessories so helpful to workers in performing their tasks. Both the Italian and American investigators found that casting, forging and pressing were the least modern and mechanized sectors. Foundries still made broad use of manual labour, yet it was also acknowledged that, apart from the high costs, the end results were often of a quality not attained in the other industrial countries.[9]

3. Industry-by-industry analysis

Both the Corbellini Committee and the Stanford group also studied the situation industry-by-industry. The best organized and most efficient was the auto industry, which had acquired a worldwide reputation both for sports cars and for family vehicles. The bulk of Italy's output was by FIAT and Lancia, both in Turin, while Alfa Romeo, Maserati and Ferrari produced a small number of luxury vehicles. The industry employed a total of 35,000 workers, 31,000 at FIAT alone. In 1951, 52 per cent of the industry's machine tools dated from before 1939, 26 per cent from 1939-1944, and the rest from the postwar era. Between 1935 and 1939 average yearly output was 50,619 cars; production dropped to 10,989 in 1946, then recovered to 25,375 in 1947, 44,425 in 1948, 65,379 in 1949, 101,310 in 1950 and 119,267 in 1951. Thus, as early as 1950, output was twice as high as in 1939. The number of cars on the roads rose from 289,174 in 1939 to 425,572 in 1951, but even so not all of the additional output was taken up by the domestic market. Exports, though failing to regain the levels of 1929-1934, nevertheless increased steadily to between 20 and 25 per cent of total output; most of the exports were accounted for by FIAT.

Medium-sized diesel-powered trucks (4 to 5 tons) and heavier ones (7 to 8 tons) and more recently lighter trucks with gasoline engines, as well as buses, trailers and coaches were produced by FIAT, Lancia, Alfa Romeo, O.M. and Bianchi, the latter three being located in Milan. With a capacity of 45,000 to 50,000 vehicles a year, this industry produced 11,777 commercial vehicles in 1938; in 1951 it produced 13,000 trucks and buses, 26,286 trolley-buses, commercial and sundry vehicles using car chassis. The same year 1,891 buses and trucks were exported, plus spare parts.[10] Tractor production also had some importance. In 1938 there were eight firms in this industry. Since the war, output had been essentially directed to farm use, with a total of 42 models, 32 wheeled and 10 tracked. Capacity was 14,000 vehicles in 1950, but only 4,700 were produced, and 8,000 in 1951. Even so, the trade balance was in surplus, exports being 184 per cent of imports.[11] Shipbuilding, however, was a deficit industry.

[8] *Ibid.*, p. 24.
[9] *Ibid.*, p. 25.
[10] *Ibid.*, pp. 25-26.
[11] *Ibid.*, p. 26.

In 1951, with about 45,000 workers and a capacity of 300,000 deadweight tons, the industry was unstandardized and thus not competitive. We shall return to this in more detail later.[12]

The lack of government orders threw the aeronautical industry into a severe slump. It still retained 60 to 70 per cent of its prewar capacity but was seeking to convert to other product such as railway rolling stock, vehicles and the like. The interest in conversion towards railways was sparked by the great dynamism of that sector, which had been one of the most severely damaged during the war. This same impulse had prompted other war industries to convert to railway work. In 1951 there were 56 railway equipment manufacturers, with 63 repair centres and workshops, far more than the market could accommodate, which meant continuous, substantial fluctuations, and, in fact, the work force expanded and contracted depending on orders. In 1951, for example, not counting the workers in the state railways' workshops, the industry work force ranged from 30,000 to 40,000. The fact is that, once repair and construction of rolling stock was completed, the sector was continually threatened with a massive slump, only very marginally attenuated by manufacturing trolleys and other light rolling stock.[13]

Motorcycle manufacturing was also marked by a large number of firms, 59 with 8,000 workers, although just three accounted for 98 per cent of the output. In 1950 Italy produced 45,000 motorcycles, 15 light vehicles and 3,000 vans. A total of 120,000 motor bikes with special frames and engines for motorized bicycles were produced, 85 per cent by five firms. A novelty was the motor scooter. This was an industry with modern equipment for mass production using the assembly line. It counted 7,000 workers and a vast sales network. Output in 1951 came to 200,000 scooters, with exports of no fewer than 60,000.[14]

Italian producers of machines generating power (boilers, steam and water turbines, heavy diesel engines) also carved out a place in the international market, which was their salvation, for their considerable capacity, especially that of the larger firms, could never have survived if it had been left to the mercy of the ups and downs of domestic shipbuilders and hydroelectric and fossil-fuel generating plant.[15] Another industry that performed well in terms of exports was the production of machinery for the textile industry, for all types of fibre, as well as for hats, knitwear and stockings. This sector expanded after the war to 120 firms with the capability of making entire machines and another 150 smaller or larger businesses making accessories. Four companies had over 1,000 employees, but most had under 100. With a capacity of 60,000 tons of machinery, the industry produced around 50,000 tons a year in 1949 and 1950, with exports of between

[12] *Ibid.*, pp. 26-27. Capacity was 280,000 tons in 1940 but dropped to 200,000 in 1946. Thanks to reconstruction, it recovered to 300,000 in 1951.

