5. Social, Organizational, and Individual Impacts of Automation

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Society and information from the evolutionary early beginnings. The revolutionary novelties of our age: the possibility for the end of a human being in the role of draught animal and the symbolic representation of the individual and of his/her property by electronic means, free of distance and time constraints. As a consequence, changing human roles in production, services, organizations and innovation; changing society stratifications, human values, requirements in skills, individual conscience. New relations: centralization and decentralization, less hierarchies, discipline and autonomy, new employment relations, less job security, more free lance, working home, structural unemployment, losers and winners, according to age, gender, skills, social background. Education and training, levels, life long learning, changing methods of education. Role of memory and associative abilities. Changes reflected in linguistic relations, multilingual global society, developments and decays of regional and social vernaculars. The social-political arena, human rights, social philosophies, problems and perspectives of democracy. The global agora and global media rule. More equal or more divided society. Some typical society patterns: US, Europe, Far East, India, Latin America, Africa.

Automation and closely related information systems are, naturally, innate and integrated ingredients of all kinds of objects, systems, and social relations of the present reality. This is the reason why this chapter treats the phenomena and problems of this automated/information society in a historical and structural framework much broader than any chapter on technology details. This process transforms traditional human work, offers freedom from burdensome physical and mental constraints and freedom for individuals and previously subjugated social layers, and creates new gaps and tensions. After detailed documentation of these phenomena, problems of education and culture are treated as main vehicles to adaptation. Legal aspects related to privacy, security, copyright, and patents are referred to, and then social philosophy, impacts of globalization, and new characteristics of information technology–society relations provide a conclusion of future prospects.

5.1 Scope of Discussion: Long and Short Range of Man–Machine Systems

Regarding the social effects of automation, a review of concepts is needed in the context of the purpose of this chapter. Automation, in general, and especially in our times, means all kinds of activity perfected by machines and not by the intervention of direct human control. This definition involves the use of some energy resources operating without human or livestock physical effort and with some kind of information system communicating the purpose of automated activity desired by humans and the automatic execution of the activity, i. e., its control.

This definition entails a widely extended view of automation, its relation to information, knowledge control systems, as well as the knowledge and practice of the related human factor. The human factor involves, practically, all areas of science and practice with respect to human beings: education, health, physical and mental abilities, instruments and virtues of cooperation (i. e., language and sociability), environmental conditions, short- and long-range ways of thinking, ethics, legal systems, various aspects of private life, and entertainment.

One of the major theses of this definitional and relational philosophy is the man–machine paradox: the human role in all kinds of automation is a continuously emerging constituent of man–machine symbiosis, with feedback to the same.

From this perspective, the inclusion of a discussion of early historical developments is not surprising. This evolution is of twin importance. First, due to the contradictory speeds of human and machine evolution, despite the fascinating results of machine technology, in most

About 375 BC	First automaton (Archytas dove, Syracuse)	1662	Elements of thermodynamics, Boyle
About 275	Archimedes	1663–68	Reflecting telescope, Gregory, Newton
About 60	Steampower, Heron	1665	Infinitesimal calculus, Newton, Leibniz
	Hodometer, Vitruvius	1666	Gravitation, Newton
About 1280	Mechanical clocks	1673	Calculator, Leibniz
AD		1676	Universal joint, Hooke
1285–90	Windmills	1679	Pressure cooker, Papin
1328	First sawmill	1690	Light-wave theory, Huygens
1421	Hoisting gear	1689	Knitting machine, Lee
1475	Printing press	1698	Steam pump, Savery
1485–1519	Leonardo's technical designs	1712	Steam engine, Newcomen
1486	Copyright (Venice)	1718	Mercury thermometer, Fahrenheit
1500	Flush toilet	1722	Fire extinguisher, Hopffer
1510	Pocket watch, Henlein	1745	Leyden jar, capacitor, Kleist
1590	Compound microscope, Janssen	1758	Chromatic lens, Dolland
1593	Water thermometer (Galileo)	1764	Spinning jenny, Hargreaves
1608	Refracting telescope	1769	Steam engine, controlled by a centrifugal governor, Watt
1609	Kinematics of Galileo; Planetary motion, Kepler	1770	Talking machine and robot mechanisms, Kempelen
1614	Logarithms, Napier	1774	Electrical telegraph, Lesage
1606–28	Blood circulation, Harvey	1775	Flush toilet, Cummings
1620	Human powered submarine	1780	Bi-focal eyeglass, Franklin
1624	Slide rule, Oughtred	1784	Threshing machine, Meikle
1625	Blood transfusion, Denys	1785	Power loom, Cartwright; Torsion balance, Coulomb
1629	Steam turbine, Branca	1790	Contact electricity, Galvani; Harmonic analysis, Fourier
1636	Micrometer, Gascoigne	1792	Gas lighting, Murdoch
1637	Analytic geometry, Descartes	1794	Ball bearings, Vaughan
1642	Adding machine, Pascal	1799	Battery, Volta; Ohm's law, Volta, Cavendish, Ohm
1643	Mercury barometer, Torricelli	1800	Loom, Jacquard
1654	Probability, Fermat, Pascal, Huygens, J. Bernoulli		
1650	Air pump, Guericke		
1657	Pendulum clock, Huygens		

Fig. 5.1 Timeline of science and technology in Western civilization

applications the very slow progress of the user is critical. Incredibly sophisticated instruments are, and will be, used by creatures not too different from their ancestors of 1000 years ago. This contradiction appears not only in the significant abuse of automated equipment against other people but also in human user reasoning, which is sometimes hysterical and confused in its thinking.

The second significance of this paradox is in our perception of various changes: its reflection in problem solving, and in understanding the relevance of continuity and change, which is sometimes exaggerated, while other times it remains unrecognized in terms of its further effects.

These are the reasons why this chapter treats automation in a context that is wider and somehow deeper than usual, which appears to be necessary in certain application problems. The references relate to the twin peaks of the Industrial Revolution: the first, the classic period starting in the late 18th century with machine power; and the second, after World War II (WWII), in the information revolution.

Practically all measures of social change due to automation are hidden in the general indices of technology effects and, within those, in the effects of automation- and communication-related technology. Human response is, generally, a steady process, apart from dramatic events such as wars, social revolutions, and crises in the economy. Some special acceleration phenomena can be observed in periods of inflation and price changes, especially in terms of decreases in product prices for high technology, and changes in the composition of general price indices and in the spread of high-technology commodities; television (TV), color TV, mobile telephony, and Internet access are typical examples. These spearhead technologies rad-

1807	Steam ship, Fulton; Electric arc lamp, Davy
1814	Spectroskopy, Frauenhofer; Photography, Niépce
1815	Miners lamp, Davy
1819	Stethoscope, Laënnec
1820	Electromagnetism, Oersted
1825	Electromagnet, Sturgeon
1827	Microphone, Wheatstone
1829	Locomotive, Stephenson; Typewriter, Burt
1830	Sewing machine, Thimmonier
1831	Electrical induction, Faraday
1836	Analytical engine, Babbage
1837	Telegraph, Morse
1839	Rubber vulcanization, Goodyear; Photography, Daguerre; Bicycle, Niépce, MacMillan; Hydrogen fuel cell, Grove
1841	Stapler, Slocum
1842	Programming Lady Lovelace, Ada Byron; Grain elevator, Dart
1843	Facsimile, Bain
1845–51	Sewing machine, Howe, Singer; Vulcanized pneu, Thomson
1850–86	Dishwasher, Houghton, Cochran
1852	Gyroscope, Foucault
1854	Fiber optics, Tyndall
1856	Pasteurization, Pasteur
1857	Sleeping car, Pullman
1861	Telephone, Bell; Safe elevator, Otis
1867	Practical typewriter, Scholes
1868	The first paper on control theory, Maxwell; Air brakes, Westinghouse; Traffic light, Knight
1869	Periodic system, Mendeleev
1873	Theory of electromagnetism, Maxwell
1876	4-Cycle gas engine, Otto
1877	Phonograph, Edison
1878	Lightbulb, Swan
1879	Electrical locomotive, Siemens; Concept notation, Frege
1880	Toilet paper; Seismograph, Milne
1881	Metal detector, Bell; Roll film for cameras, Houston
1884	Paper strip photo film, Eastman; Rayon, Chardonnay; Fountain pen, Waterman; Steam turbine, Parsons; Cash register, Ritty
1885	Automobile, Benz
1886	Motorcycle, Daimler
1887	Radar, Hertz; Gramaphone, Berliner; Contact lens, Flick
1888	AC motor, Transformer, Tesla; Pneu, Dunlop
1891	Escalator, Reno
1892	Diesel motor, Diesel
1893	Zipper, Judson
1894	Motion picture, Lumiere
1895	X-ray, Röntgen
1897–1916	Wireless, Marconi
1898	Radium, Curie

Fig. 5.1 (cont.)

