

TECHNO-ECONOMIC PARADIGMS

	EARLY MECHANIZATION 1771 to 1828		INDUSTRIAL CAPITALISM AND INCURSION OF TECHNOLOGY IN OUR EVERYDAY LIFE 1829 to 1874		EMERGING FINANCIAL CAPITALISM AND DAWN OF THE TECHNOLOGICAL SOCIETY 1875 to 1907		DEVELOPING FINANCIAL CAPITALISM AND GROWTH OF THE MASS PRODUCTION CAPITALISM 1908 to 1970		CONSOLIDATION OF THE FINANCIAL AND MASS PRODUCTION CAPITALISM AND THE EMERGING OF THE KNOWLEDGE-BASED ECONOMY 1971 to present days.			
Milestones.	From Arkwright's mill to the dawn of electromagnetism.		From the Rocket locomotive to the construction of railways all over the world.		From the Carnegie-Bessemer Steel plant to the dawn of the automotive and aviation industries.		From the Ford Model T Production to the Space Race to put a man on the moon.		From the Intel Microprocessor to the Personal Communications Services and the Internet of Things.			
General references of the period.	«Laissez faire et laissez passer, le monde va de lui même». The Boston Tea Party. United States Declaration of Independence. French Revolution. Napoleonic Wars.		«Zollverein». Congress of Vienna («Metternicht Era»). «Biedermeier» in Central Europe. «Unità d'Italia». Crimean War. «Pax Britannica». Artisan cooperatives. First laws of social character.		«Belle Époque» in Western Europe. Splendor of the «Victorian Era». The Gold Standard. State regulations. Advances in social laws. Growth of the public sector, the bureaucracy and public services. Workers' organizations that demand better work conditions. Outbreak of several financial crises. Nationalistic tensions. Instability of the political and economic systems, which later led to World War I.		World War I. Speculation and outbreak of the Great Depression in the United States. Instability of the political and economic system, which led to military dictatorships and later to World War II. Welfare State policies. Social market economy in the Northern European countries. Regulation on investment and employment. Strong trade unions. Keynesianism. Cold War. «Pax Americana».		Democracy and human rights. Multilateralism vs. «Clash of Civilizations». Globalization and... deglobalization? Truth vs. Post-truth. Security vs. Privacy. Decrease of the Welfare State. Neoliberalism: deregulation in most sectors but mainly in the financial markets. Tighter environmental regulation (but implemented very slowly). In the near future one of the most serious consequences of the climate change is the decrease in fresh water sources and the increasing scarcity of clean drinking water. <i>More than an era of changes, a change of era!</i>			
Evolution of Economics.	Political Economy.		Political Economy.		From Political Economy to the Microeconomic Revolution.		Development of the Micro and Macroeconomic rudiments.		Economic growth and development of the Knowledge-based Economy and services.			
Main intensive factors of production.	Intensive in labor and capital. First machines.		Intensive in labor, capital and technology. First services.		Intensive in labor, capital and technology. First complex and sophisticated services.		Intensive in labor, capital, technology and services. Increasing «deep knowledge».		Intensive in labor (outplacement), capital (from all over the world) and technology. Increasingly personalized services and increasing «deep learning».			
Infrastructure created.	Roads. Maritime and river ports. Dredging of rivers. Urban concentration.		Roads and ports. Railways. Maritime and river networks. Urban concentration.		Roads, maritime ports and railways. Tunnels and bridges. Hydro-electrical engineering projects. High urban concentration.		Freeways, maritime ports, railways, tunnels, bridges and airports. Dams, hydroelectric, thermoelectric and nuclear power plants. Production networks at a domestic (and European) level. Cities' expansion to metropolitan areas.		Multiple freeways, maritime ports, tunnels, bridges, canals and airports. High-speed railways. Dams, hydroelectric, thermoelectric and nuclear power plants. Satellite and digital terrestrial communication networks. Worldwide production networks. Megalopolis expand (horizontally and vertically) beyond the known limits.			