[13] *Ibid.*, p. 27.

[14] *Ibid.*, pp. 27-28.

[15] *Ibid*, p. 29.

12 and 14 billion lire, much more than in 1938.[16] The sewing-machine industry also turned in a trade surplus. Having overcome foreign dominance during the twenties, in the thirties this industry became a solid exporter; and it strengthened its position on foreign markets following the Second World War. With a score of firms and 12,000 workers, it was working at between 60 and 70 per cent of capacity. In 1951 output amounted to some 330,000 machines; exports totalled 53,000 complete machines, with 62,000 units for home use.[17]

Another of Italy's regular exporting industries was the manufacturing of machines for paper-making and printing, binding and photo reproduction, as well as type and printing plates. Large presses, offset printers and other two colour printers were not yet manufactured in Italy, however, and so were imported. However, the production of type-setting machinery had been successfully introduced. Overall, the sector counted some 150 firms, just one with more than 500 workers and another 12 with more than 50; all in all there were 5,000 to 6,000 workers. Another 25 firms produced related articles (inks, cogs, rolls, etc.); 20 more were engaged in repair and rehabilitation of worn machinery. In 1950 output of printing machinery amounted to around 4,000 or 5,000 tons. Production of binding and paper-making machinery amounted to 2,000 tons, that of printing machines for 1,000. The total value was 7.0-7.5 billion lire, or 80 per cent of capacity; half was exported and half sold domestically.

Another export industry, with a good reputation abroad, was office machinery, which, as the two study groups noted, enjoyed good technical efficiency and had been mechanized since the end of the war. It counted 20 firms, four of which had between 500 and 3,000 workers; one, with more than 3,000 workers, was vertically integrated for lack of accessory industries. In 1951, operating at 90 per cent of capacity, the Italian industry produced some 120,000 typewriters (the index rose from 100 in 1947 to 170 in 1950) and 47,000 adding machines (index at 318, from 100 in 1947). These were high-quality products at internationally competitive costs, and the industry had a good sales network, succeeding in exporting about half its output; the total value of production was 10 billion lire, with a trade surplus of around 7 billion.[18]

The electrical machinery industry was also expanding. It now consisted of 400 firms and 90,000 workers. Cables and conductors accounted for 20 per cent of total output, large machines for 19 per cent; instruments for telephone and telegraph services, 15 per cent; high and low voltage instruments, 10 per cent; and sundry other articles, 36 per cent. Total output in 1950 was valued at 176 billion lire, 12 per cent of which was exported. Many producers worked under foreign licences, while others were subsidiaries of foreign companies. Scientifically up-to-date and technologically advanced, they were successful in markets abroad.[19]

[16] *Ibid.*, pp. 28-29.
[17] *Ibid.*, p. 29.
[18] *Ibid.*, p. 30.
[19] *Ibid.*, p. 32.

Industries that had trouble in gaining success included the machine-tool industry, which produced various machines but many of mediocre quality, so that some types had to be imported. In 1951 there were 140 firms; 40 of these, operating on an industrial scale and with modern machinery, accounted for 80 per cent of total capacity. But not even half this capacity was utilized, and owing to substantial Marshall Plan and other subsidized imports from America, the sector ran a considerable trade deficit.[20] Another deficit industry was optical and precision instruments. Largely dependent on military orders, the industry exported 30 per cent of its output but, given the lack of an active domestic market, this permitted only partial utilization of plant and of its 14,000 workers.[21] The manufacture of agricultural machinery also proved uncompetitive. There were some 250 artisanally organized production faciities; six of these had over 200 workers and another hundred had between 30 and 100. Prices were 20 to 30 per cent higher than in Britain and 40 or 50 per cent higher than in West Germany.[22] The construction, roadbuilding and mining equipment manufacturing industries also had difficulty exporting.[23]

4. Obstacles to development

Enrico Bonomi's lengthy and detailed analysis made it clear that the development of the Italian mechanical engineering industry faced a number of obstacles in the immediate postwar years. The most serious drawback here, as with the development of Italian industry generally, was high production costs.[24] Yet cutting costs required not only better produtive organization but also the removal of other obstacles, such as the high cost of borrowing, the costliness of Italian steel, and higher fuel costs,[25] heavy taxation and intermittent labour conflict. These adverse factors were at best mitigated by lower labour costs than in the other industrial countries,[26] but this advantage was further undermined by the burdensome social obligations of Italian firms.

