

# Decision Making *under* **Uncertainty**



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## DECISION MAKING UNDER UNCERTAINTY

### Abstract

This paper examines **decision making under uncertainty** as a central challenge in management, public policy, and organizational life. It argues that good decisions in uncertain environments do not depend on the illusion of complete certainty, but on the disciplined ability to distinguish different forms of uncertainty, evaluate alternatives under incomplete knowledge, and build choices that are robust, adaptive, and revisable. The discussion draws on normative decision theory, especially expected utility, to explain how rational choice is traditionally modeled, while also incorporating descriptive and behavioral perspectives that show how actual human decisions are shaped by framing effects, heuristics, bounded rationality, and overconfidence. The paper further explains the distinction between measurable **risk** and deeper forms of **uncertainty**, including **deep uncertainty**, in which actors do not know or cannot agree on the relevant models, probabilities, or value trade-offs. In response to such conditions, the paper highlights the importance of strategic foresight, systems thinking, risk management, and robust decision-making approaches that test policies across multiple plausible futures rather than relying on a single forecast. The overall conclusion is that decision making under uncertainty is not the art of perfect prediction, but the art of making responsible, transparent, and resilient choices in a world where the future remains only partially knowable.

### Keywords

Decision making; uncertainty; risk; deep uncertainty; expected utility; bounded rationality; cognitive bias; strategic foresight; robust decision making; risk management.

## Introduction

Decision making under uncertainty is one of the most important themes in modern life because almost all major decisions are made without complete knowledge of the future. Managers must decide on investments when markets are still uncertain. Governments must formulate policies when their long-term effects are not yet fully known. Individuals must choose education, careers, or health-related actions without any guarantee of outcomes. Thus, the problem of decision making is not merely about choosing, but about choosing when consequences, probabilities, and even the framing of the problem itself are not fully clear. In normative decision theory, the central issue is precisely how a person ought to choose under uncertainty; one classical answer is expected utility, namely choosing the action with the highest expected value. Yet a broader body of literature also shows that the way human beings actually make decisions often differs from the ideal rational model. This is what makes decision making under uncertainty a theme that is not only economic, but also psychological, managerial, political, and ethical. ([plato.stanford.edu](http://plato.stanford.edu))

In an age marked by global complexity, technological acceleration, health crises, climate change, supply chain disruptions, and AI, uncertainty is no longer viewed as a temporary disturbance that disappears once more data become available. Many forms of uncertainty are structural. OECD emphasizes that traditional analytical tools are often inadequate when dealing with rising complexity and uncertainty, and that systemic approaches and strategic foresight are needed so policymakers do not suppress uncertainty, but learn to work with it. RAND even stresses that when decision makers pretend to know the future with certainty, they risk falling into overconfidence, missing opportunities, and choosing policies that are fragile in the face of shocks. Therefore, this topic is not merely about statistical techniques, but about intellectual and institutional maturity in facing a world that cannot be fully predicted. ([oecd.org](http://oecd.org))

This essay argues that good decisions under uncertainty do not arise from the illusion of certainty, but from the ability to distinguish types of uncertainty, understand the limits of human rationality, evaluate alternatives in a disciplined way, and build choices that are robust, adaptive, and revisable as new information emerges. To do so, the discussion will cover several layers: the difference between risk and uncertainty, normative and descriptive decision theory, the biases that distort judgment, classical approaches such as expected utility, contemporary approaches such as robust decision making and decision-making under deep uncertainty, and their practical implications for management, public policy, and organizational life. In this way, decision making under uncertainty will be understood not as the art of predicting the future, but as the art of making reasonable choices without demanding impossible certainty. ([news.mit.edu](https://news.mit.edu))

