

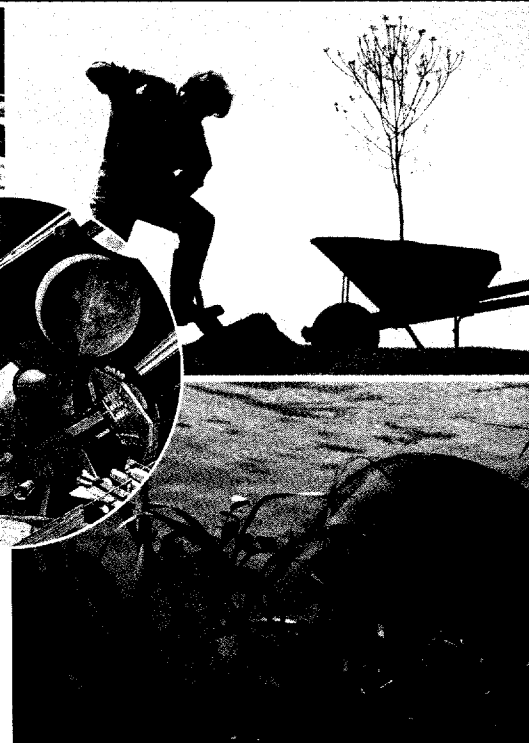
Probably the most challenging task facing humanity today is the creation of a shared vision of a sustainable and desirable society, one that can provide permanent prosperity within the biophysical constraints of the real world in a way that is fair and equitable to all of humanity, to other species, and to future generations. This vision does not now exist, although the seeds are there. We all have our own private visions of the world we really want, and we need to overcome our fears and skepticism and begin to share these visions and build on them, until we have built a vision of the world we want.

The most effective ingredient to move change in any particular direction is having a clear vision of the desired goal that is also truly shared

Four Visions of the Century Ahead: Will It Be Star Trek, Ecotopia, Big Government, or Mad Max?

By Robert Costanza

A professor of ecological economics describes four visions of the future that reflect fundamental choices: technological optimism or skepticism, free markets or communitarianism.



by the members affected by it, whether an organization, a community, or a nation.

Social observer Daniel Yankelovich has described the need for government to engage in public opinion research to guide public programs, and the need for individuals to be more informed and responsible citizens. The need for more public participation in public programs is a common theme in many public opinion surveys. For example, many people are highly in favor of more effort to protect the environment, but at the same time they are opposed to any diversion of tax revenues to do so. Coming to public judgment is the process of resolving these conflicts.

To start the dialogue and move quickly to public judgment, we may consider issues in the form of "visions" or scenarios. This article lays

out four such visions, each presented as a "future history" written from the vantage point of the year 2100. These visions include both positive and negative scenarios, hope and despair, allowing us to fully explore what the future may hold and thus to make informed choices among competing alternatives with a target of implications.

While there are an infinite number of possible future visions, I believe these four visions embody the basic patterns within which much of this variation occurs. Each of the visions is based on some critical assumptions about the way the world works, which may or may not turn out to be true. This format allows one to clearly identify these assump-

tions, assess how critical they are to the relevant vision, and recognize the consequences of them being wrong.

Four Visions of the Future

The four visions derive from two basic world views that reflect one's faith in technological progress. The