Per worker social contributions in the mechanical industry amounted to 0.6 per cent of wages in Sweden, 2.5-3 per cent in Britain, 5 per cent in Denmark, 2-6 per cent in Switzerland, 10-12 per cent in West Germany, and 18.3 per cent in Belgium. The Italian levy, in Turin, Milan and Genoa, ranged from 22.2 per cent for a skilled worker to 29.3 per cent for those at the contractual minimum. Only France had a greater incidence, at 34.8 per cent.[27] Things had been

[20] *Ibid.*, p. 28.
[21] *Ibid.*, pp. 30-31.
[22] *Ibid.*
[23] *Ibid.*, p. 31.
[24] E. Bonomi, "Situation of the mechanical industry in Italy", *Review*, VII, 2 (March 1953), p. 107 *et seq.*
[25] The difference between steel and coal prices in Italy and those in the U.S., France and the U.K. was large enough to put the Italian mechanical engineering industry out of the market. *Ibid.*, pp. 104-105.
[26] *Ibid.*
[27] *Ibid.*, p. 109.

worsened in Italy by the law of 4 April 1952, which raised premiums for disability, old age and survivors' insurance, from 18.2 to 24 per cent. The hardest hit industry was mechanical engineering, especially the large firms.[28]

5. More years of growth, with old and new protagonists

Bonomi published his series of articles in 1953, as the modernization of the Italian mechanical industry was just getting under way. Notwithstanding persistent obstacles and difficulties, the industry continued to progress during the fifties, and by the first half of 1956 the production index had risen to 226, compared with 105 in 1948.[29] One by one, some of the most illustrious prewar firms shut down, such as Caproni, Isotta-Fraschini, and the old Breda company, while newcomers made their appearance. It is thus instructive to examine the performance of the industry sector by sector.[30]

6. Motor vehicles

The automobile industry retained all of its importance and continued to advance in close connection with rising living standards, which brought the number of cars on the roads from 391,121 in 1939 to 1,259,211 in 1955 and 1,642,925 in 1957. In 1959 Rodolfo Biscaretti di Ruffia stressed that, while output of commercial vehicles had barely doubled between 1937 and 1958, that of passenger cars had risen more than sixfold, from 61,366 to 369,009; and 50 per cent of the new cars in 1958 had engines rated at no more than 600 cubic centimeters.[31] With 80,000 workers in 1958, the sector still consisted mainly of FIAT (90 per cent), and was entirely located in northern Italy: Turin (FIAT and Lancia), Milan (Alfa Romeo), Brescia (O.M.), Desio (Autobianchi). The manufacturers of parts for cars and commercial vehicles were also all located in the North (Turin, Milan, Varese, Venice and the Emilia region).

Exports continued to perform strongly. In 1958, the first year of full application of the Common Market, when customs tariffs were cut by 10 per cent, exports rose to 170,000 vehicles, including 80,000 to the rest of the EEC (especially West Germany, which took 70,000) and 31,000 to the U.S, where further growth was hampered, however, by the lack of post-sales service (repairs, spare parts, etc.).[32] Output of commercial vehicles also rose, from 16,342 in 1937 to about 36,000 in 1958. Over the next few years even greater progress was

[28] *Ibid.*, pp. 109-110.
[29] F. Mattei, "L'industria italiana nel dopoguerra", in *L'economia italiana nel decennio 1947-1956 Review*, special tenth anniversary issue, 1957, pp. 75 *et seq.*
[30] *Ibid.*, pp. 71-72.
[31] R, Biscaretti di Ruffia, "Situation and prospects of the Italian motor industry", *Review*, XIII, 3 (May 1959), pp. 273-77.
[32] *Ibid.*, pp. 275 *et seq.*

made, thanks to massive technological innovation with the introduction of machine tools and a good deal of automation, the installation of new assembly lines, etc. While the production of commercial vehicles increased slowly (65,445 in 1961, 68,933 in 1962, 75,245 in 1963), that of passenger cars soared to 877,860 in 1962 and 1,105,291 in 1963. In 1964, despite a decline of 100,000 in the number of cars made, owing to a countercyclical sales tax, the value of Italian automobile production amounted to 1,000 billion lire, 3.5 per cent of the national income and about 10 per cent of total industrial production.[33] This extraordinary growth made FIAT-O.M. the world's fifth-leading producer, behind General Motors, Ford, Chrysler and Volkswagen, and ahead of such names as BMC, Opel, British Ford, Renault, Citroën-Panhard and Toyota.[34]

Exports of 313,088 passenger cars and 18,034 commercial vehicles in 1964 accounted for 30.38 per cent of total output; 47 per cent of the sales abroad went to the EEC. West Germany was the leading outlet, with 24 per cent, followed by France, Belgium, Argentina, the Netherlands and Yugoslavia. Exports to the United States declined to 10,000, compared with 48,000 in 1959, perhaps because of the inability to create an efficient customer assistance network, but mainly because of a powerful U.S. counter-offensive against the European motor vehicle industry. Fearing that this attack threatened the survival of the smaller corporations,[35] the EEC encouraged mergers within the industry. In France the producers of commercial vehicles merged while agreements were effected between Alfa Romeo and Renault, between Peugeot and Citroen, and between Citroen and the West German NSU. In West Germany, Mercedes and Volkswagen agreed to save Auto Union DKW. As to FIAT, while it was building assembly plants in Argentina, Egypt, Morocco, India and South Africa and a good part of Spanish and Austrian motor-vehicle production was under Italian licence,[36] the corporation also engaged in various forms of cooperation with other Italian manufacturers, most notably that with Società Bianchi. Mergers occurred outside the EEC as well. In the United Kingdom, Austin and Morris merged to form British Motor Corporation (BMC); Jaguar took over Daimler and Guy Motors; and Leyland took over Triumph. In Japan, Nissan merged with Prince.[37]