### **Understanding Uncertainty: Risk, Uncertainty, and Deep Uncertainty**

The first step in discussing decision making under uncertainty is to understand that not all uncertainty is of the same kind or degree. One of the most influential distinctions comes from Frank Knight. As explained by MIT, Knight distinguished risk from uncertainty quite sharply: risk applies when outcomes are unknown but their probabilities can be measured, whereas “true uncertainty” applies when what matters cannot be measured reliably. If the probability of an airplane accident can be estimated on the basis of large historical data, we are dealing with risk. But if technological change, consumer behavior, or geopolitical dynamics make the future lack stable or trustworthy probabilities, we begin entering the realm of deeper uncertainty. This distinction matters greatly because decision methods that work well for risk may not be suitable for uncertainty. ([news.mit.edu](https://news.mit.edu))

In situations of risk, organizations can still build probabilistic models that are relatively dependable. They can calculate expected loss, run simulations, or compare alternatives on the basis of reasonably clear probabilities. However, in more severe forms of uncertainty, the problem

is not merely insufficient data, but uncertainty about the model, the assumptions, and even the objectives being prioritized. RAND refers to this condition as deep uncertainty: a state in which experts or stakeholders do not know or do not agree on the appropriate conceptual models, the relevant probability distributions, or the ways to value desirable outcomes. Under such conditions, decisions can no longer be reduced to optimization based on one best forecast. ([rand.org](http://rand.org))

This distinction has major practical implications. A financial manager deciding whether to insure a particular asset may still be operating largely in the domain of risk, because large historical loss data are available. But a university leader deciding how to design learning systems for the next five years amid generative AI, changing student preferences, cost pressures, and labor market disruption is facing a far deeper uncertainty. Here the issue is not simply, "What is the probability of one event?" but rather, "What kind of world is emerging, which assumptions still hold, and what type of decision will not be fragile if the future unfolds differently from what is currently expected?" That is why the ability to distinguish kinds of uncertainty is an essential first step toward mature decision making. ([news.mit.edu](http://news.mit.edu))

OECD adds another important layer by emphasizing that complexity and interdependence make fragmented analytical approaches increasingly weak. Uncertainty often does not stand alone; it is connected to many interacting variables. In public policy contexts, for example, changes in energy, fiscal conditions, technology, the environment, and citizen behavior cannot be neatly separated into isolated silos. Therefore, strategic foresight and systems approaches are considered important not for eliminating uncertainty, but for helping policymakers understand interdependence, diversity of perspectives, and the need to act without pretending that the system is fully understood. ([oecd.org](http://oecd.org))

### **Normative Decision Theory: How Ought We to Choose?**

In normative decision theory, the main question is this: if a person wants to choose rationally under uncertainty, what principle should guide the

choice? The Stanford Encyclopedia of Philosophy presents expected utility as the most influential orthodox answer. The basic idea is simple: under uncertainty, one should choose the option with the highest expected utility, namely the weighted average of the utilities of possible outcomes based on their respective probabilities. In this way, a choice is evaluated not only in terms of its best possible outcome, but in terms of the full structure of possible outcomes and their likelihoods.

([plato.stanford.edu](http://plato.stanford.edu))

Intellectually, the attraction of expected utility lies in its attempt to connect preferences, probabilities, and choices within a single coherent framework. If a person knows what they value and can estimate the probabilities of outcomes reasonably well, then this framework provides a systematic procedure for choosing. That is why expected utility became highly important in economics, game theory, public policy, and risk analysis. It gives a disciplined language for decisions. Rather than merely saying, "This option seems better," one can compare benefits and losses expected across different future states. ([plato.stanford.edu](http://plato.stanford.edu))

Yet here a classic problem arises. The framework is elegant, but the real world is rarely as simple as the model requires. Expected utility assumes that probabilities can be assigned with sufficient clarity and that preferences can be ordered stably. In reality, many strategic decisions involve vague probabilities, multidimensional outcomes, and values that conflict with one another. Choosing the location of a new factory, for example, does not only concern costs and profits, but also political risk, ESG reputation, community acceptance, energy supply, and regulatory change. All of these are not easily reducible to one single utility number. Stanford also notes that expected utility faces important challenges, including issues of risk attitude, catastrophic risk, unawareness, and cases in which the theory gives recommendations that seem counterintuitive.

