

The HIGHLY PROBABLE FUTURE

*83 Assumptions about
the Year 2025*

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By Joseph F. Coates

Before we can plan the future, we must make some assumptions about what that future will be like. This inventory of "highly probable" futures, developed by Coates & Jarratt, Inc., provides a foundation for getting started.

Assumptions about the future are not like assumptions in a geometry exercise. They are not abstract statements from which consequences can be derived with mathematical precision. But we need to make *some* assumptions about the future in order to plan it, prepare for it, and prevent undesired events from happening.

The following 83 statements about the year 2025 were developed for Project 2025: Anticipating Developments in Science and Technology and Their Implications for the Corporation, sponsored by 18 large organizations in the United States and Europe. The project's goal is to explore how science and technology are likely to reshape society over the next three decades.

Some are assumptions drawn from the project. Others, such as the estimates of future population, come from public or highly credible private statistical and mathematical analyses of trends. Still others result from integrating a wide

range of material; one such assumption is that we will be moving toward a totally managed globe. To present the underlying arguments supporting each of these highly reliable statements (which amount to forecasts) would require a massive report. We have, therefore, presented these statements about the future as simply and in as straightforward a manner as possible.

A few of these assumptions have a normative, or goals-oriented, aspect to them. The assumption, for example, that per capita energy consumption in the advanced nations will fall to 66% of the 1990 level is definitely not a trend extrapolation but a judgment about the confluence of social, political, economic, environmental, technological, and other concerns. Readers are urged to formulate and review alternatives that might characterize the next 30 years and test how those alternatives affect any other thoughts, concepts, beliefs, or conclusions about the future.

What follows is an inventory of high-probability statements about the year 2025 in two categories:

A. Scientific discoveries and research and technological developments and applications.

B. Contextual, that is, those factors forming the social, economic, political, military, environmental, and other factors that will shape or influence scientific and technological developments. These contextual areas form the environment for the introduction and maturation of new products, processes, and services in society.

These high-probability assumptions are the underpinnings to understanding how any particular area may develop under the influence of new scientific, technological, social, political, or economic developments.

It would be nice to suggest that these developments are inevitable, but few developments are. Nonetheless, the convergence of evidence indicates that these developments are of such high likelihood that they form an intellectual substructure for thinking about the year 2025.

Science and Technology IN THE YEAR 2025

Managing Our World

1. Movement toward a totally managed environment will have proceeded substantially at national and global levels.

Oceans, forests, grasslands, and water supplies make up major areas of the managed environment. Macroengineering—planetary-scale civil works—will make up another element of that managed environment. Finally, the more-traditional business and industrial infrastructure—telecommunications, manufacturing facilities, chemical plants, electric-generating facilities, and so on—will be a part of managed systems and subsystems.

Note that total management does not imply full understanding of what is managed. But expanding knowledge will make this management practical. Total management also does not imply total control over these systems.

2. Everything will be smart—that is, responsive to its external or internal environment. This will be achieved either by embedding microprocessors and associated sensors in physical devices or by creating materials that are responsive to physical variables such as light, heat, noise, odors, and electromagnetic fields, or by a combination of these two strategies.

Amid maps and monitors, a British Telecom network manager gets up-to-the-minute information on worldwide telephone network. The world and all its systems—natural and manufactured—are increasingly coming under human management. (Assumption 1)



Managing Human Health

3. All human diseases and disorders will have their linkages, if any, to the human genome identified. For many diseases and disorders, the intermediate biochemical processes that lead to the expression of the disease or disorder and its interactions with a person's environment and personal history will also have been explicated.

4. In several parts of the world, the understanding of human genetics will lead to explicit programs to enhance people's overall physical and mental abilities—not just prevent diseases.

5. The chemical, physiological, and genetic bases of human behavior will be generally understood. Direct, targeted interventions for disease control and individual human enhancement will be commonplace. Brain-mind manipulation technologies to control or influence emotions, learning, sensory acuity, memory, and other psychological states will be available and in widespread use.

6. In-depth personal medical histories will be on record and under full control of the individual in some form of a medical smart card or disk.