7. Motor scooters

The revolution in the car and truck industry was accompanied by another phenomenon that cannot be ignored: the revolution in the two- and three-wheeled vehicle industry, including bicycles. The first to resume production on

[33] H. Biscaretti di Ruffia, "Situation of the Italian motor industry in the middle of 1965", *Review*, XIX, 5, (September 1965), p. 368.
[34] *Ibid.*, p. 364.
[35] Though Biscaretti di Ruffia maintained that programmes and policies of specialization could ensure their survival; *Ibid.*, pp. 371-72.
[36] *Ibid.*, pp. 369-73.
[37] *Ibid.*, pp. 372-373.

a large scale after the war was the bicycle industry; Italian bicycle manufacturers had already enjoyed a good international reputation in the interwar years, thanks to their special qualities. In 1963 the industry's exports amounted to some 5 billion lire, and output reached 840,000 bicycles in 1964.[38] Obviously, however, the real revolution here was the modification of the bicycle to take a small motor and the invention of the motor scooter. Conceived during the war, the scooter first went into production at the Piaggio factory in Pontedera, Tuscany, once peace had been restored. The motor scooter was launched in 1946. The "Vespa", as it was baptized, was a success, both domestically and abroad, and Piaggio was joined by other companies when Innocenti's Lambretta model soon rivalled the Vespa.

For a decade Italian manufacture of motor bikes and scooters, two-wheeled, three-wheeled and even four-wheeled, grew with extraordinary speed, spearheaded by the Vespa and Lambretta models. They were a sales success abroad as well, with manufacture under licence in Britain, West Germany, France, Spain and elsewhere. By 1956 Italy had 2 million scooters on the roads and by 1963, over 3 million. Motor bikes numbered 750,000 in 1956 and 1.3 million in 1963.[39] Motor bike output increased from 160,000 in 1961 to 289,500 in 1963, but the trend in scooter production was less regular. The production of light scooters, up to 125 cc engine capacity, peaked at 255,000 in 1961, then dropped to 210,000 the next year and 180,000 in 1963. That of larger scooters amounted to 221,700 in 1961 and 198,800 in the recession year of 1962, but rebounded to 203,400 in 1963. Including three- and four-wheeled scooters, total output was 529,000 in 1961 but declined to 436,820 in 1963.

About a fourth of this production was exported, the main customers being the United States, Venezuela, West Germany, Uruguay and Libya.[40]

8. Farm machinery

By now, not only experts and government authorities but also farmers were convinced that agricultural modernization and progress had to come largely from mechanization, and the demand for farm machines was growing exponentially. Thus, after tripling between 1948 and 1956, the number of tractors working in Italy increased still more steeply in the years that followed.[41] At the end of 1964, two years after the passage of the ten-year farm plan, which provided special subsidies for the purchase of tractors and other farm equipment, the number of working tractors was 377,107: 74 per cent were Italian-made; non-mobile farm motors numbered 268,950. There were also 12,254 combine-

[38] L Glarey, "The cycle and motor cycle industry in Italy", *Review*, XIX, 5, (September 1965), pp. 376-83.
[39] Mattei, "L'industria italiana nel dopoguerra", pp. 83-84; Glarey, "The cycle and motor cycle industry", p. 380.
[40] *Ibid.*, p. 378.
[41] G. Nasi, "Farm machinery", *Review*, XIX, 5 (September 1965), pp. 386-87.

harvesters (reaper-threshers), 75,677 mobile tractors, 11,228 multi-purpose farm vehicles, 207,816 mechanical reapers, and 25,876 mechanical hoeing machines.[42]

The sharp rise in demand was met by an equally sharp increase in production. The number of tractors produced rose from 2,000 in 1945 to 12,000 in 1952, 28,000 in 1957, 43,000 in 1960 and 53,000 in 1964. The industry had gradually narrowed, but not closed, the gap separating it from such Common Market rivals as West Germany and France and, outside the EEC, Britain. Some 300 firms of various sizes composed the industry, plus a large number of artisanal workshops that repaired farm machinery or adapted it to local needs. Nevertheless, 90 per cent of all tractors were produced by just 5 firms. Nearly all producers were located in Emilia, Lombardy and Piedmont. The sector employed over 45,000 workers and had an output of 185 billion lire; 80 per cent of its product was sold domestically, 20 per cent exported.[43]

9. Shipbuilding

The difficulties of Italian shipbuilding in 1951 have been mentioned.[44] The industry hinged on eight large groups,[45] all government-owned, and a number of small yards building or repairing iron ships. Before the war, productive capacity for vessels of at least 10,000 deadweight tons, for dry cargo, amounted to 280,000 gross tons a year; employment was more than 50,000 workers. The shipyards of Istria and Fiume (Rijeka) were lost during the war. Those left to Italy were reorganized through mergers and divestitures, and eight major groups still survived. Such illustrious names as Odero-Terni-Orlando had disappeared (taken over by Ansaldo), while the Piaggio group had split into Cantieri Riuniti (Palermo and Ancona) and Cantieri del Tirreno (Riva Trigoso). A division of the Tosi group established Società Cantieri di Taranto.