([plato.stanford.edu](http://plato.stanford.edu))

In other words, normative decision theory remains highly useful, but it is better understood as a compass than as a complete map. It provides

direction regarding rational coherence, not a guarantee that every practical problem can be solved by one formula. In management education, this is an important lesson: formal models should neither be worshipped nor ignored. They should be used as tools for disciplined thinking, then complemented by contextual judgment, organizational learning, and awareness of the model's own limits. ([plato.stanford.edu](http://plato.stanford.edu))

### **Descriptive Decision Theory: How Do People Actually Choose?**

If normative theory asks how people ought to choose, descriptive theory asks how people in fact choose. The Stanford Encyclopedia clearly distinguishes the two: descriptive decision theory seeks to explain actual patterns in human choice, whereas normative decision theory provides standards for how choices should be made. This distinction matters because actual human decisions often do not follow ideal rational logic. Human beings do not always calculate utility neatly, weigh probabilities consistently, and then choose the best alternative. They are influenced by framing, emotions, experience, time pressure, identity, and the way a problem is presented. ([plato.stanford.edu](http://plato.stanford.edu))

Daniel Kahneman's contribution is extremely important at this point. The Nobel Prize organization notes that his award recognized his integration of insights from psychology into economics, especially concerning judgment and decision-making under uncertainty. His research produced prospect theory, a major line of thought explaining that people do not always evaluate outcomes absolutely, but rather relative to certain reference points, and that losses often feel stronger than equivalent gains. In other words, human beings are not neutral probability calculators. They are creatures who interpret gains and losses psychologically. ([nobelprize.org](http://nobelprize.org))

The implications are very broad. Two decisions that are mathematically identical may be accepted or rejected differently depending on how the issue is framed. A health policy described as "saving 90 out of 100 people" may feel more attractive than the same policy described as "10 out of 100 people still die," even though statistically the two are

equivalent. In organizations, an investment described as “avoiding losses” is often more easily accepted than an investment described as “creating additional gains,” even when the economic value is the same. This is where descriptive theory provides a vital insight: the quality of decisions depends not only on data, but also on the way the human mind processes that data. ([nobelprize.org](https://nobelprize.org))

The descriptive literature also shows that the weaknesses of expected utility as a description of actual behavior do not mean the theory is useless. Stanford notes that subjective expected utility has faced many empirical challenges since the mid-twentieth century, including the Allais and Ellsberg paradoxes. Precisely from such tensions emerged a more mature understanding: normative models may still be valuable as standards of rationality, while descriptive models help explain actual departures from those standards. In management education, both are essential. Students need to learn how decisions ought to be analyzed, but they also need to understand why human beings often fail to follow the analysis they should. ([plato.stanford.edu](https://plato.stanford.edu))

### **Bounded Rationality and the Human Problem in Decision Making**

One reason why real decisions differ from ideal models is that human rationality is bounded. Kahneman himself, in his Nobel Prize Lecture, discussed “maps of bounded rationality,” the idea that human decision-making is shaped by limitations of attention, information processing, and psychological judgment structures. This means that under uncertainty, the problem is not only whether enough data exist, but also whether human beings are capable of processing that data without relying on misleading mental shortcuts. ([nobelprize.org](https://nobelprize.org))

In organizational life, bounded rationality appears every day. An executive cannot possibly examine all relevant data before making a decision. A school principal cannot fully map all the consequences of a new policy. A retail investor cannot weigh every market signal with perfect objectivity. Because attention capacity is limited, people use heuristics, that is, simplifying strategies. These are often useful because

they speed up response, but they can also generate systematic cognitive biases. A review across four professional domains—management, finance, medicine, and law—found that various cognitive biases do indeed influence professional decisions, and that overconfidence emerges as the most recurrent bias. ([pmc.ncbi.nlm.nih.gov](http://pmc.ncbi.nlm.nih.gov))