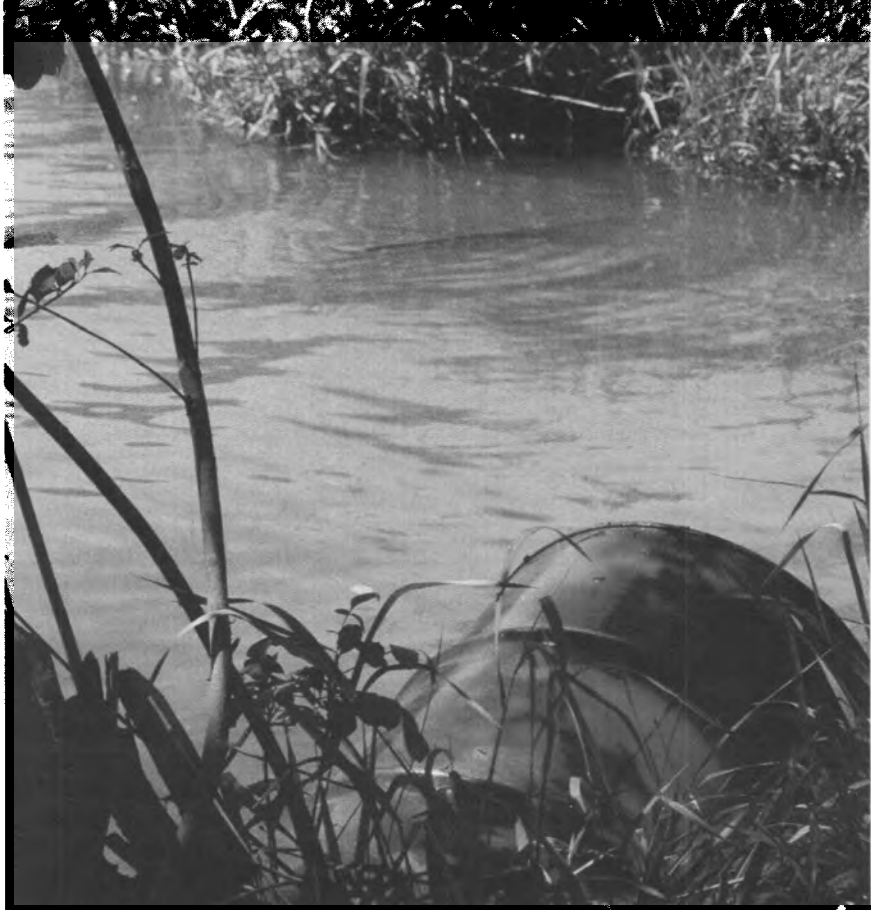
"technological optimist" world view is one of continued expansion of humans and their dominion over nature. This is the "default" vision in current Western society and represents the continuation of current trends into the indefinite future.

There are two versions of this vision, however: one in which the underlying assumptions are actually true in the real world and one in which those assumptions are false. The positive version of the "technological optimist" vision I'll call "Star Trek," named for the popular TV series that is its most articulate and vividly fleshed-out manifestation. The negative version of the "technological optimist" vision I'll call "Mad Max" after the popular postapocalyptic Australian movie of 1979 that embodies many aspects of this vision gone bad.

The "technological skeptic" vision focuses much less on technological change and more on social and community development. The version of this vision that corresponds to the skeptics being right about the nature of the world I'll call "Ecotopia" after a book of the late 1970s. If the technological skeptics turn out to be wrong, and the optimists right, about the real state of the world, we see the version I'll call "Big Government" come to pass—a scenario of protective government policies overriding the free market.

Each of these future visions is described below from the perspective of the year 2100. The visions are described as narratives with specific names and events, rather than as vague general conditions, in order to make them

Star Trek Scenario: Humans venture into space, buoyed by technological optimism and cheap, clean fuel.



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more real and vivid. They are, of course, only caricatures, but I hope they capture the essence of the visions they represent.

Star Trek: The Default Technological Optimist Vision

The turning point came in 2012, when population pressure was mounting and natural resources were being strained. The greenhouse effect caused by burning fossil fuel was beginning to cause some major disruptions. But the development of practical fusion energy allowed a rapid reduction of global fossil-fuel burning to practically zero by the year 2050, eventually reversing the greenhouse effect. Fusion energy was infinitely better and cheaper than any alternative, and it was inexhaustible.

Air pollution was essentially eliminated between 2015 and 2050, as cars were converted to clean-burning hydrogen produced with energy from fusion reactors. Electricity for homes, factories, and other uses came increasingly from fusion, so the old, risky nuclear fission reactors were gradually decommissioned; even some hydropower stations

Mad Max Scenario: Ecological systems are a complete shambles as the greenhouse effect kicks in.

were eliminated to return some great rivers to their wild state. In particular, the dams along the Columbia River in Oregon were completely eliminated by 2050, allowing the wild salmon runs and spawning grounds to be reestablished.

While clean, unlimited energy significantly lowered the impact of humans on the environment, the world was still getting pretty crowded. The solution, of course, was space colonies, built with materials taken from the Moon and asteroids and energy from the new fusion reactors. The initial space colonies were on Earth's Moon, the moons of Jupiter, and in free space in the inner solar system. From there it was a relatively short step to launch some of the smaller space colonies off toward the closer stars.