1899–1901	Vacuum cleaner, Thurman, Booth
1901	Safety razor, Gilette; Radio receiver
1902	Air conditioner, Carrier; Neon light, Claude
1903	Airplane, Wright; Radioactivity, Rutherford
1904	Teabag, Sullivan; Vacuum tube, Fleming
1905	Special relativity, Einstein
1906	Amplifier, audion, De Forest
1907	Bakelite, Baekeland; Color photography, Lumiere
1908	Model T, Ford; Geiger counter, Geiger, Müller; Artificial nitrates, Haber; Gyrocompass, Sperry
1911	Engine electrical ignition, Kettering; Helicopter, Cornu
1913	Atom model, Bohr
1915	General relativity, Einstein
1916	Radio tuner
1918	Superheterodyne radio, Armstrong
1919	Short-wave radio; Flip-flop circuit; Arc welder
1920	Robot concept, Capek
1922	Insulin, Banting; 3-D movie
1923–29	TV, Zworikin
1924	Dynamic loudspeaker, Rice, Kellog
1925	Quantum mechanics, Heisenberg
1927	Quartz clock; Technicolor
1928	Foundations of game theory, Neumann; Penicillin, Fleming; Electric shaver, Schick
1930	Analog computer, Bush; Jet engine, Whittle, von Ohain
1931	Electron microscope, Knott, Ruska; Undecidability theory, Gödel
1932	Neutrons, positrons, Chadwick; Polaroid photo, Land; Zoom lens; Light meter; Radio telescope, Jansky
1933	Frequency modulation, Armstrong; Stereo recording
1934	Magnetic recording, Begun
1935	Nylon, DuPont Labs; Radar, Watson-Watt
1936/37	Theoretical foundations of computer science, Turing
1938	Nuclear fission, Hahn, Straßmann; Foundations of information Theory, Shannon; Ballpoint pen, Biro; Teflon, Plunkett; First working turboprop; Xerography, Carlson; Nescafe
1939	First operational helicopter, Sikorsky; Electron microscope
1940–49	Wiener filter, cybernetics, Wiener
1941	Computer, Zuse
1942	Computer, Atanasoff and Berry; Turboprop; Nuclear reactor, Fermi
1944	Kidney dialysis, Kolff

Fig. 5.1 (cont.)

ically change lifestyles and social values but impact less slowly on the development of human motivations and, as a consequence, on several characteristics of individual and social behavior. The differing speeds of advancement of technology and society will be reflected on later.

5.2 Short History

The history of automation is a lesson in the bilateral conditions of technology and society. In our times wider and deeper attention is focused on the impact of automation on social relations. However, the progress of automation is arguably rather the result of social conditions.

It is generally known that automation was also present in antiquity; ingenious mechanisms operated impressive idols of deities: their gestures, winks, and opening the doors of their sanctuaries. Water-driven clocks applied the feedback principle for the correction of water-level effects. Sophisticated gearing, pumping, and elevating mechanisms helped the development of both human- and water-driven devices for construction, irrigation, traffic, and warfare. Water power was ubiquitous, wind power less so, and the invention of steam power more than 2000 years ago was not used for the obvious purpose of replacing human power and brute strength.

Historians contemplate the reasons why these given elements were not put together to create a more modern world based on the replacement of human and animal power. The hypothesis of the French Annales School of historians (named after their periodical, opened in 1929, and characterized by a new emphasis on geographical, economic, and social motifs of history, and less on events related to personal and empirical data) looks for social conditions: manpower acquired by slavery, especially following military operations, was economically the optimal energy resource. Even brute strength was, for a long time, more expensive, and for this reason was used for luxury and warfare more than for any other end, including agriculture. The application of the more efficient yoke for animal traction came into being only in the Middle Ages. Much later, arguments spoke for the better effect of human digging compared with an animal-driven plough [5.1–3].

Fire for heating and for other purposes was fed with wood, the universal material from which most objects were made, and that was used in industry for metal-producing furnaces. Coal was known but not generally used until the development of transport facilitated the joining of easily accessible coal mines with both industry centers and geographic points of high consumption. This high consumption and the accumulated wealth through commerce and population concentration were born in cities based on trade and manufacturing, creating a need for mass production of textiles. Hence, the first industrial application field of automation flourished with the invention of weaving machines and their punch-card control.

In the meantime, Middle Age and especially Renaissance mechanisms reached a level of sophistication surpassed, basically, only in the past century. This social and secondary technological environment created the overall conditions for the Industrial Revolution in power resources (Fig. 5.1) [5.3–8]. This timeline is composed from several sources of data available on the Internet and in textbooks on the history of science and technology. It deliberately contains many disparate items to show the historical density foci, connections with everyday life comfort, and basic mathematical and physical sciences. Issues related to automation per se are sparse, due to the high level of embeddedness of the subject in the general context of progress. Some data are inconsistent. This is due to uncertainties in historical documents; data on first publications, patents, and first applications; and first acceptable and practically feasible demonstrations. However, the figure intends to give an overall picture of the scene and these uncertainties do not confuse the lessons it provides.

The timeline reflects the course of Western civilization. The great achievements of other, especially Chinese, Indian, and Persian, civilizations had to be omitted, since these require another deep analysis in terms of their fundamental impact on the origins of Western science and the reasons for their interruption. Current automation and information technology is the direct offspring of the Western timeline, which may serve as an apology for these omissions.

The whole process, until present times, has been closely connected with the increasing costs of manpower, competence, and education. Human requirements, welfare, technology, automation, general human values, and social conditions form an unbroken circle of multiloop feedback.

5.3 Channels of Human Impact

Automation and its related control technology have emerged as a partly hidden, natural ingredient of everyday life. This is the reason why it is very difficult to separate the progress of the technology concerned from general trends and usage. In the household of an average family, several hundred built-in processors are active but remain unobserved by the user. They are not easily distinguishable and countable, due to the rapid spread of multicore chips, multiprocessor controls, and communication equipment. The relevance of all of these developments is really expressed by their vegetative-like operation, similar to the breathing function or blood circulation in the body.

An estimate of the effects in question can be given based on the automotive and aerospace industry. Recent medium-category cars contain about 50 electronic control units, high-class cars more than 70. Modern aircrafts are nearly fully automated; about 70% of all their functions are related to automatic operations and in several aerospace equipment even more. The limit is related to humans rather than to technology. Traffic control systems accounts for 30–35% of investment but provide a proportionally much larger return in terms

of safety. These data change rapidly because proliferation decreases prices dramatically, as experienced in the cases of watches, mobile phones, and many other gadgets. On the one hand, the sophistication of the systems and by increasing the prices due to more comfort and luxury, on the other.

The silent intrusion of control and undetectable information technology into science and related transforming devices, systems, and methods of life can be observed in the past few decades in the great discoveries in biology and material science. The examples of three-dimensional (3-D) transparency technologies, ultrafast microanalysis, and nanotechnology observation into the nanometer, atomic world and picosecond temporal processes are partly listed on the timeline.

These achievements of the past half-century have changed all aspects of human-related sciences, e.g., psychology, linguistics, and social studies, but above all life expectancy, life values, and social conditions.

5.4 Change in Human Values

The most important, and all-determinant, effect of mechanization–automatization processes is the change of human roles [5.10]. This change influences social stratification and human qualities. The key problem is realizing freedom from hard, wearisome work, first as exhaustive physical effort and later as boring, dull activity. The first historical division of work created a class of clerical and administrative people in antiquity, a comparatively small and only relatively free group of people who were given spare energy for thinking.

The real revolutions in terms of mental freedom run parallel with the periods of the Industrial Revolution, and subsequently, the information–automation society. The latter is far from being complete, even in the most advanced parts of the world. This is the reason why no authentic predictions can be found regarding the possible consequences in terms of human history.

Slavery started to be banned by the time of the first Industrial Revolution, in England in 1772 [5.11, 12], in France in 1794, in the British Empire in 1834, and in the USA in 1865, serfdom in Russia in 1861, and worldwide abolition by consecutive resolutions in 1948, 1956, and 1965, mostly in the order of the development of mechanization in each country.

The same trend can be observed in prohibiting childhood work and ensuring equal rights for women. The minimum age for children to be allowed to work in various working conditions was first agreed on by a 1921 ILO (International Labour Organization) convention and was gradually refined until 1999, with increasingly restrictive, humanistic definitions. Childhood work under the age of 14 or 15 years and less rigorously under 16–18 years, was, practically, abolished in Europe, except for some regions in the Balkans.

In the USA, Massachusetts was the first state to regulate child labor; federal law came into place only in 1938 with the Federal Labor Standards Act, which has been modified many times since. The eradication of child labor slavery is a consequence of a radical change in human values and in the easy replacement of slave work by more efficient and reliable automation. The general need for higher education changed the status of children both in the family and society. This reason together with those mentioned above decreased the number of children dying in advanced countries; human life becomes much more precious after the defeat of infant mortality and the high costs of the required education period. The elevation of human values is a strong argument against all kinds of nostalgia back to the times before our automation–machinery world.