Industrial strategic inputs.	Cotton. Iron. Coal and lignite.		Cotton. Iron. Coal and lignite.		Cotton. Steel. Coal and lignite. Hydrocarbons (petroleum and kerosene).		Cotton. Steel. Coal and lignite. Hydrocarbons (petroleum and natural gas). Agro-alimentary industries.		Steel and aluminum. Hydrocarbons (petroleum and natural gas – fracking). Access to gold, coltan, silicon, tellurium and lithium (minerals for electronic components). Agro-alimentary. Clean drinking water.			
Main industries.	Textile. Mining (coal). Hydraulic engineering. Construction.		Textile. Mining (coal and lignite). Hydraulic engineering. Construction. Machine tools.		Textile. Mining (coal, lignite and gold). Hydraulic engineering. Construction. Steam engines.		Textile. Mining. Hydraulic, electric and nuclear engineering. Construction. Metallurgy (steel). Railways. Petroleum and petrochemistry. Heavy equipment.		In addition to the last aforementioned: Telecommunications. Pharmaceutical. Agro-alimentary. All kind of services. Finance and banking.		Electronics and computing. Information and knowledge - complex based systems (Big Data).	
Fastest-growing industries.	Finance and insurance. Metallurgy (iron). Mining (coal). Steam engines.		Finance, banking and insurance. Petroleum and petrochemistry. Railways.		Finance, banking and insurance. Electric power industry. Blast furnaces. Petroleum and petrochemistry.		Finance, banking and insurance. Durable goods. Hydroelectric, thermoelectric and nuclear power engineering.		In addition to the last aforementioned: Development of new materials (e.g. graphene). Biotechnology and biomedical engineering (bionics). Mechatronics (robotics).		Green energy. Education and training. Leisure and entertainment. Emissions market.	
Service sector.	Boost of the international trade: growth of the shipping companies for the transport of goods and slaves. Last years of the «Manila Galleon». Development of financial and insurance services.		In addition to the aforementioned: Growth of secondary services to meet the needs of the industry. Development of the transport of persons for the distribution of goods. First telegraph services. Development of the international mail services.		In addition to the aforementioned: Growth of the services to meet the needs of the industry at international level. Services of Inter-oceanic Telegraphy. Growth of the public sector, bureaucracy and the public services. First department stores. Transport of the first refrigerated products. First services focused in education and training.		In addition to the aforementioned: Development of the services to meet the needs of the growing middle class. Development of telephone services. Development of multinational service networks. Development of self-services (e.g. fast food and supermarkets). Development of social services provided by the State. Development of highly sophisticated financial services. Development of the tourism and leisure sectors.		In addition to the aforementioned: Development of computing and ICT's services. Development of global service networks throughout the value chain. Development of security and intelligence services. Development of highly-personalized services (e.g. in the financial sector, the «plastic money»). Development of on demand («outsourcing») services. Emergence of various types of «low-cost» services. Globalization of services: «outplacement» and the experience of taking the same coffee at a Starbucks cafe anywhere in the world.			
Limitations to be overcome.	Insufficient use of economies of scale. In-control processes. Unreliable technology. Institutional constraints. «Enclosure Acts». Corruption.		Insufficient use of economies of scale. Unreliable technology. Private monopolies. Limited use of the hydraulic energy. Institutional constraints. Corruption.		Insufficient use of economies of scale. Unreliable technology. Strong private monopolies. Limited use of steel. Institutional constraints. Corruption.		Insufficient use of economies of scale. Environmental depredation. Scheduled obsolescence (e.g. Phoebe cartel). High dependence on petroleum. Strong State monopolies. Inflexible assembly processes. Constraints arising from Cold War. Waste produced. Corruption.		High dependence on petroleum. Environmental depredation. Scheduled obsolescence. Limitations on the use of green energy. Poverty and inequalities (at international level but also inside the countries). Non-operative domestic and international institutions. Digital disruption. Waste produced (Anthropocene). Corruption.			
Alternatives to overcome the limitations.	Mechanization. Industrial organization. More effective regulations and institutions.		Steam engines and new transport systems. More effective regulations and institutions. Generalization of the technological change.		Availability of steel at a low cost. Bigger electrical power plants. Standardization of components. Standardization of measure systems. More effective regulations and institutions.		Easier access to energy resources (e.g. petroleum and natural gas). Affordability of durable consumer goods. New dynamics in the assembly line. New models of urbanization and industrial location thanks to the mobility of the automobile. More effective regulations and institutions.		More intensive use of economies of scale. Greater use of clusters. Supervision and control through electronic and computer systems. More access to technology. Open access to information and knowledge. Use of green energy and reduction of the waste produced (Circular Economy). More effective regulations and institutions. Hyperloops for transport of people.			