By 2050, about one-tenth of the total population of 20 billion was living in space colonies. Currently (A.D. 2100), the total human population of 40 billion is split almost equally between Earth and extrater-

restrial populations. The population of Earth is not expected to rise above about 20 billion, with almost all future growth coming in space-based populations.

Since food production and manufacturing are mainly automated and powered by cheap fusion energy, only about one-tenth of the population actually needs to work for a living. Most are free to pursue whatever interests them. Often the biggest technological and social breakthroughs have come from this huge population of "leisure thinkers." People also have plenty of time to spend with family and friends, and the four-child family is the norm.

Mad Max: The Technological Skeptic's Nightmare

The turning point came in 2012, when the world's oil production finally peaked and the long slide down started. The easy-to-get oil

was simply exhausted, and the price started to rise rapidly. All the predictions about the rapidly rising price of oil causing new, cheaper alternatives to emerge just never came to pass. There *were* no cheaper alternatives—only more-expensive ones. Oil was so important in the economy that the price of everything else was tied to it, and the alternatives just kept getting more expensive at the same rate. Solar energy continues to be the planet's major power source—through agriculture, fisheries, and forestry—but direct conversion using photovoltaics never achieved the price/performance ratios to allow it to compete, even with coal.

Of course, it didn't really matter anyway, because the greenhouse effect was kicking in, and the earth's climate and ecological systems were in a complete shambles. Rising sea levels inundated most of the Netherlands, as well as big chunks of Bangladesh, Florida, Louisiana, and

other low-lying coastal areas, by about 2050.

Once the financial markets figured out what was happening, the bubble really burst. During the stock market crash of 2016, the Dow Jones average dropped 87% in a little over three days in December. Although there was a brief partial recovery, it has been downhill ever since.

Both the physical infrastructure and the social infrastructure have been gradually deteriorating, along with the natural environment. The human population has been on a long downward spiral since the global *airbola* (airborne Ebola) virus epidemic killed almost a quarter of the human population in 2025-2026. The population was already weakened by regional famines and wars over water and other natural resources, but the epidemic came as quite a shock. The world population peaked in 2020 at almost 10 billion. More than 2 billion died in the epi-

Four Visions of the Year 2100

Scenario Matrix:

THE REAL STATE OF THE WORLD

WORLD VIEW AND POLICIES

Technological Optimism:

Resources are unlimited.
 Technical progress can deal with any challenge.
 Competition promotes progress; markets are the guiding principle.

Technological Skepticism:

Resources are limited.
 Progress should depend less on technology and more on social and community development.
 Cooperation promotes progress; markets are the servants of larger goals.

Optimists Are Right:

Resources are unlimited.

STAR TREK

Fusion energy becomes practical, solving many economic and environmental problems.
 Humans journey to the inner solar system, where population continues to expand.

BIG GOVERNMENT

Governments sanction companies that fail to pursue public interests.
 Fusion energy is slow to develop due to strict safety standards.
 Family-planning programs stabilize growth, and incomes equalize.

Skeptics Are Right:

Resources are limited.

MAD MAX

Oil production declines and no affordable alternative emerges.
 Financial markets collapse and governments weaken, too broke to maintain armies and control desperate, impoverished populations.
 The world is run by transnational corporations.

ECOTOPIA

Tax reforms favor ecologically beneficial industries and punish polluters and resource depleters.
 Habitation patterns reduce need for transportation and energy.
 A shift away from consumerism reduces waste.

demic in the course of a little over a year and a half. Since then, death rates have exceeded birthrates almost everywhere, and the current population of 4 billion is still decreasing by about 2% per year.

National governments have weakened, becoming mere symbolic relics. The world has been run for some time by transnational corporations intent on cutthroat competition for the dwindling resources. The distribution of wealth has become more and more skewed. The dwindling few with marketable skills work for global corporations at good wages and lead comfortable and protected lives in highly fortified enclaves. These people devote their lives completely to their work, often working 90- or 100-hour weeks and taking no vacation at all.

The rest of the population survives in abandoned buildings or makeshift shelters built from scraps. There is

Big Government Scenario: Strict regulation keeps technological and economic development at slow, safe pace.

no school, little food, and a constant struggle just to survive. The majority of the world's population lives in conditions that would make the favellas of twentieth-century Rio seem luxurious. The almost constant social upheavals and revolutions are put down with brutal efficiency by the corporate security forces (governments are too broke to maintain armies anymore).