Also, legal regulations protecting women in work started in the 19th century with maternity- and health-

Table 5.1 Women in public life (due to elections and other changes of position the data are informative only) after [5.9]

Country	Members of national parliament 2005 (%)	Government ministers 2005/2006
Finland	38	8
France	12	6
Germany	30	6
Greece	14	3
Italy	12	2
Poland	20	1
Slovakia	17	0
Spain	36	8
Sweden	45	8

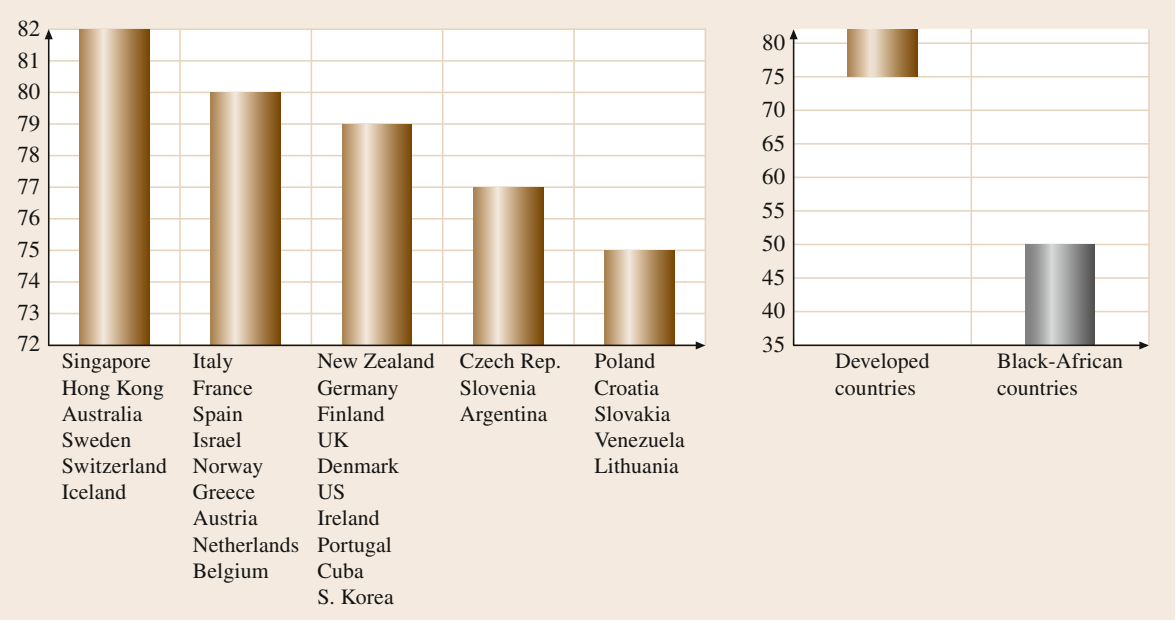

Fig. 5.2 Life expectancy and life conditions (after [5.14])

related laws and conventions. The progress of equal rights followed WWI and WWII, due to the need for female workforce during the wars and the advancement of technology replacing hard physical work. The correlation between gender equality and economic and society–cultural relations is well proven by the statistics of women in political power (Table 5.1) [5.9, 13].

The most important effect is a direct consequence of the statement that the human being is not a draught animal anymore, and this is represented in the role of physical power. Even in societies where women were sometimes forced to work harder than men, this situation was traditionally enforced by male physical superiority. Child care is much more a common bi-gender duty now, and all kinds of related burdens are supported by mass production and general services, based on automation. The doubled and active lifespan permits historically unparalleled multiplicity in life foci.

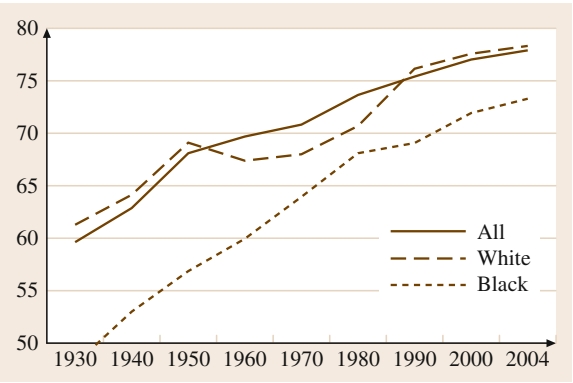

Fig. 5.3 Life expectancy at birth by race in the US (after [5.14])

Another proof of the higher status of human values is the issue of safety at work [5.11, 12]. The ILO and the US Department of Labor issue deep analyses of injuries related to work, temporal change, and social work-related details. The figures show great improvement in high-technology workplaces and better-educated workforces and the typical problems of low educated people, partly unemployed, partly employed under uncertain, dubious conditions. The drive for these values was the bilateral result of automatic equipment for production with automatic safety installations and stronger requirements for the human workforce.

All these and further measures followed the progress of technology and the consequent increase in the wealth of nations and regions. Life expectancy, clean water supplies, more free time, and opportunities for leisure, culture, and sport are clearly reflected in the figures of technology levels, automation, and wealth [5.15] (Figs. 5.2 and 5.3) [5.14, 16].

Life expectancy before the Industrial Revolution had been around 30 years for centuries. The social gap

Table 5.2 Relations of health and literacy (after [5.15])

Country	Approx. year	Life expectancy at birth (years)	Infant mortality to age 5 years per 1000 live births	Adult literacy (%)	Access to safe water (%)
Argentina	1960	65.2	72	91.0	51
	1980	69.6	38	94.4	58
	2001	74.1	19	96.9	94
Brazil	1960	54.9	177	61.0	32
	1980	62.7	80	74.5	56
	2001	68.3	36	87.3	87
Mexico	1960	57.3	134	65.0	38
	1980	66.8	74	82.2	50
	2001	73.4	29	91.4	88
Latin America	1960	56.5	154	74.0	35
	1980	64.7	79	79.9	53
	2001	70.6	34	89.2	86
East Asia	1960	39.2	198	n.a.	n.a.
	1980	60.0	82	68.8	n.a.
	2001	69.2	44	86.8	76

in life expectancy within one country's lowest and highest deciles, according to recent data from Hungary, is 19 years. The marked joint effects of progress are presented in Table 5.2 [5.17].

5.5 Social Stratification, Increased Gaps

Each change was followed, on the one hand, by mass tragedies for individuals, those who were not able to adapt, and by new gaps and tensions in societies, and on the other hand, by great opportunities in terms of social welfare and cultural progress, with new qualities of human values related to greater solidarity and personal freedom.

In each dynamic period of history, social gaps increase both within and among nations. Table 5.3 and Fig. 5.4 indicate this trend – in the figure markedly both with and without China – representing a promising future for all mankind, especially for long lagging developing countries, not only for a nation with a population of about one-sixth of the world [5.18]. This picture demonstrates the role of the Industrial Revolution and technological innovation in different parts of the world and also the very reasons why the only recipe for lagging regions is accelerated adaptation to the economic–social characteristics of successful historical choices.

The essential change is due to the two Industrial Revolutions, in relation to agriculture, industry, and services, and consequently to the change in professional and social distributions [5.16, 19]. The dramatic picture of the former is best described in the novels of Dickens, Balzac, and Stendhal, the transition to the second in Steinbeck and others. Recent social uncertainty dominates American literature of the past two decades.

This great change can be felt by the decease of distance. The troops of Napoleon moved at about the same speed as those of Julius Caesar [5.20], but mainland communication was accelerated in the USA between 1800 and 1850 by a factor of eight, and the usual 2 week passage time between the USA and Europe of the mid 19th century has decreased now by 50-fold. Similar figures can be quoted for numbers of traveling people and for prices related to automated mass production, especially for those items of high-technology consumer goods which are produced in their entirety by these technologies. On the other hand, regarding the prices of all items and services related to the human workforce, the opposite is true. Compensation in professions demanding higher education is through relative increase of salaries.

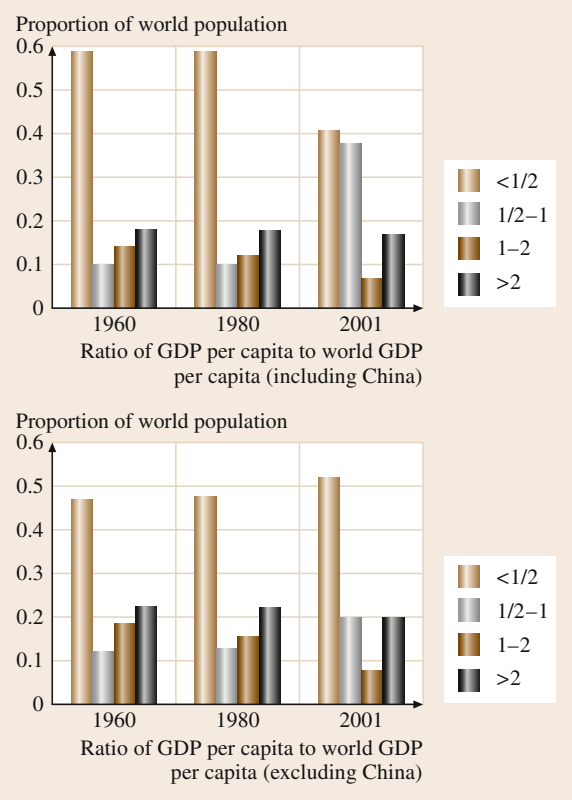

Fig. 5.4 World income inequality changes in relations of population and per capita income in proportions of the world distribution (after [5.21] and UN/DESA)

Due to these changed relations in distance and communication, cooperative and administrative relations have undergone a general transformation in the same sense, with more emphasis on the individual, more freedom from earlier limitations, and therefore, more personal contacts, less according to need and mandatory organization rather than current interests. The most important phenomena are the emerging multinational production and service organizations. The increasing relevance of supranational and international political, scientific, and service organizations, international standards, guidelines, and fashions as driving forces of consumption attitudes, is a direct consequence of the changing technological background.