7. More people in advanced countries will be living to their mid-80s while enjoying a healthier, fuller life.

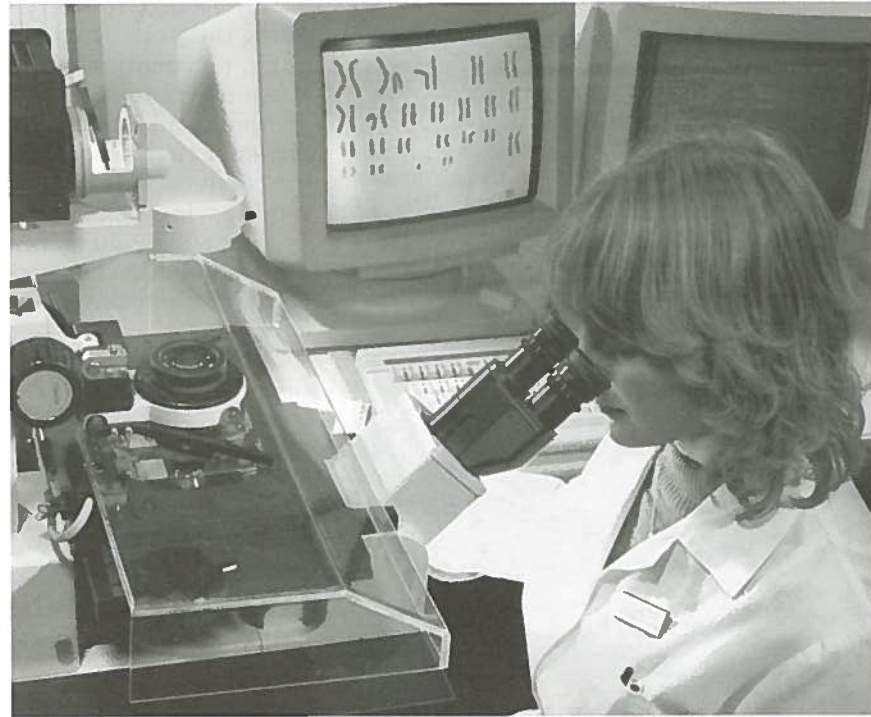
8. Custom-designed drugs such as hormones and neurotransmitters (chemicals that control nerve impulses) will be as safe and effective as those produced naturally within humans or other animals.

9. Prosthesis (synthetic body parts or replacements) with more targeted drug treatments will lead to radical improvements for people who are injured, impaired, or have otherwise degraded physical or physiological capabilities.

Managing Environment And Resources

10. Scientists will have worked out the genome of prototypical plants and animals, including insects. This will lead to more-refined management, control, and manipulation of their health, propagation, or elimination.

11. New forms of microorganisms, plants, and animals will be common-



Genetic abnormalities in an unborn baby are scanned by medical researcher. All human ailments that have a genetic link will be identified and mapped by 2025. (Assumption 3)

place due to advances in genetic engineering.

12. Foods for human consumption will be more diverse as a result of agricultural genetics. There will be substantially less animal protein in diets in advanced nations, compared with the present. A variety of factors will bring vegetarianism to the fore, including health, environmental, and ethical trends.

13. There will be synthetic and genetically manipulated foods to match each individual consumer's taste, nutritional needs, and medical status. Look for "extra-salty (artificial), low-cholesterol, cancer-busting french fries."

14. Farmers will use synthetic soils, designed to specification, for terrain restoration and to enhance indoor or outdoor agriculture.

15. Genetically engineered microorganisms will do many things. In particular, they will be used in production of some commodity chemicals as well as highly complex chemicals and medicines, vaccines, and drugs. They will be widely used in

agriculture, mining, resource upgrading, waste management, and environmental cleanup.

16. There will be routine genetic programs for enhancing animals used for food production, recreation, and even pets. In less-developed countries, work animals will be improved through these techniques.

17. Remote sensing of the earth will lead to monitoring, assessment, and analysis of events and resources at and below the surface of the earth and ocean. In many places, *in situ* sensor networks will assist in monitoring the environment. Worldwide weather reporting will be routine, detailed, and reliable.

18. Many natural disasters, such as floods, earthquakes, and landslides, will be mitigated, controlled, or prevented.

19. Per capita energy consumption of all types of goods and services in the advanced nations will be at 66% of per capita consumption in 1990.

20. Per capita consumption in the rest of the world will be at 160% of per capita consumption in 1990.



Scientist studies rice's resistance to salt at the University of Sussex in England. New and improved foods will result from genetic manipulation. (Assumption 12)

21. Resource recovery along the lines of recycling, reclamation, and remanufacturing will be routine in all advanced nations. Extraction of virgin materials through mining, logging, and drilling will be dramatically reduced, saving energy and protecting the environment.