Big Government: Public Interest Trumps Private Enterprise

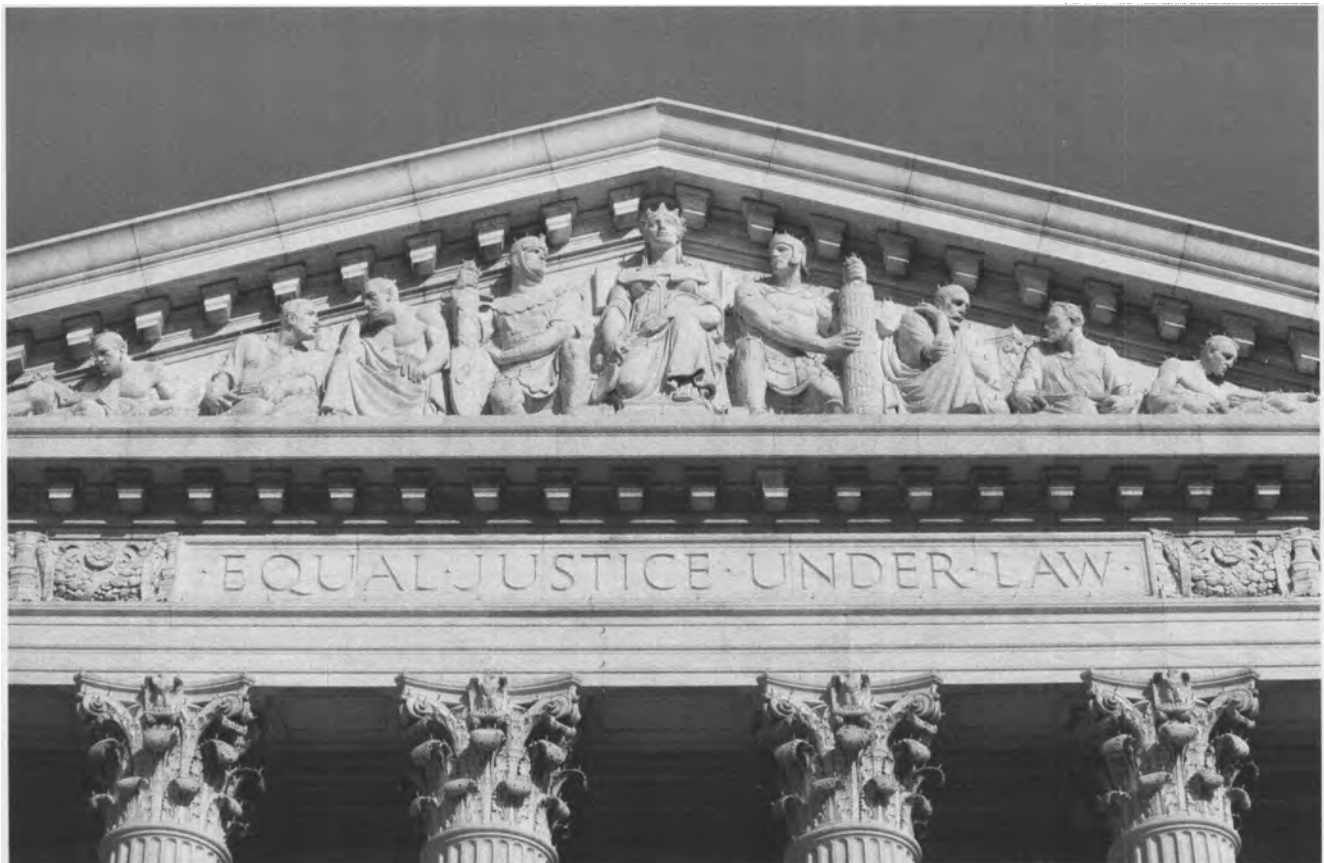
The turning point came in 2012, when the corporate charter of General Motors was revoked by the U.S. federal government for failing to pursue the public interest. Even though GM had perfected the electric car, it had failed to make its breakthrough battery technology available to other car makers, even on a licensing basis. It preferred, instead, to retain a monopoly on electric cars, to produce them exclusively in China with cheap labor, and to gouge the public with high prices for

them. After a series of negotiations broke down, government lawyers decided to invoke their almost forgotten power to revoke a corporation's charter and made the technology public property. This caused such a panic through corporate America that a complete rethinking of the corporate/public relationship took place, which left the government and the public with much more control over corporate behavior.