Figure 5.5 [5.22–24] shows current wages versus social strata and educational requirement distribution of the USA. Under the striking figures of large company CEOs (chief executive officers) and successful capitalists, who amount to about 1–1.5% of the population, the distribution of income correlates rather well with required education level, related responsibility, and adaptation to the needs of a continuously technologically advancing society. The US statistics are based on tax-refund data and reflect a rather growing disparity in incomes. Other countries with advanced economies show less unequal societies but the trend in terms of social gap for the time being seems to be similar. The disparity in jobs requiring higher education reflects a disparity in social opportunity on the one hand, but also probably a realistic picture of requirements on the other.

Figure 5.6 shows a more detailed and informative picture of the present American middle-class cross section.

A rough estimate of social breakdown before the automation–information revolution is composed of several different sources, as shown in Table 5.4 [5.25].

These dynamics are driven by finance and management, and this is the realistic reason for overvaluations in these professions. The entrepreneur now plays the role of the condottiere, pirate captain, discoverer, and adventurer of the Renaissance and later. These roles, in a longer retrospective, appear to be necessary in periods of great change and expansion, and will be consolidated in the new, emerging social order. The worse phenomena of these turbulent periods are the

Population in %	Income in 1000 US$/y	Class distribution		Education
1–2	200 and more	Capitalists, CEO, politicians, celebritics, etc.		?
15	200–60	Upper middle class	Professors managers	Graduate
30	60–30	Middle class	Professional sales, and support	Bachelor deg. significant skill
30	30–10	Lower middle class	Clerical, service, blue collar	Some college
22–23	10 and less	Poor underclass	Part time, unemployed	High school or less

Fig. 5.5 A rough picture of the US society (after [5.22–24])

Table 5.3 The big divergence: developing countries versus developed ones, 1820–2001, (after [5.26] and United Nations Development of Economic and Social Affairs (UN/DESA))

	GDP per capita (1990 international Geary–Khamis dollars)					
	1820	1913	1950	1973	1980	2001
Developed world	1204	3989	6298	13 376	15 257	22 825
Eastern Europe	683	1695	2111	4988	5786	6027
Former USSR	688	1488	2841	6059	6426	4626
Latin America	692	1481	2506	4504	5412	5811
Asia	584	883	918	2049	2486	3998
China	600	552	439	839	1067	3583
India	533	673	619	853	938	1957
Japan	669	1387	1921	11 434	13 428	20 683
Africa	420	637	894	1410	1536	1489
	Ratio of GDP per capita to that of the developed world					
	1820	1913	1950	1973	1980	2001
Developed world	–	–	–	–	–	–
Eastern Europe	0.57	0.42	0.34	0.37	0.38	0.26
Former USSR	0.57	0.37	0.45	0.45	0.422	0.20
Latin America	0.58	0.37	0.40	0.34	0.35	0.25
Asia	0.48	0.22	0.15	0.15	0.16	0.18
China	0.50	0.14	0.07	0.06	0.07	0.16
India	0.44	0.17	0.10	0.06	0.06	0.09
Japan	0.56	0.35	0.30	0.85	0.88	0.91
Africa	0.35	0.16	0.14	0.11	0.10	0.07

Table 5.4 Social breakdown between the two world wars (rough, rounded estimations)

Country	Agriculture	Industry	Commerce	Civil servant and freelance	Domestic servant	Others
Finland	64	15	4	4	2	11
France	36	34	13	7	4	6
UK	6	46	19	10	10	9
Sweden	36	32	11	5	7	9
US	22	32	18	9	7	2

political adventurers, the dictators. The consequences of these new imbalances are important warnings in the directions of increased value of human and social relations.

The most important features of the illustrated changes are due to the transition from an agriculture-based society with remnants of feudalist burdens to an industrial one with a bourgeois–worker class, and now to an information society with a significantly different and mobile strata structure. The structural change in our age is clearly illustrated in Fig. 5.7 and in the investment policy of a typical country rapidly joining the welfare world, North Korea, in Fig. 5.8 [5.18].

Most organizations are applying less hierarchy. This is one effect of the general trend towards overall control modernization and local adaptation as leading principles of optimal control in complex systems. The concentration of overall control is a result of advanced, real-time information and measurement technology and related control theories, harmonizing with the local traditions and social relations. The principles developed in the control of industrial processes could find general validity in all kinds of complex systems, societies included.

The change of social strata and technology strongly affects organizational structures. The most characteris-

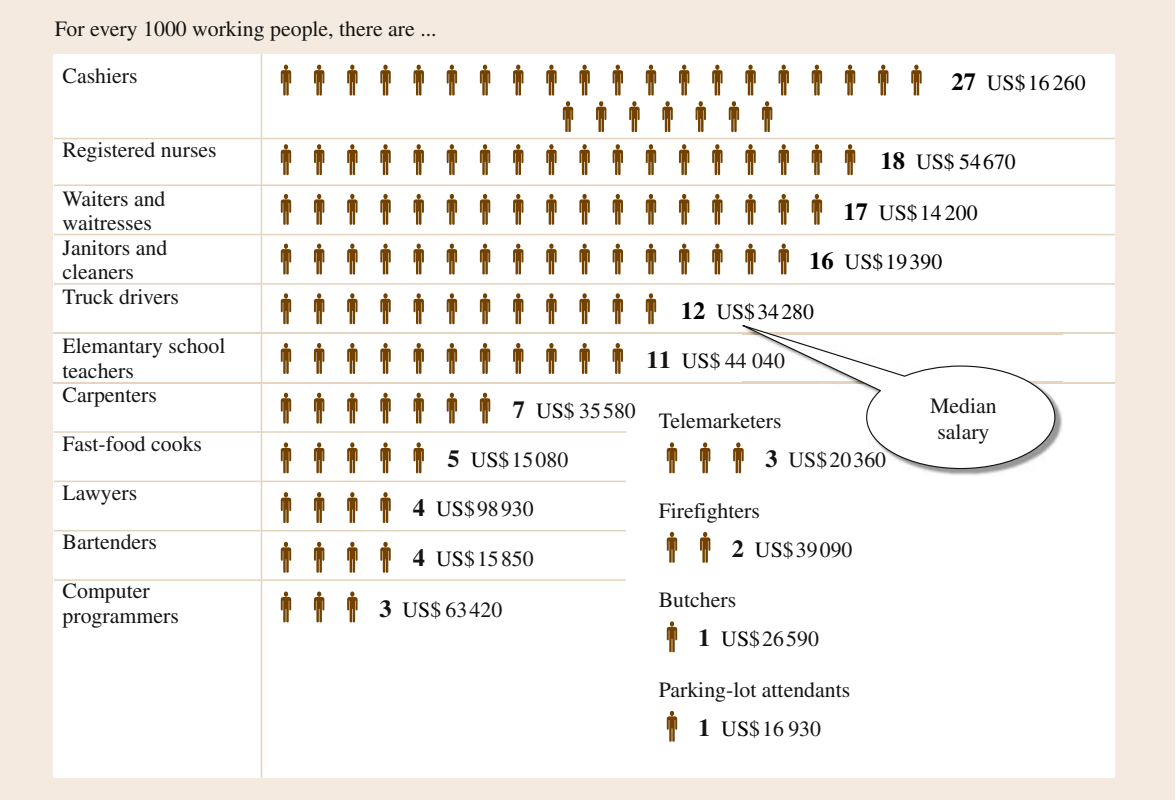

Fig. 5.6 A characteristic picture of the modern society (after [5.22])

tic phenomenon is the individualization and localization of previous social entities on the one hand, and centralization and globalization on the other. Globalization has an usual meaning related to the entire globe, a general trend in very aspect of unlimited expansion, extension and proliferation in every other, more general dimensions.

The great change works in private relations as well. The great multigenerational family home model is over. The rapid change of lifestyles, entertainment technology, and semi-automated services, higher income standards, and longer and healthier lives provoke and allow the changing habits of family homes.

The development of home service robots will soon significantly enhance the individual life of handicapped persons and old-age care. This change may also place greater emphasis on human relations, with more freedom from burdensome and humiliating duties.

5.6 Production, Economy Structures, and Adaptation

Two important remarks should be made at this point. Firstly, the main effect of automation and information technology is not in the direct realization of these special goods but in a more relevant general elevation of any products and services in terms of improved qualities and advanced production processes. The computer and information services exports of India and Israel account for about 4% of their gross domestic product (GDP). These very different countries have the highest figures of direct exports in these items [5.18].

The other remark concerns the effect on employment. Long-range statistics prove that this is more influenced by the general trends of the economy and by the adaptation abilities of societies. Old professions are replaced by new working opportunities, as demonstrated in Figs. 5.9 and 5.10 [5.22, 27, 28].