Overconfidence is especially dangerous under uncertainty because it makes people think they understand more than they actually do. Managers become too certain about projections, doctors too confident in an initial diagnosis, judges too trusting of their intuition, and investors too convinced they can “read the market.” Such bias does not always appear in a crude form; often it comes dressed as professionalism and confidence. This is where critical reflection becomes necessary. A good decision is not only one that is fast or decisive, but one that recognizes the limits of its own knowledge. ([pmc.ncbi.nlm.nih.gov](http://pmc.ncbi.nlm.nih.gov))

### **Major Biases in Decision Making**

Besides overconfidence, there are several other biases that are practically very relevant to decision making under uncertainty. First is confirmation bias, although not discussed in detail in the main sources used here, it is broadly consistent with findings that people tend to seek or give greater weight to information supporting their initial beliefs. In organizations, this causes teams to see only the data that confirm the strategy they already prefer. Second is anchoring, in which an initial number or piece of information exerts too strong an influence on later estimates. In budget negotiations, the first projection often becomes an anchor even when its basis is weak. Third is availability bias, in which people judge the likelihood of an event according to how easily examples come to mind, rather than according to actual probability. A crisis that has just occurred often leads organizations to overreact to one type of threat while underestimating threats that are less dramatic but more likely. Berthet’s review confirms that such biases affect decisions across professions, even though the strength of evidence varies. ([pmc.ncbi.nlm.nih.gov](http://pmc.ncbi.nlm.nih.gov))

Another important bias is loss aversion, closely related to prospect theory. People are often more sensitive to losses than to equivalent gains. Because of this, organizations may delay important investments simply because they fear losing resources now, even though failing to invest may create a greater risk of losing competitiveness later. In public policy, loss aversion causes governments to delay reforms that are beneficial in the long run because the short-term political cost feels too threatening. As a result, decision making becomes reactive rather than strategic. ([nobelprize.org](https://nobelprize.org))

Framing effects are also highly important. The way a question is posed or the way alternatives are labeled can significantly shift choices. That is why the quality of deliberation matters greatly. A healthy decision-making team does not merely examine numbers; it also challenges the way the problem is formulated. Are we discussing "cost cutting" or "resource reallocation"? Are we discussing "the risk of adopting AI" or "the risk of being left behind by not adopting AI"? Different framing can produce very different decisions even when the factual basis is the same. ([plato.stanford.edu](https://plato.stanford.edu))

All of this underscores one thing: errors in decision making under uncertainty do not always come from lack of data. Often the data are abundant, but the problem lies in how the human mind uses them. Therefore, good decision governance requires more than dashboards and reports. It requires process design that can reduce bias: safe space for dissent, red-team review, counter-scenarios, premortem analysis, periodic revision, and a culture that does not punish correction of assumptions. While not all of these terms are detailed in the sources used here, their spirit aligns closely with RAND and NIST: good decisions under uncertainty must emphasize learning, monitoring, and adaptation, not just the appearance of certainty at the beginning. ([rand.org](https://rand.org))

### **From Predict-Then-Act to Robust Decision Making**

In many classical management traditions, strategic decisions are built using a predict-then-act logic: make the best forecast, then choose the

optimal option based on that forecast. This approach is useful when the environment is relatively stable and probabilities can be estimated reasonably well. However, RAND emphasizes that under deep uncertainty, reliance on methods requiring prediction of the future can become counterproductive and even dangerous. DMDU, or Decision Making under Deep Uncertainty, works with a different logic. Rather than seeking one optimal policy for one best-estimate future, it seeks policies that are robust across many plausible futures and designs implementation that can be adjusted as new information emerges.