Strict government regulations had kept the development of fusion energy slow while safety issues were being fully explored. No one wanted a repeat of fission energy's problems: The Three Mile Island and Chernobyl accidents were nothing compared to the meltdown of one of France's fission breeder reactors in 2005, which left almost one-quarter of the French countryside uninhabitable, killing over 100,000 people directly and causing untold premature cancer deaths throughout Europe.

Fusion energy therefore got a very long and careful look. Government regulators also required the new fusion power plants to bear the full fi-

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nancial liability, causing a much more careful (albeit slightly slower) development of the industry.

High taxes on fossil energy counteracted the greenhouse effect and stimulated renewable energy technologies. Global carbon-dioxide emissions were brought down to 1990 levels by 2005 and kept there through 2030 with concerted government effort and high taxes. Later, the new fusion reactors—along with new, cheaper photovoltaics—gradually eliminated the need for fossil fuels, and the worst of the predicted climate-change effects were thus averted.

Government population policies that emphasized female education, universal access to contraception, and family planning managed to stabilize the global human population at around 8 billion, where it remained (give or take a few hundred million) for almost the entire twenty-first century.

A stable population allowed many recalcitrant distributional issues to finally be resolved, and income distribution has become much more equitable worldwide. While in 1992, the richest fifth of the world's population received about 83% of the world's income and the poorest fifth received only a little more than 1%, by 2092, the richest fifth received 30%, and the poorest, 10%. The income distribution "champagne glass" had become a much more stable and equitable "tumbler." Some libertarians have decried this situation, arguing that it does not provide enough incentive for risk-taking entrepreneurs to stimulate growth. But governments have explicitly advocated slow or no-growth policies, preferring to concentrate instead on assuring ecological sustainability and more-equitable distribution of wealth.

Stable human population also took much of the pressure off other species. The total number of species on earth declined during the twentieth century from about 3 million to a low of about 2.2 million in 2010. But that number has stabilized and even recovered somewhat in the twenty-first century, as some species previously thought to be extinct were rediscovered and some natural

speciation of fast-growing organisms has occurred. The current estimate of the number of species on earth is about 2.5 million, and there are strict regulations in effect worldwide not only to prevent any further loss, but also to encourage natural speciation.

Ecotopia: The Low-Consumption Sustainable Vision

The turning point came in 2012, when ecological tax reform was enacted almost simultaneously in the United States, the European Union, Japan, and Australia after long global discussions and debates, mostly over the Internet. In the same year, Herman Daly won the Nobel Prize for Human Stewardship (formerly the prize for economics) for his work on sustainable development.

A broadly participatory global dialogue had allowed an alternative vision of a sustainable world to emerge and gain very wide popular support. People finally realized that governments had to take the initiative back from transnational corporations and redefine the basic rules of the game if their carefully constructed vision was ever going to come to pass.

The public had formed a powerful judgment against the consumer lifestyle and for a sustainable lifestyle. The slogan for the new revolution became the now famous "sustainability, equity, efficiency."

All depletion of natural capital was taxed at the best estimate of the full social cost of that depletion, and taxes on labor and income were reduced for middle-income and lower-income people. A "negative income tax," or basic life support, was provided for those below the poverty level. Countries without ecotaxes were punished with ecological tariffs on goods they produced.

The QLI (Quality of Life Index) came to replace the GNP as the primary measure of national performance. The reforms were introduced



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Ecotopia Scenario: People begin to take better care of the environment, changing lifestyles toward less consumption and more satisfaction.

gradually over the period from roughly 2012 to 2022 in the United States, European Union, Japan, and Australia, giving businesses ample time to adjust. The rest of the world followed soon thereafter, with almost all countries completing the reforms by 2050. They had very far-reaching effects.