22. Restorative agriculture (i.e., "prescription" farming) will be routine. Farmers will design crops and employ more-sophisticated techniques to optimize climate, soil treatments, and plant types.

Automation and Infotech

23. There will be a worldwide, broadband network of networks based on fiber optics; other techniques, such as communications satellites, cellular, and microwave will be ancillary. Throughout the advanced nations and the middle class and prosperous crust of the developing world,

face-to-face, voice-to-voice, person-to-data, and data-to-data communication will be available to any place at any time from anywhere.

24. Robots and other automated machinery will be commonplace inside and outside the factory, in agriculture, building and construction, undersea activities, space, mining, and elsewhere.

25. There will be universal, on-line surveys and voting in all the advanced nations. In some jurisdictions, this will include voting in elections for local and national leaders.

26. Ubiquitous availability of computers will facilitate automated control and make continuing performance monitoring and evaluations of physical systems routine.

27. The ability to manipulate materials at the molecular or atomic level will allow manufacturers to customize materials for highly specific functions such as environmental sensing and information processing.

28. Totally automated factories will be common but not universal for a variety of reasons, including the cost and availability of technology and labor conflicts.

29. Virtual-reality technologies will be commonplace for training and recreation and will be a routine part of simulation for all kinds of physical planning and product design.

30. In printed and—to a lesser extent—in voice-to-voice telecommunication, language translation will be effective for restricted but practically significant vocabularies.

31. Expert systems will be developed to the point where the learning of machines, systems, and devices will mimic or surpass human learning. Certain low-level learning will evolve out of situations and experiences, as it does for infants. The toaster will "know" that the person who likes white bread likes it toasted darker, and the person who chooses rye likes it light.

Satellite images of the earth are studied at National Remote Sensing Centre in Hampshire, England. Space-based monitoring of the environment will help us predict the weather as well as mitigate or prevent natural disasters. (Assumptions 17 and 18)



32. The fusion of telecommunications and computation will be complete. We'll use a new vocabulary of communications as we *televote*, *teleshop*, *telework*, and *tele-everything*. We'll *e-mail*, *tube*, or *upload* letters to Mom. We'll go *MUDing* in cyberspace and mind our *netiquette* during virtual encounters.

33. Factory-manufactured housing will be the norm in advanced nations, with prefabricated modular units making housing more flexible as well as more affordable.

34. In the design of many commercial products such as homes, furnishings, vehicles, and other articles of commerce, the customer will participate directly with the specialist in design.

35. New infrastructures throughout the world will be self-monitoring. Already, some bridges and coliseums have "tilt" sensors to gauge structural stress; magnetic-resonance imaging used in medical testing will also be used to noninvasively examine materials for early signs of damage so preventive maintenance can be employed.

36. Interactive vehicle-highway systems will be widespread, with tens of thousands of miles of highway either so equipped or about to be. Rather than reconstruct highways, engineers may retrofit them with the new technologies.

37. Robotized devices will be a routine part of the space program, effectively integrating with people. Besides the familiar robotic arm used on space shuttles, robots will run facilities in space, operating autonomously where humans are too clumsy or too vulnerable to work effectively.

38. Applied economics will lead to a greater dependency on mathematical models embodied in computers. These models will have expanded capabilities and will routinely integrate environmental and quality-of-life factors into economic calculations. One major problem will be how to measure the economic value of information and knowledge. A Nobel Prize will be granted to the economist who develops an effective theory of the economics of information.

Society IN THE YEAR 2025

Population Trends

39. World population will be about 8.4 billion people.

40. Family size will be below replacement rates in advanced nations but well above replacement rates in the less-developed world.

41. Birth-control technologies will be universally accepted and widely employed, including a market for descendants of RU486.

42. The population of advanced nations will be older, with an average age of 41.

43. The less-developed world will be substantially younger but will have made spotty but significant progress in reducing birth rates. However, the population of these countries will not stop growing until sometime after 2025.

44. The majority of the world's population will be metropolitan, including people living in satellite cities clustered around metropolitan centers.

45. World population will divide into three tiers: at the top, World 1, comprising advanced nations and the world's middle-classes living in prosperity analogous to Germany, the United States, and Japan; at the bottom, World 3, people living in destitution; and in the middle, World 2, a vast range of people living comfortably but not extravagantly in the context of their culture. We use the terms *World 1*, *World 2*, and *World 3* for the emerging pattern of nations that moves us beyond the post-World War II nomenclature.