Models of business organization.	Innovative entrepreneur. Medium enterprises. Optimization of local, European and transoceanic commercial networks.		Innovative entrepreneurship. Private monopolies. Cooperation among firms. Optimization of commercial networks. First workers' organizations (but with limited power).		Consolidation of private monopolies. Grouping and strengthening of banking and capital firms. Optimization of commercial networks. First theories for business management. Consolidation of workers' organizations.		Advanced theories for business management. Multinational firms. Consolidation of State monopolies. Large flow of Foreign Direct Investment. First steps in vertical manufacturing networks. Strong trade unions.		Horizontal manufacturing and control networks. «Learning by doing». Multidisciplinary teams. Global firms. Schumpeter's «creative destruction». Labor instability due to continuous changes in companies («outplacement»). Weak workers' organizations. Shareholder vs. Stakeholder models.			
Competitiveness / Cooperation.	Rising competitiveness among firms.	Dawn of cooperation among innovative firms and capital markets.	Rising competitiveness among firms. Oligopolistic competition. Protectionism and economic nationalism.	Dawn of long-term agreements that brought stability and reduction of production costs.	Rising competitiveness among firms. Oligopolistic competition. Antitrust laws.	Long-term agreements that brought stability and reduction of production costs.	Rising competitiveness among firms. Antitrust laws. Strong public monopolies.	Long-term agreements that brought stability and reduction of production costs. First networks among companies at international level. Economic European Community (EEC).	Very strong competitiveness among the economic actors (States and firms – SMEs, multinational and global). Extinction of State monopolies. «Just-in-time» manufacturing (zero stock). International trade agreements.		Global networks. Worldwide communications. Clusters made of big business and medium enterprises. New financing models. Cooperation for the development of innovations. Free trade agreements. European Union (EU). OECD.	
Main domestic credit sources.	Owners and partners.		Industrial firms.		Industrial firms. States.		Domestic banks and conglomerates of firms. States.		Domestic banks, hedge funds and private equity. States.			
Main external credit sources.	Commercial and merchant banks.		Investment banks.		Investment banks.		States and big banks. International economic institutions (e.g. IMF and World Bank).		Global banks, hedge funds, sovereign funds and private equity. International economic institutions (e.g. IMF, WB and European Central Bank).			
Dominant groups of economic power.	Traders and bankers.		Industrial potentates, traders, bankers and investors.		Industrial potentates, traders, bankers and investors.		Multinational firms, big banks, traders and investors.		Global firms, global banks and hedge funds.			
Regulatory / deregulatory mechanisms.	Emerging of nationalistic movements. «Laissez faire et laissez passer, le monde va de lui même». The last Spanish «almojarifazgos».		Strengthening of nationalistic movements. Growth of the international trade.		Dynamic trade among the Metropolis and the Colonies. Protectionism and economic nationalism in the rest of the world.		In the first half, protectionism and economic nationalism. Statism in the countries under the control of the Soviet Union. «Bretton Woods» and the creation of international economic institutions. In the second half, welfare state policies, Keynesianism and at the same time gradual opening in Western Europe via European Economic Community (EEC).		Emerging of trading blocks worldwide. Rules emanating from the «Washington Consensus». International economic institutions with limited faculties to regulate the worldwide flow of capitals and the behavior of the multinational and global firms. Tighter environmental regulations (but implemented very slowly). «Neoliberalism».			