With reorganization and modernization, thanks to substantial investment, Italy had more than recouped its prewar yearly shipbuilding capacity, with a potential output of 300,000 tons. Nevertheless, Italian shipyards were unprepared for international competition. The tonnage launched in 1951 was no more than a third of the industry's capacity, so a new effort, with new investment, was made to boost productivity and cut costs. The main recipients of investment were the Cerusa-Voltri yards of the Ansaldo group, San Rocco of Trieste, Società dei Cantieri dell'Adriatico and Navalmeccanica of Naples. Other investments, subsequently, went to Pietra Ligure (Società Cantieri del Mediterraneo) and Taranto (Società Cantieri di Taranto), and eventually to all the major producers.

[42] *Ibid.*

[43] The main export markets were France, Australia, Denmark, Turkey, the Netherlands, Belgium, Switzerland, Spain, West Germany and the United Kingdom.

[44] See Section 3 above.

[45] Ansaldo, Odero-Terni-Orlando, Navalmeccanica, Piaggio, Tosi, Breda, Cantieri Riuniti dell'Adriatico, and Cantieri del Quarnaro. See G. Tupini, "Some remarks concerning the Italian shipbuilding industry", *Review*, XVI, 6 (November 1962), pp. 484-85.

Within a few years, as Tupini noted, Italian shipyards had been perceptibly transformed to adapt, in terms of size and specialty, to the changing needs of maritime transport. In the oil sector, for instance, 20,000 deadweight-ton tankers were now too small, and shippers demanded vessels of 50,000 and 60,000, or even 130,000 tons. Engine manufacturers now had to offer power plants that could propel these new ships not at 14 knots, as in the past, but at 17 knots or better. In July 1954 a law granted the shipbuilding industry supplementary government payments for the construction of new ships and the repair or refitting of those in service.[46] Even so, the recovery proceeded haltingly from 1951 to 1956. Launch tonnage was 263,000 tons dwt in 1953 but fell to 162,000 in 1954 and 167,000 in 1955. Not until 1956 was a real gain made, with launchings of 358,000 tons, and output peaked in 1958 at over 550,000 tons; the subsequent decline brought launchings down to 331,000 tons in 1961.[47]

Thanks in part to excess global capacity, shipbuilding was an industry marked by lively, aggressive international competition. Italian yards needed constant infusions of resources to respond to ever-changing demand; losses were frequent and sometimes sizable. Great expectations accompanied the formation of the EEC; it was hoped that this would cut the cost of steel and other raw materials while broadening the market for Italian ships. Yet radical restructuring of the industry could no longer be deferred, with a reduction in manning levels to keep step with technical and technological advances. In 1962, after a number of fruitless attempts, it was agreed that a programme of actions was the only way to prevent a contraction of output and substantial redundancies. In 1962, in the midst of a huge world-wide shipbuilding slump, Tupini, chairman of the board of Fincantieri, wrote that "the evils besetting the shipyards cannot be cured with improvident and dilatory remedies or by defending formulas that have become obsolete in a period of rapid technical and economic evolution which makes adjustment imperative and presents new opportunities regarding the mobility and employment of manpower".[48]

10. Machine tools

As was clear from Bonomi's lengthy analysis, the Italian machine- tool industry was quite backward.[49] With its modest output (24,400 tons) it struggled along until 1955, when it initiated an expansion that continued, with fluctuations, until 1963 (100,000 tons). In the mid-sixties the machine-tool industry, like others, felt the impact of labour strife, and output fell to 79,000 tons in 1964 and 49,000 in 1965. In 1966 (64,700 tons) and 1967 (104,000) output resumed its upward

[46] *Ibid.*, p. 487.

[47] *Ibid.*

[48] *Ibid.*, p. 490.

[49] Bonomi, "Situation of the mechanical industry", p. 28.