46. A worldwide middle class will emerge. Its growth in World 2 and to a lesser extent in World 3 will be a powerful force for political and economic stability and for some forms of democracy.

Worldwide Tensions

47. There will be worldwide unrest reflecting internal strife, border conflicts, and irredentist movements. But the unrest will have declined substantially after peaking between 1995 and 2010.

48. Under international pressures, the United Nations will effectively take on a *peacemaking* role to complement its historic *peacekeeping* role.

49. Widespread contamination by a nuclear device will have occurred either accidentally or as an act of political/military violence. On a scale of 1 to 10 (with Three Mile Island a 0.5 and Chernobyl a 3), this event will be a 5 or higher.

50. Increasing economic and political instabilities will deter business involvement in specific World 3 countries.

51. Despite technological advances, epidemics and mass starvation will be common occurrences in World 3 because of strained resources in some areas and politically motivated disruptions in others.

52. Supranational government will become prominent and effective, though not completely, with regard to environmental issues, war, narcotics, design and location of business facilities, regulation of global business, disease prevention, workers' rights, and business practices.

53. There will be substantial environmental degradation, especially in World 3. Governments will commit money to ease and correct the problem, but many will sacrifice long-term programs that will prevent the problems from happening in the first place.

54. There will be shifts in the pattern of world debtor and creditor



Pylon supporting electric power lines is prepared for a new job: carrying fiber-optic cable. By 2025, there will be a broadband, fiber-optic-based network of networks circling the world. (Assumption 23)

countries. Japan's burst economic bubble, the ever-growing U.S. debt, and Germany's chronic unemployment problems are harbingers of things to come.

55. NIMBY ("Not In My Back Yard") will be a global-scale problem for a variety of issues, ranging from hazardous-waste disposal to refugees to prisons to commercial real-estate ventures.

56. Migration throughout the world will be regulated under new international law.

57. Terrorist activity that crosses international borders will continue to be a problem.

The Electronic Global Village

58. Global environmental management issues will be institutionalized

in multinational corporations as well as through the United Nations and other supranational entities.

59. A global currency will be in use.

60. English will remain the global common language in business, science, technology, and entertainment.

61. Schooling on a worldwide basis will be at a higher level than it is today. Education may approach universality at the elementary level and will become more accessible at the university level through distance-education technologies.

62. In the advanced nations, lifelong learning will be effectively institutionalized in schools and businesses.

63. There will be substantial, radical changes in the U.S. government.

National decisions will be influenced by electronically assisted referenda.

64. Throughout the advanced nations, people will be computer literate and computer dependent.

65. Worldwide, there will be countless virtual communities based on electronic linkages.

66. There will be a worldwide popular culture. The elements of that culture will flow in all directions, from country to country. In spite of the trend toward "demassification" in both information and production, the global links of communications and trade will ensure that ideas and products will be *available* to all, whether they like it or not.

67. The multinational corporation will be the world's dominant business form.

68. Economic blocs will be a prominent part of the international economy, with many products and commodities moving between these porous blocs. The principal blocs will be Europe, East Asia, and the Americas.

69. Universal monitoring of business transactions on a national and international business basis will prevail.

70. Identification cards will be universal. Smart cards will contain information such as nationality, medical history (perhaps even key data from one's genome), education and employment records, financial accounts, social security, credit status, and even religious and organizational affiliations.