([rand.org](http://rand.org))

The concept of robustness here is very important. A robust option is not necessarily the best-performing one in a single future, but it performs adequately and is not fragile across many possible futures. For example, a coastal city designing infrastructure for climate change may not be able to know exactly how high sea levels will be in a specific year. But it can design a phased strategy: initial infrastructure strong enough for multiple scenarios, monitoring mechanisms, and escalation options if certain indicators are reached. Such an approach is wiser than choosing one expensive design that only works if one particular prediction turns out to be correct. ([rand.org](http://rand.org))

There is substantial managerial wisdom here. Many organizations fail not because they lack plans, but because their plans are too fragile when assumptions change. They choose strategies that look highly efficient on paper, but only if the world behaves exactly as projected in the spreadsheet. When one major variable changes—energy prices, regulation, consumer preferences, geopolitical conflict—the strategy collapses. DMDU offers a corrective: in a rapidly changing world, the goal of decision making is not merely optimality, but survivability, adaptability, and robustness. This is a very important paradigm shift for twenty-first-century leaders. ([rand.org](http://rand.org))

## **Strategic Foresight and Systems Thinking**

OECD makes an important contribution by emphasizing strategic foresight as support for decision making. Strategic foresight is not mystical prediction of the future, but a systematic process for exploring possibilities, interdependencies, and disruptions that may shape the future. OECD states that systems approaches invite policymakers to embrace uncertainty and complexity rather than suppress them, and to become more sensitive to diversity of perspectives and relationships among stakeholders. ([oecd.org](https://www.oecd.org))

Here, good decisions require a shift in mentality. In older approaches, uncertainty was often seen as an enemy to be eliminated before action could be taken. In strategic foresight, uncertainty is treated instead as a reality to be mapped, tested, and integrated into the decision.

Governments or organizations do not wait until all the fog disappears; they build action maps while acknowledging that the fog is real. Thus, decisions are not delayed indefinitely, but they are also not made recklessly. They become reflective actions that learn along the way. ([oecd.org](https://www.oecd.org))

This approach also demands interdisciplinary work. Many major decisions fail because they are made in silos. The finance department calculates costs, the technology team talks about infrastructure, HR discusses talent, and legal focuses on compliance—but no one integrates the whole. OECD shows that systems approaches try to understand the whole system and promote co-creation among actors. In practice, this means strategic decisions must invite multiple lenses: economic, technical, social, behavioral, reputational, and political. Uncertainty often arises not because of lack of intelligence in one field, but because of failure to connect multiple fields at once. ([oecd.org](https://www.oecd.org))

### **Risk Management as the Architecture of Decision Making**

In organizational practice, decision making under uncertainty is closely tied to risk management. NIST explains that risk management is a comprehensive process requiring four major components: frame risk, assess risk, respond to risk, and monitor risk. This is important because

many organizations treat risk management merely as a list of threats. According to NIST, however, the purpose of risk management is not simply to maintain a list of risks, but to support effective decision making at various organizational levels. A risk register is only a tool; what matters is the quality of the decisions it supports. ([nvlpubs.nist.gov](https://nvlpubs.nist.gov))

The framing of risk is especially important and often underestimated. Before calculating anything, an organization must define the context of the decision: what assumptions are being used, what the limits are, what level of risk tolerance is acceptable, which trade-offs are acceptable, and which time horizon is prioritized. NIST emphasizes that framing makes the risk perspectives routinely used in investment and operational decisions explicit and transparent. This is crucial, because many decisions fail not because the analysis is unsophisticated, but because the underlying assumptions are never openly examined. ([nvlpubs.nist.gov](https://nvlpubs.nist.gov))

The assess risk stage evaluates threats, vulnerabilities, likelihood, and impact. The respond to risk stage determines whether a risk will be accepted, reduced, transferred, or avoided. The monitor risk stage ensures that decisions are not treated as final once made, but are continually reviewed through communication and feedback loops for continuous improvement. In highly uncertain conditions, this monitoring dimension is essential. A decision that makes sense today may need to be revised three months later. Mature organizations are not embarrassed to update decisions; revision based on evidence is a sign of governance maturity. ([nvlpubs.nist.gov](https://nvlpubs.nist.gov))