Fossil fuels became much more expensive, both limiting travel and transport of goods and encouraging the use of renewable alternative energies. Mass transit, bicycles, and sharing the occasional need for a car became the norm. Human habitation came to be structured around small villages of roughly 200 people, whether these were in the countryside or inside urban concentrations. The village provided most of the necessities of life, including schools, clinics, and shopping, all within easy walking distance. It also allowed for a real sense of "community" missing from late-twentieth-century urban life. Such changes drastically reduced the GNP of most countries, but drastically increased the QLI.

Because of the reduction in consumption and waste, there was only moderate need for paid labor and

money income. By 2050, the work week had shortened in most countries to 20 hours or fewer, and most full-time jobs became shared by two or three workers. People could devote much more of their time to leisure, but rather than consumption-oriented vacations taken far from home, they began to pursue more community activities (like participatory music and sports) and public service (like caring for children and the elderly).

Unemployment became an almost obsolete term, as did the distinction between work and leisure. People were able to do things they really liked much more of the time, and their quality of life soared (even as their money income plummeted).

We need to take a closer look at the potential costs of being wrong.

The distribution of income became an almost unnecessary statistic, since income was not equated with welfare or power and the quality of almost everyone's life was relatively high.

While physical travel decreased, people began to communicate electronically over a much wider web. The truly global community could be maintained without the use of resource-consuming physical travel.

Judging the Four Visions

How should society decide among these four visions? A two-step process starts with forming and expressing values with the goal of finding a rational policy for managing human activities. Social discourse and consensus is built around the broad goals and visions of the future and the nature of the world in which we live. When a consensus is formed, institutions and analytical methods are marshaled to help achieve the vision.

Three of the four visions are sustainable in the sense that they represent continuation of the current society (only "Mad Max" is not), but we need to take a closer look at their underlying world views, critical assumptions, and the potential costs of

those assumptions being wrong. I have already set up the four visions with this in mind.

The world view (and attendant policies) of the "Star Trek" vision is technological optimism and free competition, and its essential underlying assumption is unlimited resources, particularly cheap energy. If that assumption is wrong, the cost of pursuing this world view and its policies is something like the "Mad Max" vision.

Likewise, the world view (and attendant policies) of the "Ecotopia" vision is technological skepticism and communitarianism (the community comes first), and its essential underlying assumptions are that resources are limited and that coopera-

tion pays. If the assumption that resources are limited is wrong, the cost of pursuing this world view and its policies is the "Big Government" vision, where a "community first" policy slows down growth relative to the free market "Star Trek" vision.

The next step toward coming to public judgment is to discuss the four visions with a broad range of participants and then have them evaluate each vision in terms of its overall desirability. Most of those I have already surveyed found the "Ecotopia" vision "very positive"; very few expressed a negative reaction to such a world. "Star Trek" was the next most-positive vision.

Questioning Technology

After discussing and evaluating these scenarios, we can choose between the two world views (technological optimism or skepticism) and their attendant policies, but we face pure and irreducible uncertainty. Who knows whether or not practical fusion or something equivalent will be invented? Should we choose the "Star Trek" vision (and the optimist policies) merely because it is the most popular or because it is the direction things seem to be heading in already?

From the perspective of game theory, this problem has a fairly clear answer: The game can only be played once, and the relative probabilities of each outcome are completely unknown. In addition, we can assume that society as a whole should be risk averse in this situation.

For the optimistic policy set, "Mad Max" would be considered the worst case. For the skeptical policy set, "Big Government" would be the worst case. If "Big Government" is viewed as more positive (or less negative) than "Mad Max," then it would make sense to choose the skeptic's policy set, at least until more information is available.

In fact, the way I have set up the game, "Mad Max" is the one really negative outcome and the one really unsustainable outcome. We should develop policies that assure us of not ending up in "Mad Max," no matter what happens.

One could also argue that the probabilities of each state of the world in the scenario matrix are not completely unknown. If the prospects for cheap, unlimited, non-polluting energy were, in fact, known to be very good, then the choices would have to be weighted with those probabilities.

But the complete dependence of the "Star Trek" vision on discovering a cheap, unlimited, nonpolluting energy source argues for discounting the probability of its occurrence. By adopting the skeptic's policies, the possibility of this invention is preserved, but we don't have to be so utterly dependent on it.

It's like leaping off the World Trade Center and hoping to invent a parachute before you hit the ground. It's better to wait until you have the parachute (and have tested it extensively) before you jump. □



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