Innovation systems.	Founding of universities, polytechnic schools and research institutes. Development of domestic patent laws. Development of systems of measurement: the metric system.		In addition to the aforementioned: Training of scientists and engineers. Professionalization of the workforce. Development of the international patent laws. Development of the international system of measurements. Highlight of the «stages of learning»: i) unconscious incompetence; ii) conscious incompetence; iii) conscious competence, and iv) unconscious competence.		In addition to the aforementioned: Development of specialized areas in R&D in firms. First laws of elementary education. Transfer of knowledge and technology through the international emigration of «brains» (scientist and engineers) and highly skilled workers. Development of scientific publications. Development of scientific meetings.		In addition to the aforementioned: Development of public politics in science and technology. Science and technology at the service of war like never before. Transfer of technology through licenses and agreements for the use of know-how. Development of legislation on Foreign Direct Investment. Scientific and technological industrial training education. Development of compulsory and secondary education. Universal literacy.		In addition to the aforementioned: Information and knowledge flow at a very high speed as they are more accessible than ever before. Triple Helix: cooperation among States, firms and universities to achieve R&D objectives. Collaboration networks in science and technology (multidisciplinary teams). Horizontal integration of the R&D, from the first steps to marketing and distribution. Transfer of information, knowledge and technology through the emigration of «brains» (scientist and engineers) and highly skilled workers. New risks: espionage and piracy. New financing models (e.g. «crowdfunding»). «Blockchain» systems.			
Relation with the environment.	Brutally predatory.		Brutally predatory.		Brutally predatory.		Brutally and consciously predatory.		Brutally and consciously predatory.			
Representative countries.	Great powers: <ul style="list-style-type: none"> England France Germany 	Small developed country: <ul style="list-style-type: none"> Belgium 	Great powers: <ul style="list-style-type: none"> England France Germany 	Small developed country: <ul style="list-style-type: none"> Belgium 	Great powers: <ul style="list-style-type: none"> England France Germany 	Small developed countries: <ul style="list-style-type: none"> Belgium Netherlands Switzerland 	Great powers: <ul style="list-style-type: none"> European Economic Community France Canada Japan Soviet Union United Kingdom United States 	Small and medium developed countries: <ul style="list-style-type: none"> Australia Belgium Canada Denmark Netherlands Sweden Switzerland 	Great powers: <ul style="list-style-type: none"> China European Union Germany Japan United Kingdom United States 	Small and medium developed countries: <ul style="list-style-type: none"> Australia / Austria Belgium / Canada Denmark / Finland France / Holland / Lux. Ireland / Italy / N.Zland Singapore / S. Korea Spain / Sweden Switzerland / Taiwan 	Emerging (big) countries: <ul style="list-style-type: none"> Brazil India Indonesia Mexico Russia S. Africa Turkey 	Emerging (small and medium) countries: <ul style="list-style-type: none"> Argentina Chile Colombia Peru Poland Thailand