### **A Managerial Narrative: Choosing Investment in a Blurred World**

Imagine a medium-sized manufacturing company in Indonesia deciding whether to automate part of its production line using AI and robotic systems. If it uses only traditional logic, leadership may request a five-year ROI projection, compare initial investment costs with labor savings, and make an optimal decision based on one growth assumption. But in the real world, many more variables matter: the speed of technology adoption by competitors, stability of component supply, changes in

labor regulation, employee resistance, the need for reskilling, cyber risk, and the possibility that the purchased technology will quickly become obsolete. This is clearly not a simple problem. ([rand.org](https://www.rand.org))

If leaders fall into overconfidence, they may trust one best projection too strongly and treat uncertainty as mere noise. If they are excessively loss-averse, they may do nothing at all and fall structurally behind. A more mature approach is to recognize that this problem contains both risk and uncertainty. Some elements can be modeled quantitatively, but others require scenario thinking. Here, the principles of DMDU and NIST can be combined: define the risk frame, develop several plausible futures, evaluate robust options, prepare early indicators, and design phased implementation that can be adjusted. Rather than making an all-in investment, the company may choose phased adoption with periodic review, pilot projects, and escalation options. That is not a sign of indecision, but of strategic intelligence. ([rand.org](https://www.rand.org))

This narrative shows that decision making under uncertainty is not about reckless courage, but about structured courage. A good leader does not say, "We must be certain first before we move," because that is often impossible. But neither does the leader say, "Let us move without discipline." The leader builds choices that are defensible, monitorable, and revisable. In practical terms, a good decision is not always the boldest or the most conservative one, but the one most prepared to face reality if reality moves differently from expectations. ([rand.org](https://www.rand.org))

### **Public Decisions: Uncertainty, Legitimacy, and Values**

In public policy, decision making under uncertainty becomes even more complex because the issue is not only facts and probabilities, but also values. RAND explicitly notes that deep uncertainty also exists when parties do not agree on how desirable outcomes should be valued or weighed. This means that public policy problems cannot be treated as purely technical optimization problems. For example, in energy transition, the question is not only "Which option is most efficient?" but also "Who bears the cost of transition?", "How are affected workers

protected?”, and “How much environmental or fiscal risk is acceptable?” ([rand.org](http://rand.org))

Therefore, public decisions require legitimacy of process in addition to quality of analysis. OECD emphasizes the importance of diversity of perspectives, co-creation, and sensitivity to interdependence. Under uncertainty, citizens will not trust simply because experts say, “Trust our model.” In fact, honesty about uncertainty can strengthen trust because it shows that policymakers are not selling false certainty. RAND also stresses that DMDU can help people work together to build common understanding and creative compromise strategies, rather than merely telling them what to do. ([rand.org](http://rand.org))

In this context, decision making under uncertainty is also a matter of democracy. Good decisions must be analytical enough to be serious, but also open enough to be corrected. They must be firm enough to act, but also humble enough to acknowledge that policy may need revision. This is especially important in an era when crises often unfold faster than formal procedures. A mature state is not one that pretends to know all the answers, but one that is capable of acting adaptively without losing accountability. ([oecd.org](http://oecd.org))

### **The Role of Data, Models, and AI**

In the digital age, many people hope that big data, machine learning, and AI will solve the problem of decision making under uncertainty. This hope is partly valid, but also dangerous if exaggerated. AI can expand the ability to detect patterns, model scenarios, and process information. RAND even notes that DMDU uses computers to help people explore many future pathways, stress-test policies, and identify scenarios relevant to policy. However, technology does not eliminate deep uncertainty. Models are still built on assumptions, historical data, and particular definitions of objectives. If the future brings developments not reflected in past data, even very precise models can point in the wrong direction. ([rand.org](http://rand.org))

This is the key lesson: AI and analytics should strengthen human judgment, not replace it blindly. Under uncertainty, the main issues are often not computation alone, but framing, value judgment, and interpretation. A model may show possibilities, but it cannot by itself determine ethical, political, or social trade-offs. Therefore, mature decisions in the age of AI still require collaboration between machine analysis and human wisdom. RAND refers to this orientation as human-machine collaboration. That is a healthier vision than the idea that algorithms will automatically provide the best decision for every situation. ([rand.org](http://rand.org))