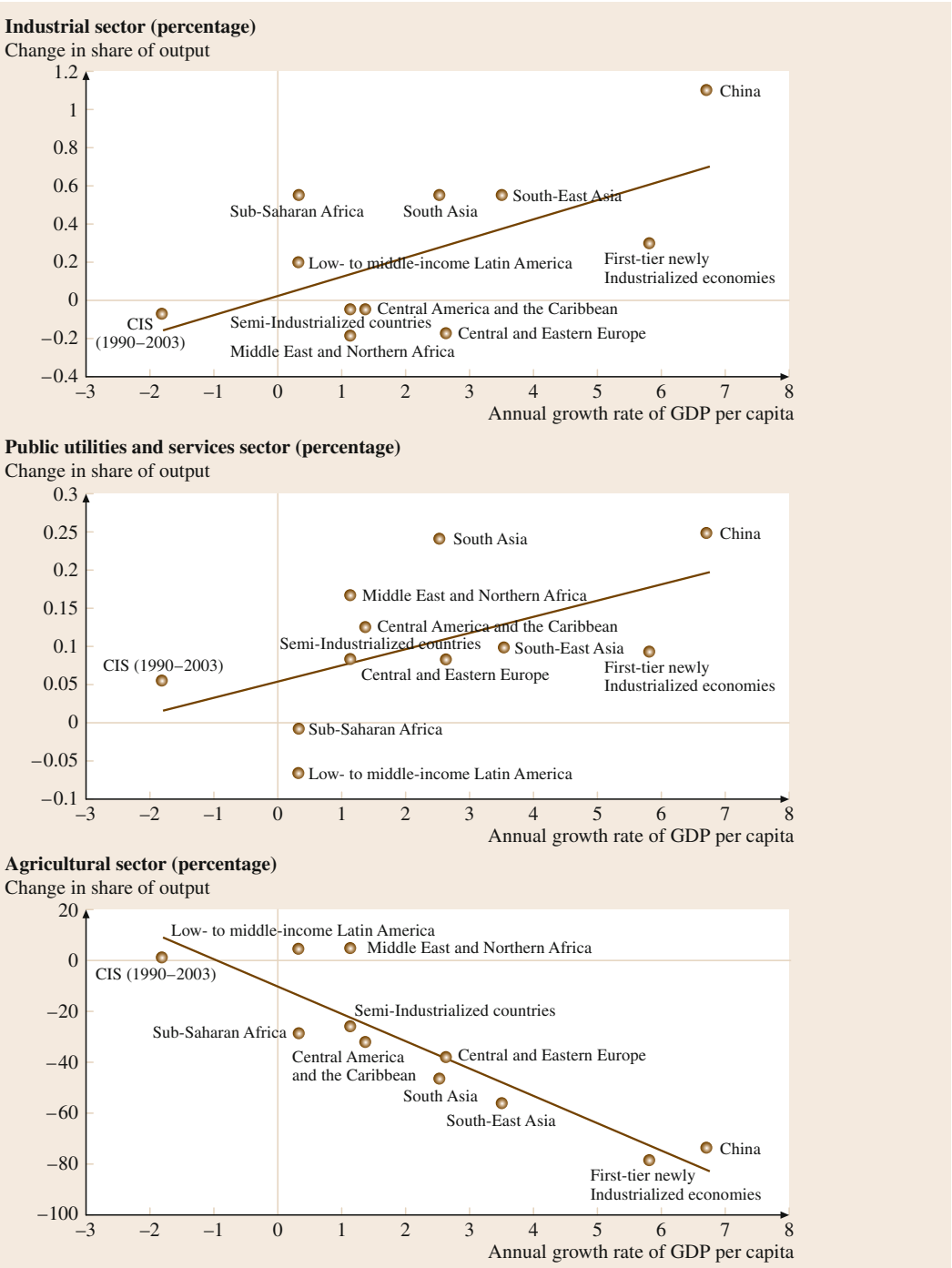

Fig. 5.7 Structural change and economic growth (after [5.18] and UN/DESA, based on United Nations Statistics Division, National Accounts Main Aggregates database. Structural change and economic growth)

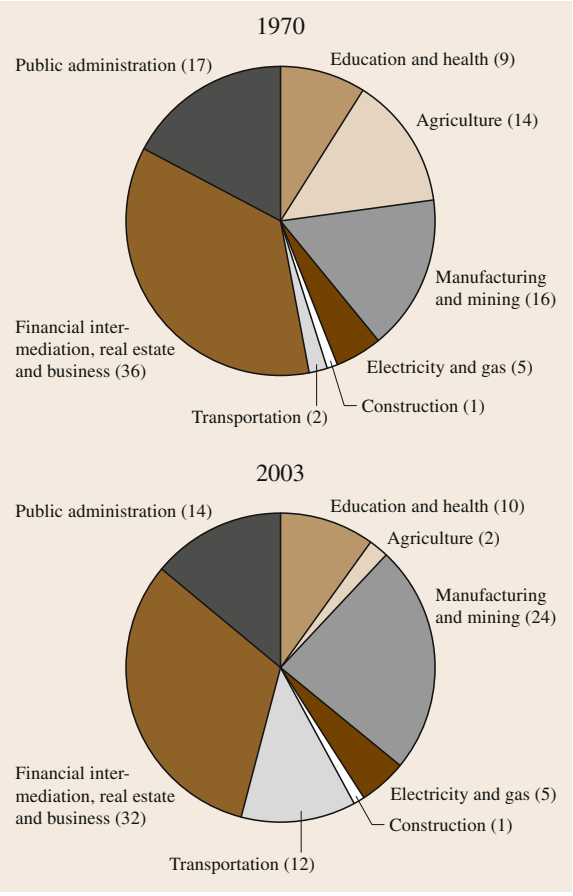

Fig. 5.8 Sector investment change in North Korea (after UN/DESA based on data from National Statistical Office, Republic of Korea Structural change and economic growth)

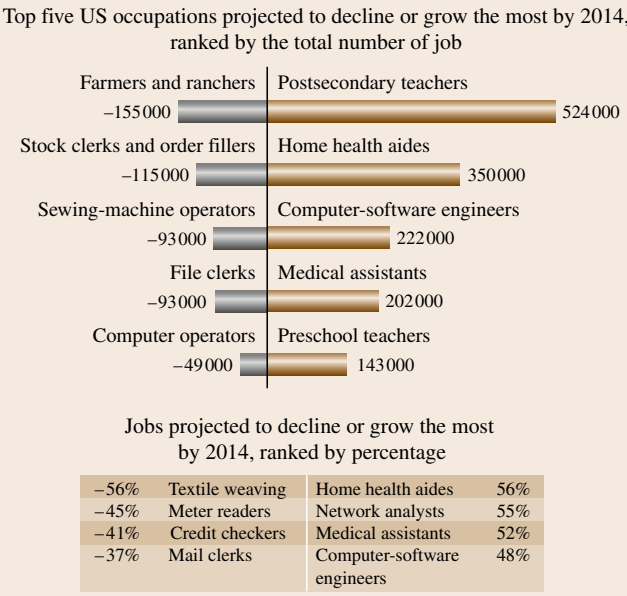

Fig. 5.9 Growing and shrinking job sectors (after [5.22])

One aspect of changing working conditions is the evolution of teleworking and outsourcing, especially in digitally transferable services. Figure 5.11 shows the results of a statistical project closed in 2003 [5.29].

Due to the automation of production and servicing techniques, investment costs have been completely transformed from production to research, development, design, experimentation, marketing, and maintenance support activities. Also production sites have started to become mobile, due to the fast turnaround of production technologies. The main fixed property is knowhow and related talent [5.30, 31]. See also Chap. 6 on the economic costs of automation.

The open question regarding this irresistible process is the adaptation potential of mankind, which is closely related to the directions of adaptation. How can the majority of the population elevate its intellectual level to the new requirements from those of earlier animal and quasi-animal work? What will be the directions of adaptation to the new freedoms in terms of time, consumption, and choice of use, and misuse of possibilities given by the proliferation of science and technology?

These questions generate further questions: Should the process of adaptation, problem solving, be controlled or not? And, if so, by what means or organizations? And, not least, in what directions? What should be the control values? And who should decide about those, and how? Although questions like these have arisen in all historical societies, in the future, giving the

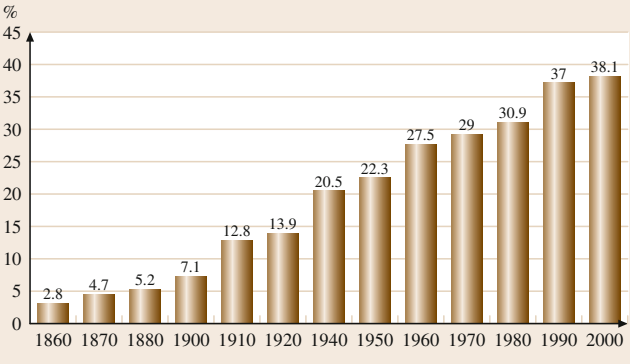

Fig. 5.10 White-collar workers in the USA (after [5.28])