Names of the firms.	Richard Arkwright Matthew Boulton James Watt Joseph Bramah Élieuthère Irénée du Pont James Brindley John Jacob Astor	Mayer Rothschild Henry Maudslay Thomas Telford William T. Clark Antoine Lavoisier Josiah Wedgwood John Kay Stephen Girard	George Stephenson Joseph Whitworth Isambard K. Brunel James Beaumont Neilson Henry Lehman Paul Julius Reuter John Kimberly	Marcus Goldman Isaac Merritt Singer Friedrich Bayer William Welch Deloitte Charles Pfizer Samuel Lowell Price Yataro Iwasaki William H. Vanderbilt	John Pierpont Morgan Gottlieb Daimler Rudolf Diesel Carl Benz John D. Rockefeller Andrew W. Mellon Giovanni Battista Pirelli Andrew Jackson Beard	Andrew Carnegie Werner von Siemens Alfred Nobel Friedrich Alfred Krupp Cornelius Vanderbilt James Fisk Robert Bosch Harvey Samuel Firestone	Alfred P. Sloan / J. Paul Getty Akio Morita / Solomon Guggenheim Henry Ford / Howard Hughes Sōichirō Honda / Shigeo Shingo Michio Suzuki / Sakichi Toyoda Lee Iaccoca / August Horch / John Kluge Frank McNamara / Ralph Schneider Paul Graham / James Roosevelt	Giovanni Agnelli / Herb Kelleher Samuel Walton / Christy Walton Heinz Heinrich Nordhoff Konosuke Matsushita / J.R. Tata Conrad Hilton / Thomas Watson Walt Disney / Aristotle Onassis Ray Kroc / Robert Noyce Momofuku Ando / Estee Lauder	William H. Gates / Carlos Slim Helú / Paul Allen Steve Jobs / Lakshmi Mittal / Sheldon Adelson Amancio Ortega / George Soros / Ted Turner Wang Jianlin / Bernard Arnaut / R. Abramovich Lawrence Ellison / Eike Batista / L. Bettencourt Stefane Persson / Karl Albrecht / Donald Bren Mukesh Ambani / Ingvar Kamprad / F. Pinault Kushal Pal Singh / Oleg Deripaska / M. Dell	Mark Zuckerberg / Li Ka-Shing Elon Musk / Jeff Bezos / Larry Page Serguéi Brin / Akio Toyoda Warren Buffet / Larry Ellison Charles & David Koch / Isak Andic Michael Bloomberg / M. Ferrero Philip Knight / Ronald Perelman Leonardo Del Vecchio		
Names of the science and technology.	Charles Babbage James Hargreaves Edward Jenner Antoine Lavoisier John Dalton Benjamin Franklin	Alessandro Volta Carl von Linneo A. Avogadro W. Sturgeon James Watt Humphry Davy	Antonio Meucci Charles Darwin Walter Flemming Joseph M. Jacquard George Stephenson	Jacob Perkins Samuel F. B. Morse Dmitri Mendeléyev Gregor Mendel Friedrich Wöhler Henry Bessemer	Alexandre Gustave Eiffel Ferdinand de Lesseps Arthur Eichengrün Santiago Ramón y Cajal Pierre and Marie Curie H. H. R. Koch / Louis Pasteur	Ernest Rutherford Frederick Banting Karl Landsteiner Joseph J. Thomson John Wesley Hyatt Thomas Hunt Morgan	Nikola Tesla Ernest Rutherford Severo Ochoa James Chadwick Alexander Fleming / Paul Ehrlich Thomas A. Edison	Rosalind Franklin James Watson / Francis Crick Max Planck / Imre Lakatos Albert Einstein / Niels Bohr Marshall W. Nirenberg Erwin Schrödinger	Stephen W. Hawking Robert Gallo / Luc Montagnier Harold Varmus / John Michael Bishop Robert F. Curl / Hugh Herr Gerhard Ertl Stefan Hell	Charles Felferman Mildred Dresselhaus Mario J. Molina Francis Mojica		
Names of the economics and society.	Adam Smith Jean Baptiste Say Thomas Malthus Jeremy Bentham François Quesnay David Hume Friedrich Hegel	P.S. du Pont de Nemours Robert Owen A.R.J. Turgot Sismonde de Sismondi H. de Saint Simon	David Ricardo Friedrich List Alexander Hamilton Gustav Schmoller William Roscher Auguste Comte Augustin Thierry	Thomas Paine Antoine A. Cournot Friedrich List John Stuart Mill James Mill Karl Marx Friedrich Engels	Alfred Marshall Felix Hoffman Wilfredo Pareto Léon Walras Vladimir Ilich Uliánov «Lenin» Thorstein B. Veblen Herbert Spencer	Ernest Rutherford Frederick Banting Karl Landsteiner Joseph J. Thomson John Wesley Hyatt Thomas Hunt Morgan Knut Wicksell / Mary A. Evans Alfred Russel Wallace Wesley Clair Mitchell Harriet Martineu George Henry Lewes	Frederick Winslow Taylor John Maynard Keynes / Michal Kalecki Arthur C. Pigou / Irving Fisher Gunnar Myrdal / Wassily Leontief Sigmund Freud / Jacques Lacan Ludwig Wittgenstein / Karl Popper Theodor Adorno / Georg Lukács	Roy F. Harrod / Evsey D. Domar Karl Polanyi / Paul A. Samuelson Abba P. Lerner / Simon Kuznets Robert Solow / John R. Hicks Ludwig von Mises / Friedrich Hayek / Milton & Rose Friedman Joseph A. Schumpeter / T. Kuhn	Michael Porter / M. Aoki Peter F. Drucker W. Edwards Deming Christopher Freeman Joseph Stiglitz Paul Krugman / Jean Tirole K. Daron Acemoglu	TECHNO-ECONOMIC PARADIGMS © Sergio A. Berumen ESIC Editorial Madrid – 2018		