[50] M. Bruniera, "The Italian machine tool industry", *Review*, XXIII, 5 (September 1968), p. 356.

trend.[50] These ups and downs reflected the machine-tool industry's nature as what one observer called "a highly sensitive barometer measuring the degree of general economic development".[51] Vast in its range of products (lathes, drills, milling machines, planing machines, grinders, etc.), the industry was fragmented, with a myriad tiny firms. In 1962 there were 550 companies with 25,000 employees.[52] The bulk of this array of producers (66 per cent) were located in Lombardy, in the provinces of Milan, Brescia and Varese; another 20 per cent were in the province of Turin.[53] Both economic fragmentation and geographical concentration reflected the historical course of Italian industrialization, as the machine-tool industry is, like steel production, energy use, the road network and other economic infrastructures, itself an indicator of a country's degree of industrial development.[54] In fact, the first Italian machine tools were produced in 1880, when Maserta displayed his first large planing machine in Turin. But this was a spasmodic appearance, without lasting consequences. Not until 1898, with industrialization now fully under way in the Genoa-Turin-Milan "triangle", did Italy have the Schleifer milling machine and not until 1925 was it produced in quantity, and with quite a fine tolerance. Between the wars, under the regime of autarky, substantial progress was made. In 1942 more than 20,000 workers were employed in machine-tool production.[55]

The expansion that began in 1956, once the initial postwar difficulties had been overcome, made Italy one of Europe's leading producers from 1960 onwards. In 1964, for the first time ever, the industry recorded a trade surplus[56]; the best customers were, in order, Argentina, the United States, France, West Germany, and Switzerland.[57] Domestic consumption had also expanded considerably in the meantime, supplied in part by imports.[58] By 1967 Italy was Europe's fourth leading producer, behind West Germany, the U.K. and France,[59] and the world's eighth (behind the United States, the Soviet Union, Japan and Czechoslovakia).[60]

In 1970 output reached 170,000 tons, and the sectoral trade surplus continued to widen. Things changed in 1971, however, not just because of recession and the introduction of VAT, which caused great concern among businessmen,[61] but, above all, because of technical change. New machines were required, such as large engines, vertical lathes, rotating rolling mills for reamers, presses, etc.

[51] M. Bruniera, "The Italian machine tool industry", *Review*, XXIII, 5 (September 1968), p. 356.
[52] Bruniera, "The Italian machine tool industry", p. 360.
[53] Marzano, "The Italian machine tool industry", p. 110.
[54] Bruniera, "The Italian machine tool industry", p. 353.
[55] *Ibid.*, pp. 363-64.
[56] *Ibid.*, p. 356.
[57] Marzano, "The Italian machine tool industry", pp. 111 *et seq.*
[58] Bruniera, "The Italian machine tool industry", p. 356.
[59] *Ibid.*, p. 359.
[60] *Ibid.*, p. 360.
[61] G. Conti, "Situation and prospects of the Italian machine tool industry", *Review*, XXVI, 2 (March 1972), p. 125.

weighing over 100 tons. Only large and complex enough companies could produce them. Furthermore, machines were needed capable of numerical control on all operations performed by machine tools. For modern processes, the industry now needed continuous infusions of new technical know-how.

In 1977 Angelo Girola, president of UCIMU, the industry association since 1945, noted that "the Italian machine tool industry ha[d] already reached the stage of full development and [was] oriented towards increasingly sophisticated products".[62] Thus the greatest component of overall production costs was not that of raw materials or semifinished goods but of labour, which accounted for 40-45 per cent of the total, as against 10 per cent for the other items.[63] Tightly bound as it was to the technological advances being made in the course of industrial development, the machine tool industry also absorbed the results of research on materials and promptly replaced standard materials with new ones as they became available.

Despite the technical gains, the industry was still highly fragmented at the end of the seventies, with some 450 firms, flanked by hundreds and hundreds of small factories, sometimes little more than artisanal workshops. Some 75 per cent of total Italian machine tool output, and 80 per cent of its exports, was the work of 150 firms.[64] Workers now numbered 37,000, as another sign of the industry's considerable expansion. Even so, with so many companies the average firm was small in size, just 82 workers compared with 270 in the U.K, 225 in the United States, 188 in France, etc.[65] Girola contended that this did not damage Italian companies but helped the industry, sheltering it from cyclical ups and downs.

Certainly, firms were reluctant to expand their work forces. When faced with rising demand that would require additional hiring, many machine-tool makers, finding it hard sometimes to find qualified workers who could maintain their companies' good name and efficiency, significantly preferred not to hire but to contract part of the work out to other factories and deploy their own workers in the more delicate phases of design, assembly and control.[66] The domestic market for machine tools was composed of over 10,000 mechanical engineering firms with at least 20 workers each. At the end of 1975 this group of firms had 541,159 metal-shaping or cutting machines, of which 75.5 per cent were metal cutters. This proportion was the same as in 1967; the comparable figures were 76 per cent in France (1974) and 85 per cent in the UK (1971).[67]

[62] A. Girola, "Machine tools: Advanced technology for Italian industry", *Review) vol. XXXI, n.* 4-5 (July-September 1977), p. 223.
[63] *Ibid.*, p. 221.
[64] *Ibid.*, p. 225.
[65] *Ibid.*, p. 222.
[66] *Ibid.*, pp. 223-24.
[67] *Ibid.*, p. 227.

Most interestingly, with southern industrialization the share of machine tools used in the South rose from 13 per cent in 1967 to 18 per cent in 1975. From 1972 through 1975, of every four machine tools manufactured, one was installed in a southern firm. The advance in metal-shaping machines was even stronger, from 4.4 per cent in the South in 1967 to 8.4 per cent in 1975. The proportion of numerically controlled machines was higher in the North and Centre, however.