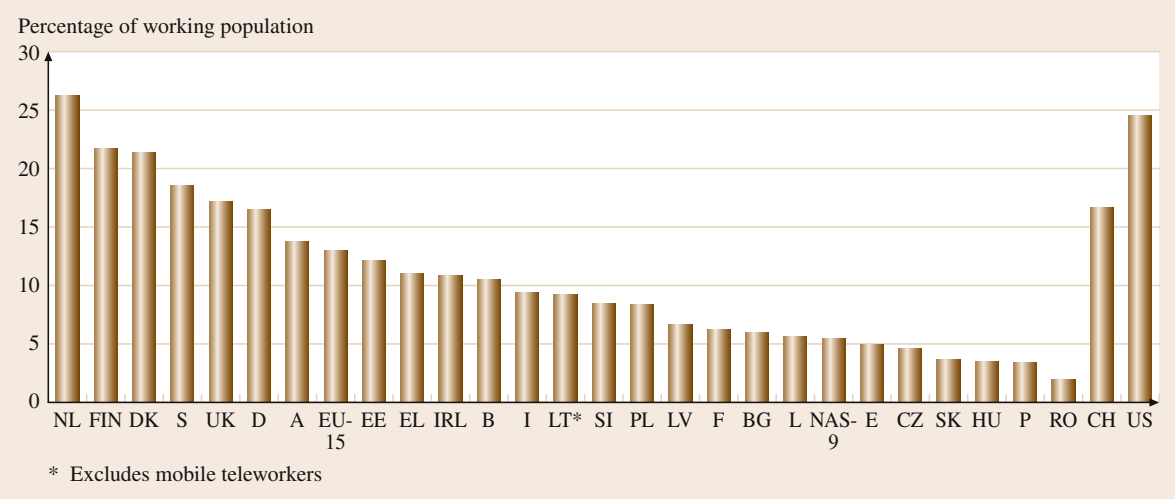

Fig. 5.11 Teleworking, percentage of working population at distance from office or workshop (after [5.29]) (countries, abbreviations according car identification, EU – European Union, NAS – newly associated countries of the EU)

Table 5.5 Coherence indices (after [5.29])

	Gross national income (GNI)/capita[a] (current thousand US$)	Corruption[b] (score, max. 10 [squeaky clean])	e-Readiness[c] (score, max. 10)
Canada	32.6	8.5	8.0
China	1.8	–	4.0
Denmark	47.4	9.5	8.0
Finland	37.5	9.6	8.0
France	34.8	7.4	7.7
Germany	34.6	8.0	7.9
Poland	7.1	3.7	5.5
Rumania	3.8	3.1[d]	4.0[d]
Russia	4.5	3.5	3.8
Spain	25.4	6.8	7.5
Sweden	41.0	9.2	8.0
Switzerland	54.9	9.1	7.9
UK	37.6	8.6	8.0

[a] according to the World Development Indicators of the World Bank, 2006,
[b] The 2006 Transparency, International Corruption Perceptions Index according to the Transparency International Survey,
[c] Economic Intelligence Unit [5.32],
[d] Other estimates

immensely greater freedom in terms of time and opportunities, the answers to these questions will be decisive for human existence.

Societies may be ranked nowadays by national product per capita, by levels of digital literacy, by estimates of corruption, by e-Readiness, and several other indicators. Not surprisingly, these show a rather strong coherence. Table 5.5 provide a small comparison, based on several credible estimates [5.29, 30, 33].

A recent compound comparison by the Economist Intelligence Unit (EIU) (Table 5.6) reflects the EIU e-Readiness rankings for 2007, ranking 69 countries in terms of six criteria. In order of importance, these are: consumer and business adoption; connectivity and technology infrastructure; business environment; social and cultural environment; government policy and vision; and legal and policy environment.

Table 5.6 The 2007 e-Readiness ranking

Economist Intelligence Unit e-Readiness rankings, 2007									
2007 e-Readiness rank (of 69)	**2006 rank**	**Country**	**2007 e-Readiness score (of 10)**	**2006 score**	**2007 e-Readiness rank (of 69)**	**2006 rank**	**Country**	**2007 e-Readiness score (of 10)**	**2006 score**
1	1	Denmark	8.88	9.00	36	37	Malaysia	5.97	5.60
2 (tie)	2	US	8.85	8.88	37	39	Latvia	5.88	5.30
2 (tie)	4	Sweden	8.85	8.74	38	39	Mexico	5.86	5.30
4	10	Hong Kong	8.72	8.36	39	36	Slovakia	5.84	5.65
5	3	Switzerland	8.61	8.81	40	34	Poland	5.80	5.76
6	13	Singapore	8.60	8.24	41	38	Lithuania	5.78	5.45
7	5	UK	8.59	8.64	42	45	Turkey	5.61	4.77
8	6	Netherlands	8.50	8.60	43	41	Brazil	5.45	5.29
9	8	Australia	8.46	8.50	44	42	Argentina	5.40	5.27
10	7	Finland	8.43	8.55	45	49	Romania	5.32	4.44
11	14	Austria	8.39	8.19	46 (tie)	43	Jamaica	5.05	4.67
12	11	Norway	8.35	8.35	46 (tie)	46	Saudi Arabia	5.05	5.03
13	9	Canada	8.30	8.37	48	44	Bulgaria	5.01	4.86
14	14	New Zealand	8.19	8.19	49	47	Thailand	4.91	4.63
15	20	Bermuda	8.15	7.81	50	48	Venezuela	4.89	4.47
16	18	South Korea	8.08	7.90	51	49	Peru	4.83	4.44
17	23	Taiwan	8.05	7.51	52	54	Jordan	4.77	4.22
18	21	Japan	8.01	7.77	53	51	Colombia	4.69	4.25
19	12	Germany	8.00	8.34	54 (tie)	53	India	4.66	4.04
20	17	Belgium	7.90	7.99	54 (tie)	56	Philippines	4.66	4.41
21	16	Ireland	7.86	8.09	56	57	China	4.43	4.02
22	19	France	7.77	7.86	57	52	Russia	4.27	4.14
23	22	Israel	7.58	7.59	58	55	Egypt	4.26	4.30
24	–	Malta[a]	7.56	–	59	58	Equador	4.12	3.88
25	25	Italy	7.45	7.14	60	61	Ukraine	4.02	3.62
26	24	Spain	7.29	7.34	61	59	Sri Lanka	3.93	3.75
27	26	Portugal	7.14	7.07	62	60	Nigeria	3.92	3.69
28	27	Estonia	6.84	6.71	63	67	Pakistan	3.79	3.03
29	28	Slovenia	6.66	6.43	64	64	Kazakhstan	3.78	3.22
30	31	Chile	6.47	6.19	65	66	Vietnam	3.73	3.12
31	32	Czech Rep.	6.32	6.14	66	63	Algeria	3.63	3.32
32	29	Greece	6.31	6.42	67	62	Indonesia	3.39	3.39
33	30	UAE	6.22	6.32	68	68	Azerbaijan	3.26	2.92
34	32	Hungary	6.16	6.14	69	65	Iran	3.08	3.15
35	35	South Africa	6.10	5.74					

[a] New to the annual rankings in 2007 (after EIU)

5.7 Education

Radical change of education is enforced by the dramatic changes of requirements. The main directions are as follows:

- Population and generations to be educated
- Knowledge and skills to be learnt
- Methods and philosophy of education.

General education of the entire population was introduced with the Industrial Revolution and the rise of nation states, i. e., from the 18th to the end of the 19th centuries, starting with royal decrees and laws expressing a will and trend and concluding in enforced, pedagogically standardized, secular systems [5.35].

The related social structures and workplaces required a basic knowledge of reading and writing, first of names, simple sentences for professional and civil communication, and elements of arithmetic. The present requirement is much higher, defined (PISA, Program for International Student Assessment of the OECD) by understanding regular texts from the news, regulations, working and user instructions, elements of measurement, dimensions, and statistics.

Progress in education can be followed also as a consequence of technology sophistication, starting with four to six mandatory years of classes and continued by mandatory education from 6 to 18 years. The same is reflected in the figures of higher education beyond the mandatory education period [5.16, 30, 34].

For each 100 adults of tertiary-education age, 69 are enrolled in tertiary education programs in North America and Europe, compared with only 5 in sub-Saharan Africa and 10 in South and West Asia. Six countries host 67% of the world's foreign or mobile students: with 23% studying in the USA, followed by the UK (12%), Germany (11%), France (10%), Australia (7%), and Japan (5%).

An essential novelty lies in the rapid change of required knowledge content, due to the lifecycles of technology, see timeline of Fig. 5.1. The landmarks of technology hint at basic differences in the chemistry, physics, and mathematics of the components and, based on the relevant new necessities in terms of basic and higher-level knowledge, are reflected in application demands. The same demand is mirrored in work-related training provided by employers.

The necessary knowledge of all citizens is also defined by the systems of democracy, and modern democracy is tied to market economy systems. This defines an elementary understanding of the constitutional–legal system, and the basic principles and practice of legal institutions. The concept of constitutional awareness is not bound to the existence of a canonized national constitution; it can be a consciousness, accord on fundamental social principles.

As stated, general education is a double requirement for historical development: professional knowledge for producers and users of technology, and services and civil culture as necessary conditions for democracy. These two should be unified to some extent in each person and generation. This provides another hint at the change from education of children and adolescents towards a well-designed, pedagogically renewed, socially regulated lifelong education schedule with mandatory basic requirements. There should also be mandatory requirements for each profession with greater responsibility and a wide spectrum of free opportunities, including in terms of retirement age (Table 5.7).