At the organizational level, the use of data must also be accompanied by continuous monitoring. NIST emphasizes that risk management requires effective communication, continuous monitoring, and feedback loops. This means dashboards and predictive models should not be treated as finished once installed. They should become part of the organization's learning cycle. Data that never change decisions are merely digital decoration. By contrast, decisions that respond to new data show that an organization is intellectually alive. ([nvlpubs.nist.gov](http://nvlpubs.nist.gov))

### **Process Quality Matters More than the Illusion of Perfect Answers**

One of the most important lessons from the study of decision making under uncertainty is that process quality often matters more than the claim of having found a perfect answer. In stable conditions, it may still make sense to imagine one optimal decision. But in a world full of change, the quality of a decision lies in the process that generates, monitors, and updates it. NIST states that the purpose of risk management is not to maintain a list of risks, but to support effective decisions. RAND adds that the focus of DMDU is informing good decisions rather than making good predictions. These two ideas converge: excellence does not lie in one persuasive forecast, but in an architecture of decision making that can learn. ([nvlpubs.nist.gov](http://nvlpubs.nist.gov))

For that reason, several features characterize a healthy decision process under uncertainty. First, the problem is explicitly framed: objectives,

assumptions, constraints, trade-offs, and risk tolerance are made clear. Second, alternatives are tested not only against one future, but against several plausible scenarios. Third, dissent and differing perspectives are given room so collective bias does not harden. Fourth, decisions are linked to clear monitoring indicators so revision can occur in time. Fifth, organizations distinguish between irreversible decisions and those that can be phased in gradually. Although this list is a synthesis I formulate here, its spirit is fully consistent with NIST's frame-assess-respond-monitor model and RAND's robust multi-scenario approach.

([nvlpubs.nist.gov](http://nvlpubs.nist.gov))

### **The Ethical Dimension: Decision for Whom and at What Cost?**

Decision making under uncertainty also has an ethical dimension that must not be ignored. When future consequences are not fully known, who bears the cost of a wrong decision? Who benefits when certain assumptions are used? Who is harmed when an organization becomes overconfident? Deep uncertainty often reveals that value questions are no less important than data questions. RAND explicitly includes disagreement about how to weigh and value desirable outcomes as part of deep uncertainty. This means that uncertainty is not only about probabilities, but also about justice, priorities, and the distribution of consequences. ([rand.org](http://rand.org))

For example, a company may decide to relocate a factory for the sake of future efficiency, but that decision carries uncertainty about the fate of local workers. A government may choose a certain subsidy to maintain short-term stability, but create long-term fiscal uncertainty. In every such case, decisions cannot be measured solely by financial or technical output. There is a moral dimension concerning who is regarded as valuable, who is heard, and who is left to bear risk. In public policy, OECD emphasizes co-creation, multiple perspectives, and systemic understanding; this also indicates that good decisions must be morally inclusive. ([oecd.org](http://oecd.org))

### **Personal Decisions Under Uncertainty**

Although much of the above discussion sounds macro-level, in reality every individual lives under uncertainty every day. Choosing further study, changing jobs, starting a business, or even deciding when to act and when to wait are all decisions never made with full certainty. This is where decision theory helps not by making life mechanical, but by improving the quality of reflection. We do not need to calculate utility formally for every personal decision, but we can learn to ask better questions: What is the real objective? What assumptions am I making? Which risks are measurable and which are not? What alternatives are sufficiently robust if life unfolds differently from my expectations? What new information would cause me to revise direction? ([plato.stanford.edu](http://plato.stanford.edu))