Another significant trend was the decentralization of the industry. While the proportion of the industry located in Liguria, the Veneto and Emilia did not change between 1967 and 1975, that located in Piedmont declined from 24.3 to 19.4 per cent and that in Lombardy from 38.9 to 37.3 per cent. The share located in Trentino and Friuli increased.[68] This redistribution coincided, after 1972, with a decline in investment and a contraction of domestic demand. But the brunt of the decline was borne by imports, whose share of total sales dropped below 30 per cent for the first time in over a decade, to 28.7 per cent.[69] Internationally, Italy remained fifth in both production and exports. In 1976 world trade in machine tools contracted by 10 per cent, however, and the share of Italian output exported dropped from 52 to 49 per cent in volume terms and from 49 to 48 per cent in value, although the industry still recorded a trade surplus of 175 billion lire.

France remained the main export market, but there was a perceptible shift towards Eastern Europe, Romania in particular, which trebled its purchases, and a still more pronounced shift towards Latin America, especially Argentina and Venezuela, and the Middle East. Exports to Iran, Turkey and Sweden also increased, from 3.7 to 10 billion lire. The outlook for 1977 was good for exports to the industrial countries and to some developing countries, but not so good for the domestic market.[70]

11. The electronic and electrical industry

Electronics was a new industry and in 1961 was in rapid expansion in Italy, as Leopoldo Marzano noted. To be sure, Italy was behind, but it was gaining ground, despite the fact that the industry had more than doubled in Europe in ten years. In the United States it had expanded three-and-a-half times, and Japan had achieved a growth of that magnitude in just four years. Not only did electronics involve a variety of products and types of activity but it also affected the activities of other industries, altering technology and growth. Marzano divided electronic products into five major groups: i) home consumer goods; b) military materials and equipment; iii) telecommunications equipment; iv) measurement and control instruments; and v) spare parts.

Aside from home consumer goods (radio and television sets, etc.) and telecommunications, for which Italian industry had long been equipped, electronics

[68] *Ibid.*, pp. 227-28.
[69] *Ibid.*, p. 237.
[70] *Ibid.*, pp. 237-38.

established itself in the sectors of industrial machinery (with such producers as Perego, Sindel and Marelli), in computers (Olivetti and IBM), and in spare parts (Microlambda, RCA, Marconi Italiana and Società Generale Semiconduttori).[71]

Extremely sensitive to innovation, the companies engaged in electronics production tended to extend their range of products where electronics was involved. Small factories, almost artisanal workshops, worked side by side with huge industrial complexes, but in Italy, as elsewhere, the bulk of output (60 to 70 per cent) was accounted for by a limited group of large firms.

The electronics industry thus had very good prospects for growth, as was indicated by Italy's low consumption of electronic products in relation to GDP by the standards of such countries as the United States or Japan.[72] And this was so, despite the fact that the Italian industry, unlike the Japanese, was still scientifically and technically dependent on America, which seriously limited its possibilities of expansion.[73]

Nevertheless, output increased by 192 per cent between 1955 and 1966, thanks to substantial investment (which rose by 70 per cent) and staff expansion (43 per cent). Consumption increased by 176 per cent, imports by 370 per cent, and exports even more sharply, by 760 per cent.[74]

The electronics sector was growing at a much faster pace than the electrical industry. While the former expanded at an average annual rate of 20 per cent between 1955 and 1959, the latter gained 12 per cent per year.[75] Some segments grew more rapidly than others, however. During those years, production of generators and materials for energy transmission increased by just 6 per cent per year; output of industrial equipment gained even more slowly, just 1 per cent a year, while electrical equipment for motor vehicles gained at a pace of 12 per cent p.a. Only two segments significantly outperformed the industry as a whole, and these corresponded to soaring consumption: telecommunications equipment (with annual growth of 19 per cent) and consumer goods (refrigerators, washing machines, musical instruments, record players, tape recorders, etc.), which expanded at 27 per cent a p.a.[76]

12. Office machines

The industry in which electronics made a particularly successful entry was that of office machinery. An article of Roberto Olivetti's[77] recounted the great

[71] L. Marzano, "The electronic industry in Italy", *Review*, XV, 6 (November 1961), p. 510.
[72] *Ibid.*, p. 520.
[73] *Ibid.*, p. 527.
[74] L. Baggiani, "Situation and prospects of the Italian electronic industry", *Review*, XXI, 5 (September 1967), pp. 420-21.
[75] Marzano, "The electronic industry in Italy", pp. 513-14.
[76] *Ibid.*, p. 513.
[77] R. Olivetti, "The office machine industry in Italy: The present situation and prospects", *Review*, XXI, 6 (November 1967), pp. 471-75.

transformation of the industry since the war with the introduction of data processing equipment, an innovation that may not have eliminated the machines already in use but did require many substantial modifications. Manual typewriters and adding machines were gradually supplanted by electric ones, much less tiring to operate. Moreover, a line of smaller typewriters was introduced and met with considerable success. Calculating machines also made progress, going beyond addition and multiplication to perform a variety of operations. In the early sixties the product line added the desk calculator. Then came accounting machines, which linked calculations to specialized functions such as the registration of accounting items and the compilation of the related documents; photostatic copiers that could copy documents, rapidly produce multiple copies, and copy at a distance via telephone; plus files, file boxes, cash registers and the like.