In advanced democracies this change strongly affects the principle of equal opportunities, and creates a probably unsolvable contradiction between increasing knowledge requirements, the available amount of different kinds of knowledge, maintenance and strengthening of the cultural–social coherence of societies, and the unavoidable leverage of education. Educating the social–cultural–professional elite and the masses of a democratic society, with given backgrounds in terms of talent, family, and social grouping, is the main concern of all responsible government policies. The US Ivy League universities, British Oxbridge, and the French Grand Écoles represent elite schools, mostly for a limited circle of young people coming from more highly educated, upper society layers.

Table 5.7 Lifelong learning. Percentage of the adult population aged 25–64 years participating in education and training (mostly estimated or reported values), after [5.34]

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005
EU (25 countries)	–	–	–	–	–	7.5	7.5	7.6	9.0	9.9	10.2
EU (15 countries)	–	–	–	–	8.2	8.0	8.0	8.1	9.8	10.7	11.2
Euro area	4.5	5.1	5.1	–	5.6	5.4	5.2	5.3	6.5	7.3	8.1

The structures of education are also defined by the capabilities of private and public institutions: their regulation according to mandatory knowledge, subsidies depending on certain conditions, the ban on discrimination based on race or religion, and freedom of access for talented but poor people.

The structural variants of education depend on necessary and lengthening periods of professional education, and on the distribution of professional education between school and workplace. Open problems are the selection principles of educational quotas (if any), and the question of whether these should depend on government policy and/or be the responsibility of the individual, the family or educational institutions.

In the Modern Age, education and pedagogy have advanced from being a kind of affective, classical psychology-like quality to a science in the strong sense, not losing but strengthening the related human virtues. This new, science-type progression is strongly related to brain research, extended and advanced statistics and worldwide professional comparisons of different experiments. Brain research together with psychology provides a more reliable picture of development during different age periods. More is known on how conceptual, analogous, and logical thinking, memory, and processing of knowledge operate; what the coherences of special and general abilities are; what is genetically determined and definable; and what the possibilities of special training are. The problem is greater if there are deterministic features related to gender or other inherited conditions. Though these problems are particularly delicate issues, research is not excluded, nor should it be, although the results need to be scrutinized under very severe conditions of scientific validity.

The essential issue is the question of the necessary knowledge for citizens of today and tomorrow. A radical change has occurred in the valuation of traditional cultural values: memorizing texts and poems of acknowledged key authors from the past; the proportion of science- versus human-related subjects; and the role of physical culture and sport in education. The means of social discipline change within the class as a preparation for ethical and collegial cooperation, just like the abiding laws of the community.

The use of modern and developing instruments of education are overall useful innovations but no solution for the basic problems of individual and societal development. These new educational instruments include moving pictures, multimedia, all kinds of visual and auditive aids, animation, 3-D representation, question-answering automatic methods of teaching, freedom of learning schedules, mass use of interactive whiteboards, personal computers as a requisite for each student and school desk, and Internet-based support of remote learning. See Chap. 44 on *Education and Qualification* and Chap. 85 on *Automation in Education/Learning Systems* for additional information.

A special requirement is an international standard for automatic control, system science, and information technology. The International Federation of Automatic Control (IFAC), through its special interest committee and regular symposia, took the first steps in this direction from its start, 50 years ago [5.36]. Basic requirements could be set regarding different professional levels in studies of mathematics, algorithmics, control dynamics, networks, fundamentals of computing architecture and software, components (especially semiconductors), physics, telecommunication transmission and code theory, main directions of applications in system design, decision support and mechanical and sensory elements of complex automation, their fusion, and consideration of social impact.

All these disciplines change in their context and relevance during the lifetime of a professional generation, surviving at least three generations of their subject. This means greater emphasis on disciplinary basics and on the particular skill of adopting these for practical innovative applications, and furthermore on the disciplinary and quality ethics of work.

A major lesson of the current decade is not only the hidden spread of these techniques in every product, production process, and system but also the same spread of specialists in all kinds of professional activities.

All these phenomena and experiments display the double face of education in terms of an automated, communication-linked society. One of the surprising facts from the past few decades is the unexpected increase in higher-education enrolment for humanities, psychology, sociology, and similar curricula, and the decline in engineering- and science-related subjects. This orientation is somehow balanced by the burst of management education, though the latter has a trend to deepen knowledge in human aspects outweighing the previous, overwhelming organizational, structural knowledge.

5.8 Cultural Aspects

The above contradictory, but socially relatively controlled, trend is a proof of the initial thesis: in the period of increasing automation, the human role is emerging more than ever before. This has a relevant linguistic meaning, too. Not only is knowledge of foreign languages (especially that of the modern lingua franca, English) gaining in importance, but so is the need for linguistic and metalinguistic instruments as well, i. e., a syncretistic approach to the development of sensitive communication facilities [5.37, 38].

The resulted plethora of these commodities is represented in the variations of goods, their usage, and in the spectra of quality. The abundance of supply is in accordance not only with material goods but also the mental market.

The end of the book was proclaimed about a decade ago. In the meantime the publication of books has mostly grown by a modest, few percentage points each year in most countries, in spite of the immense reading material available on the Internet. Recent global statistics indicate a growth of about 3–4% per year in the past period in juvenile books, the most sensitive category for future generations.

The rapid change of electronic entertainment media from cassettes to CD-DVD and MP3 semiconductor memories and the uncertainties around copyright problems made the market uncertain and confused. In the past 10 years the prices of video-cassettes have fallen by about 50%; the same happened to DVDs in the past 2 years.

All these issues initiate cultural programs for each age, each technological and cultural environment, and each kind of individual and social need, both maintaining some continuity and inducing continuous change.

On the other hand, the market has absorbed the share in the entertainment business with a rapidly changing focus on fashion-driven music, forgotten classics, professional tutoring, and great performances. The lesson is a naturally increasing demand together with more free time, greater income, and a rapidly changing world and human orientation. Adaptation is serviced by a great variety of different possibilities.

High and durable cultural quality is valued mostly later in time. The ratio of transitory low-brow cultural goods to high-brow permanent values has always been higher by orders of magnitude. Automatic, high-quality reproduction technology, unseen and unimaginable purchasing power, combined with cultural democracy is a product of automated, information-driven engineering development. The human response is a further question, and this is one reason why a nontechnical chapter has a place in this technology handbook.

5.9 Legal Aspects, Ethics, Standards, and Patents

5.9.1 Privacy

The close relations between continuity and change are most reflected in the legal environment: the embedding of new phenomena and legal requirements into the traditional framework of the law. This continuity is important because of the natural inertia of consolidated social systems and human attitudes. Due to this effect, both Western legal systems (Anglo-Saxon Common Law as a case-based system and continental rule-based legal practice) still have their common roots in Roman Law. In the progress of other civilizations towards an industrial and postindustrial society, these principles have been gradually accepted. The global process in question is now enforced, not by power, but by the same rationality of the present technology-created society [5.4, 39].

The most important legal issue is the combined task of warranting privacy and security. The privacy issue, despite having some antecedents in the Magna Carta and other documents of the Middle Ages, is a modern idea. It was originated for an equal-rights society and the concept of all kinds of private information properties of people. The modern view started with the paper entitled *The Right to Privacy* by *Warren* and *Brandeis*, at the advent of the 20th century [5.40]. The paper also defines the immaterial nature of the specific value related to privacy and the legal status of the material instrument of (re)production and of immaterial private property.

Three components of the subject are remarkable and all are related to the automation/communication issue: mass media, starting with high-speed wide-circulation printing, photography and its reproduction technologies, and a society based on the equal-rights principle.

In present times the motivations are in some sense contradictory: an absolute defense against any kind of intrusion into the privacy of the individual by alien power. The anxiety was generated by the real experience of the 20th century dictatorships, though executive terror and mass murder raged just before modern information instruments. On the other hand, user-friendly, efficient administration and security of the individual and of the society require well-organized data management and supervision. The global menace of terrorism, especially after the terrorist attacks of 11 September, 2001, has drawn attention to the development and introduction of all kinds of observational techniques.

The harmonization of these contradictory demands is given by the generally adopted principles of human rights, now with technology-supported principles:

- All kind of personal data, regarding race, religion, conscience, health, property, and private life are available only to the person concerned, accessible only by the individual or by legal procedure.
- All information regarding the interests of the citizen should be open; exemption can be made only by constitutional or equivalent, specially defined cases.
- The citizen should be informed about all kinds of access to his/her data with unalterable time and authorization stamps.

Table 5.8 Regulations concerning copyright and patent

Regulations: Article I, Section 8, Clause 8 of the US Constitution, also known as the Copyright Clause, gives Congress the power to enact statutes *To promote the Progress of Science and useful Arts, by securing for limited Times to Authors and Inventors the exclusive Right to their respective Writings and Discoveries.*

Congress first exercised this power with the enactment of the Copyright Act of 1790, and has changed and updated copyright statutes several times since. The Copyright Act of 1976, though it has been modified since its enactment, is currently the basis of copyright law in the USA.

The **Berne Convention for the Protection of Literary and Artistic Works**, usually known as the **Berne Convention**, is an international agreement about copyright, which was first adopted in Berne, Switzerland in 1886.

Paris Convention for the Protection of Industrial Property, signed in Paris, France, on March 20, 1883.

The **Agreement on Trade Related Aspects of Intellectual Property Rights** (**TRIPS**) is a treaty administered by the World Trade Organization (WTO) which sets down minimum standards for many forms of intellectual property (IP) regulation. It was negotiated at the end of the Uruguay Round of the General Agreement on Tariffs and Trade (GATT) treaty in 1994.