Public Issues and Values

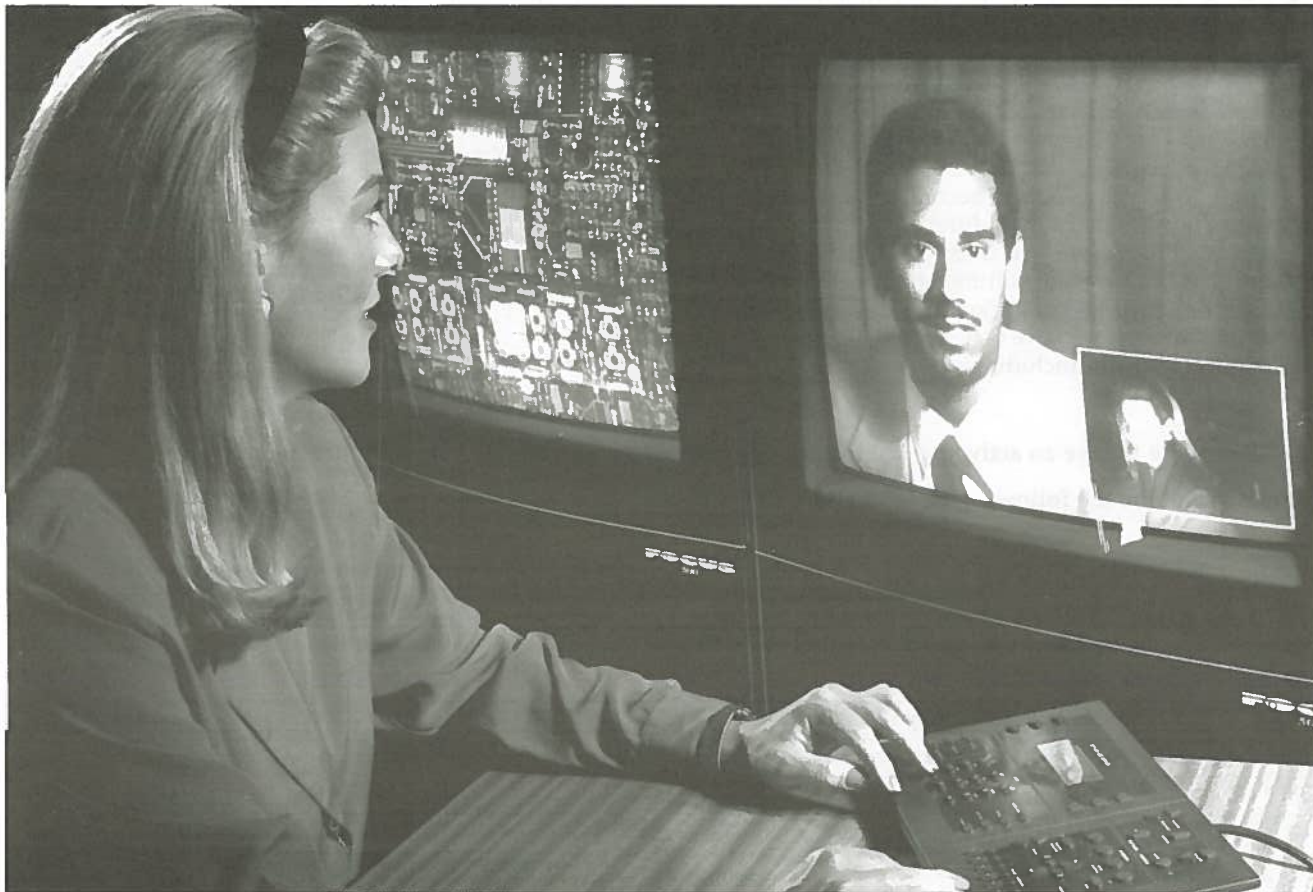
71. Within the United States there will be a national, universal health-care system.

72. In the United States, the collapse of the Social Security system will have led to a new form of old-age security such as one based on need-only criteria.

73. Genetic screening and counseling will be universally available and its use encouraged by many incentives and health choices.

74. There will be more recreation and leisure time for the middle class in the advanced nations.

75. The absolute cost of energy will rise, affecting the cost of trans-



portation and goods movement. Planners will reallocate terrain and physical space to make more-efficient use of scarce resources. In other words, cities will be redesigned and rezoned to improve efficiencies of energy in transportation, manufacturing, and housing, etc.

76. There will be a rise in secular substitutes for traditional religious beliefs, practices, institutions, and rituals for a substantial portion of the population of the advanced nations and the global middle class. The New Age movement, secular humanism, and virtual communities built on electronic networking are a few harbingers.

77. Socially significant crime—i.e., the crimes that have the widest negative effects—in the advanced nations will be increasingly economic and computer based. Examples include disruption of business, theft, introduction of maliciously false information, and tampering with medical records, air traffic control,

Face-to-face, yet far from each other, colleagues link up through videoconferencing equipment. “Virtual communities” will arise via telecommunications. (Assumption 65)

or national-security systems.

78. Tax filing, reporting, and collecting will be computer managed.

79. Quality, service, and reliability will be routine business criteria around the globe.

80. Customized products will dominate large parts of the manufacturing market. Manufacturers will offer customers unlimited variety in their products.

81. Economic health will be measured in a new way, including considerations of environment, quality of life, employment, and other activity and work. These new measures will become important factors in governmental planning.

82. GNP and other macroeconomic measures and accounts will include new variables such as environmental quality, accidents and disasters, and hours of true labor.

83. Sustainability will be the central concept and organizing principle in environmental management, while ecology will be its central science. □



About the Author

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