The industry evolved constantly from 1945 onwards. Production of standard and portable typewriters, which had been about 40,000 a year before the war, went above 117,000 in 1950, then rose to 344,000 in 1956, nearly 641,000 in 1961 and 715,000 in 1963.[78] Of the two, portables accounted for the lion's share.[79] As Olivetti noted, in typewriter manufacture Italy had overtaken all its main competitors: Germans, British and Americans.[80]

Comparable growth was achieved in calculators. In 1950 total output (embracing those with a printing function and those without) was scarcely 47,000. In 1960 418,000 machines were produced, in 1961 over 619,000, in 1962 more than 714,000, in 1963 721,000. By then non-printing calculating machines had been almost completely supplanted by printers. Of the 1963 output of 721,000 machines, lss then 6,000 lacked the printing function.[81]

Italy recorded a growing trade surplus on typewriters: 3 billion lire in 1950, 10 billion in 1960, over 20 billion in 1965 and 21 billion in 1966. Calculators also produced a growing surplus (except for a deficit of 468 million lire in 1950): net inflow of 5 billion lire in 1955, over 29 billion in 1960, nearly 43 billion in 1965 and 52 billion in 1966. Though trade in other office machines remained in deficit for many years, scoring its first surplus in 1966,[82] the overall balance was regularly positive for Italy, with a surplus rising from 2 billion lire in 1950 to over 60 billion in 1965 and 79 billion in 1966.[83] In short, between 1950 and 1966 Italian typewriter exports increased ninefold in volume and sevenfold in value; those of calculators, 28-fold and 25 fold, respectively.[84]

At the centre of this enormous expansion was the Olivetti corporation, whose relative importance steadily increased. In 1950 Olivetti accounted for 78 per cent

[78] *Ibid*, p. 476.
[79] *Ibid.*
[80] *Ibid.*, p. 475.
[81] *Ibid*, p. 477.
[82] *Ibid.*, p. 478.
[83] *Ibid.*, p.474.
[84] *Ibid.*, p. 479.

of typewriter production and 52 percent of calculators; in 1966 the shares were 82 and 76 percent. Olivetti employed 78 percent of the industry's work force. The company's success was the consequence not only of the quality and variety of its products and its competitive prices, its efficient sales network and the integration of computers into traditional mechanical technology, but also and above all of the enormous expansion of industry and services everywhere, together with trade liberalization. Olivetti's importance went well beyond Italian and even European confines. Aside from its domestic production plants, it had facilities in Britain, Spain, the United States, Argentina, Brazil and Mexico. The corporation had won a dominant position within the industry.[85]

13. Sewing machines

Having taken hold in Italy following the First World War, by the end of the Second the sewing machine industry[86] had a product line distinguished by high quality and elegant design. Six companies accounted for 95 percent of the machines produced, having gradually taken over virtually all the smaller firms. They were located in Lombardy (Milan, Monza, Pavia). Although they produced all the components themselves, these factories had not neglected to specialize. One made only sewing machines for large industry. Others produced only spare parts. Still others specialized in electrical motors for sewing machines.[87] Most of the machines produced were for home use, but they had substantial markets abroad as well as domestically, especially in the United States.

About 89,000 sewing machines were produced in 1947; output then rose to 430,000 in 1954, 472,000 in 1959, 498,000 in 1961, 537,000 in 1963 and 671,000 in 1966. Exports, too, increased, though with some ups and downs: 89,000 machines sold abroad in 1950, 147,000 in 1959, 166,000 in 1962, 203,000 in 1963, and over 473,000 in 1966.[88]

With such substantial exports, while even in the worst years imports never exceeded 53,000 machines and in most years were considerably lower, the industry had a steadily mounting trade surplus: from 2 billion lire in 1950 to over 6 billion in 1963.[89] Yet the entire industry was threatened by the emerging competition of Japan, where sewing machine production rose from 299,000 in 1949 to 2,572,000 in 1959 and 3,473,000 in 1963. The Japanese manufacturers, even with exports of more than 2 million machines that year, continued to press for access to the Italian market at prices less than half the Western average.[90]

[85] *Ibid.*
[86] G. Manidi, "Situation and prospects of the Italian sewing machine industry", *Review*, XXI, 6 (November 1967), p. 499.
[87] *Ibid.*, p. 500.
[88] *Ibid.*, pp. 500-01.
[89] *Ibid.*, pp. 501-03.
[90] *Ibid.*, pp. 498, 504.