Specifically, TRIPS contains requirements that nations' laws must meet for: copyright rights, including the rights of performers, producers of sound recordings, and broadcasting organizations; geographical indications, including appellations of origin; industrial designs; integrated-circuit layout designs; patents; monopolies for the developers of new plant varieties; trademarks; trade address; and undisclosed or confidential information. TRIPS also specified enforcement procedures, remedies, and dispute-resolution procedures.

Patents in the modern sense originated in Italy in 1474. At that time the Republic of Venice issued a decree by which new and inventive devices, once they had been put into practice, had to be communicated to the Republic in order to obtain the right to prevent others from using them. England followed with the Statute of Monopolies in 1623 under King James I, which declared that patents could only be granted for "projects of new invention." During the reign of Queen Anne (1702–1714), the lawyers of the English Court developed the requirement that a written description of the invention must be submitted. These developments, which were in place during the colonial period, formed the basis for modern English and US patent law.

In the USA, during the colonial period and Articles of Confederation years (1778–1789), several states adopted patent systems of their own. The first congress adopted a Patent Act, in 1790, and the first patent was issued under this Act on July 31, 1790.

European patent law covers a wide range of legislations including national patent laws, the Strasbourg Convention of 1963, the European Patent Convention of 1973, and a number of European Union directives and regulations.

The perfection of the above principles is warranted by fast, broadband data links, and cryptographic and pattern recognition (identification) technology. The introduction of these tools and materialization of these principles strengthen the realization of the general, basic statement about the elevation effect of human consciousness. The indirect representation of the Self, and its rights and properties is a continuous, frequently used mirror of all this. And, through the same, the metaphoric high level of the mirror is a self-conscious intelligence test for beings. The system contributes to the legal consciousness of the advanced democracy.

The semi-automatic, data-driven system of administration separates the actions that can, and should be, executed in an automatic procedure by the control and evaluation of data, and follows the privacy and security principles. A well-operating system can save months of civilian inquiries, and hours and days of traveling, which constitutes a remarkable percentage of the administrative cost. A key aspect is the increased concentration on issues that require human judgment. In real human problems, human judgment is the final principle.

Citizens' indirect relationship with the authorities using automatic and telecommunication means evokes the necessity for natural language to be understood by machines, in written and verbal forms, and the creation of user-friendly, natural impression dialogues. The need for bidirectional translation between the language of law and natural communication, and translation into other languages, is emerging in wide, democratic usage. These research efforts are quickly progressing in several communities.

5.9.2 Free Access, Licence, Patent, Copyright, Royalty, and Piracy

Free access to information has different meanings. First of all, it is an achievement and new value of democracy: the right to access directly all information regarding an individual citizen's interests. Second, it entails a new relation to property that is immaterial, i. e., not physically decreased by alienation. Easy access changes the view regarding the right of the owner, the author. Though the classic legal concepts of patent and copyright are still valid and applied, the nonexistence of borders and the differences in local regulations and practice have opened up new discussions on the subject. Several companies and interest groups have been arguing for more liberal regulations. These arguments comprise the advertising interests of even more dynamic companies, the costs and further difficulties of safeguarding ownership rights, and the support of developing countries.

Table 5.8 presents an overview of the progress of these regulations.

5.10 Different Media and Applications of Information Automation

A contradictory trend in information technology is the development of individual user services, with and without centralized control and control of the individual user. The family of these services is characterized by decentralized input of information, centralized and decentralized storage and management, as well as unconventional automation combined with similarly strange freedom of access. Typical services are blog-type entertainment, individual announcements, publications, chat groups, other collaborative and companion search, private video communication, and advertisements. These all need well-organized data management, automatic, and desire-guided browsing search support and various identification and filtering services. All these are, in some sense, new avenues of information service automation and society organization in close interaction [5.26, 41, 42].

Two other services somehow belonging to this group are the information and economic power of very large search organizations, e.g., Google and Yahoo, and some minor, global, and national initiatives. Their automatic internal control has different search and grading mechanisms, fundamentally based on user statistics and subject classifications, but also on statistical categorizations and other pattern-recognition and machine-supported text-understanding instruments.

Wikipedia, YouTube, and similar initiatives have greater or lesser control: principally everybody can contribute to a vast and specific edifice of knowledge, controlled by the voluntary participants of the voluntary-access system. This social control appears to be, in some cases, competing in quality with traditional, professional encyclopedic-knowledge institutions. The contradictory trends survive further: social knowledge bases have started to establish some proved, controlled quality groups for, and of, professionals.

The entertainment/advertisement industry covers all these initiatives by its unprecedented financial interest and power, and has emerged as the leading economic power after the period of automotive and traffic-related industry that followed the iron and steel, textile, and agricultural supremacy. Views on this development are extremely different; in a future period can be judged if these resulted in a better-educated, more able society, or deteriorated essential cultural values.

Behind all these emerging and ruling trends operates the joint technology of automatic control, both in the form of instrumentation and in effects obeying the principles of feedback, multivariate, stochastic and nonlinear, and continuous and discrete system control. These principles are increasingly applied in modeling the social effects of these human–machine interactions, trying not only to understand but also to navigate the ocean of this new–old supernature.

5.11 Social Philosophy and Globalization

Automation is a global process, rapidly progressing in the most remote and least advanced corners of the world. Mass production and World Wide Web services enforce this, and no society can withstand this global trend; recent modernization revolution and its success in China and several other countries provide indisputable evidence. Change and the rapid speed in advanced societies and their most mobile layers create considerable tension among and within countries. Nevertheless, clever policies, if they are implemented, and the social movements evoked by this tension, result in a general progress in living qualities, best expressed by extending lifespans, decreasing famine regions, and the increasing responsibility displayed by those who are more influential. However, this overall historical process cannot protect against the sometimes long transitory sufferings, social clashes, unemployment, and other human social disasters [5.41, 43, 44].

Transitory but catastrophic phenomena are the consequence of minority feelings expressed in wide, national, religious, ideology-related movements with aggressive nature. The state of hopeless poverty is less irascible than the period of intolerance. The only general recommendation is given by *Neumann* [5.45]:

> *The only solid fact is that these difficulties are due to an evolution that, while useful and constructive, is also dangerous. Can we produce the required adjustments with the necessary speed? The most hopeful answer is that the human species has been subjected to similar tests before and seems to have a congenital ability to come through, after varying amounts of trouble. To ask in advance for a complete recipe would be unreasonable. We can specify only the human qualities required: patience, flexibility, and intelligence.*

5.12 Further Reading

Journals and websites listed as references provide continuously further updated information. Recommended periodicals as basic theoretical and data sources are:

- *Philosophy and Public Affairs*, Blackwell, Princeton – quarterly
- *American Sociological Review*, American Sociological Association, Ohio State University, Columbia – bimonthly
- *Comparative Studies in Sociology and History*, Cambridge University Press, Cambridge/MA – quarterly
- *The American Statistician*, American Statistical Association – quarterly
- *American Journal of International Law*, American Society of International Law – quarterly
- *Economic Geography, Clark University*, Worcester/MA – quarterly
- *Economic History Review*, Blackwell, Princeton – three-yearly
- *Journal of Economic History*, Cambridge University Press, Cambridge/MA – quarterly
- *Journal of Labor Economics*, Society of Law Economists, University Chicago Press – quarterly
- *The Rand Journal of Economics*, The Rand Corporation, Santa Monica – quarterly

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5.21 World Bank: World Development Indicators 2005 database
5.22 Time, America by the Numbers, Oct. 22, 2006
5.23 W. Thompson, J. Hickey: *Society in Focus* (Pearson, Boston 2004)
5.24 US Census Bureau – http://www.census.gov/
5.25 Hungarian Central Statisical Office: *Hungarian Statistical Pocketbook* (Magyar Statisztikai Zsebkönyv, Budapest 1937)
5.26 A. Maddison: *The World Economy: A Millennial Perspective* (Development Center Studies, Paris 2001)
5.27 E. Bowring: Post-Fordism and the end of work, Futures **34/2**, 159–172 (2002)
5.28 G. Michaels: Technology, complexity and information: The evolution on demand for office workers, Working Paper, http://econ-www.mit.edu
5.29 SIBIS (Statistical Indicators Benchmarking the Information Society) – http://www.sibis-eu.org/
5.30 World Development Indicators, World Bank, 2006
5.31 UNCTAD Handbook of Statistics, UN publ.
5.32 Economist Intelligence Unit, *Scattering the seeds of invention: the globalization of research and development* (Economist, London 2004), pp. 106–108
5.33 Transparency International, the global coalition against corruption – http://www.transparency.org/publications/gcr
5.34 http://epp.eurostat.ec.europa.eu
5.35 K.F. Ringer: *Education and Society in Modern Europe* (Indiana University Press, Bloomington 1934)
5.36 IFAC Publications of the Education, Social Effects Committee and of the Manufacturing and Logistic Systems Group – http://www.ifac-control.org/
5.37 http://www1.worldbank.org/education/edstats/
5.38 B. Moulton: The expanding role of hedonic methods in the official statistics of the United States, Working Paper (Bureau of Economic Analysis, Washington 2001)
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