In personal life, major errors often arise from two extremes. The first is paralysis by analysis: a person delays decisions because they are waiting for total certainty that will never arrive. The second is impulsive certainty: a person acts too quickly because of a confidence that is not proportionate to the evidence. A more mature approach is to cultivate what may be called reflective courage: courageous enough to act without full certainty, yet reflective enough not to ignore risks and willing to learn from new information. This is not a magical formula, but it is a far healthier intellectual attitude than the two extremes just mentioned. ([pmc.ncbi.nlm.nih.gov](http://pmc.ncbi.nlm.nih.gov))

## **Conclusion**

Ultimately, decision making under uncertainty is one of the deepest tests of human intelligence and institutional maturity. It tests whether we are able to act without full certainty, whether we can distinguish risk from uncertainty, whether we are humble enough to recognize the limits of our models and our own minds, and whether we can design decisions that are not fragile when the future unfolds differently from expectation. Normative decision theory teaches rational disciplines such as expected utility. Descriptive theory and behavioral research remind us that human beings often depart from such standards because of bias, framing, and bounded rationality. RAND shows that under deep uncertainty, the

objective is no longer to find one best prediction, but to build decisions that are robust across many plausible futures. NIST shows that good risk management must support effective decisions through framing, assessment, response, and monitoring. OECD adds that uncertainty and complexity must be embraced systemically rather than suppressed through silo thinking. ([plato.stanford.edu](http://plato.stanford.edu))

Therefore, a good decision under uncertainty is not one that claims absolute certainty. It is a decision that is honest about the limits of knowledge, careful in weighing alternatives, aware of bias, robust enough to endure across multiple possibilities, and adaptive enough to be improved when reality provides new signals. In simpler terms, wisdom is not the ability to predict the future perfectly, but the ability to choose responsibly when the future is not yet fully open. That is why decision making under uncertainty will remain a central theme in management, leadership, public policy, and human life in general. ([rand.org](http://rand.org))

## **Glossary**

### **Decision making under uncertainty**

The process of choosing among alternatives when outcomes, probabilities, or even the structure of the problem are not fully known. Decision theory studies the reasoning behind such choices.

### **Risk**

A condition in which outcomes are uncertain, but the probabilities of those outcomes can be estimated or measured with reasonable confidence. Knight's distinction, summarized by MIT, contrasts this with "true uncertainty."

### **Uncertainty**

A condition in which relevant outcomes or future states are not fully known, and where probabilities may be difficult or impossible to specify reliably.

### **Deep uncertainty**

A condition in which decision makers do not know or cannot agree on the relevant models, the probabilities of future outcomes, or the way desirable outcomes should be valued. RAND uses this concept to explain why single-forecast planning can fail.

### **Expected utility**

A major concept in normative decision theory holding that rational choice under uncertainty should select the act with the highest expected utility.

### **Normative decision theory**

The branch of decision theory concerned with how people ought to choose if they are choosing rationally.

### **Descriptive decision theory**

The branch of decision theory concerned with describing and explaining how people actually make choices in practice.

### **Bounded rationality**

A concept describing decision making under limits of information, time, attention, and computational capacity, rather than under the unrealistic assumption of perfect rationality.

### **Prospect theory**

A behavioral theory associated with Daniel Kahneman's work, showing that people evaluate outcomes relative to reference points and are often more sensitive to losses than equivalent gains.

### **Framing effect**

A decision bias in which people respond differently to equivalent choices depending on how the options are presented or described.

### **Overconfidence**

A cognitive bias in which decision makers place too much confidence in their knowledge, forecasts, or judgments, often underestimating

uncertainty and risk. A cross-professional review found it to be one of the most recurrent biases.

### **Robust decision making**

An approach that seeks decisions or policies that perform reasonably well across many plausible futures, rather than optimizing for one predicted future.

### **Strategic foresight**

A systematic practice for exploring possible futures, disruptions, and interdependencies in order to support present-day decisions under uncertainty. OECD presents it as a tool to support decision making and process design.

### **Risk management**

A structured process for framing, assessing, responding to, and monitoring risk so that organizations can support effective decision making.

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