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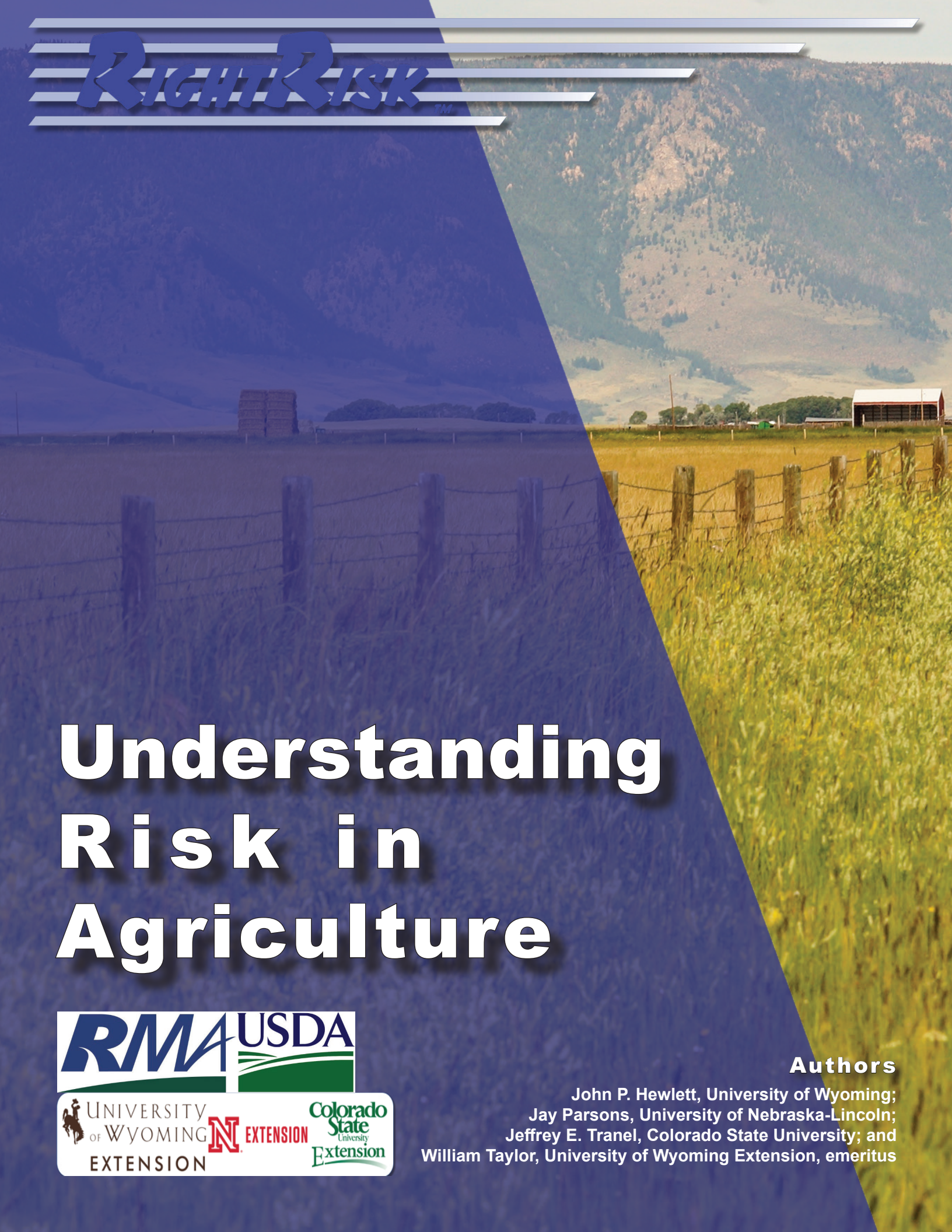

Understanding Risk in Agriculture

RMA USDA

University of Wyoming Extension | Nebraska Extension | Colorado State University Extension

Authors

John P. Hewlett, University of Wyoming;
Jay Parsons, University of Nebraska-Lincoln;
Jeffrey E. Tranel, Colorado State University; and
William Taylor, University of Wyoming Extension, emeritus

This document has been developed to accompany the online course module *Understanding Risk in Agriculture*. The module may be accessed free of charge at **RightRisk.org**, along with recorded presentations, notes, slides and other materials.

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Table of Contents

What Is Risk?

Challenges Predicting The Future

In popular usage, risk is generally understood to mean future events for which the outcomes are unknown or uncertain. However, it is important to note that not all aspects of the unknown future are created equal.

We might describe risk as a case where the unknown future matters; if the outcomes did not matter there would be no risk. In such cases, the consequences make a difference to those who are making the decisions or may be affected. Risk does not always imply a negative or bad outcome. Uncertain future events may result in good, bad or neutral outcomes. The probabilities or the likelihood of one or more outcomes may also be unknown.

Risk does not always imply a negative or bad outcome. Uncertain future events may result in good, bad or neutral outcomes. The probabilities or the likelihood of one or more outcomes may also be unknown.

In his book, *Risk Savvy: How to Make Good Decisions*, Gerd Gigerenzer explains that societies around the world generally lack risk literacy and members of those societies are generally not risk savvy. Although risk is part of nearly everyone's daily life, few are trained to evaluate risk alternatives in any formal way. In addition, information provided by many trusted sources (doctors, lawyers, politicians, lenders) is often inaccurate, incomplete, or incorrectly portrayed because the experts are unclear about what the practical implications are.

People tend to think that complex problems require complex solutions when faced with risk alternatives. This tendency compounds the challenges even further. With risk the opposite is true. Simple rules can not only help to clarify the choices open to us, but also make the consequences more obvious. This can help make risk savvy choices more possible in the face of an unknown future.

Known Future (Certainty)

Much, if not most, of the future is unknown to decision makers. However, that does not keep us from attempting to predict what it holds for us! "Humans appear to have a need for certainty, a motivation to hold on to something rather than to question it" (Risk Savvy, 2014).

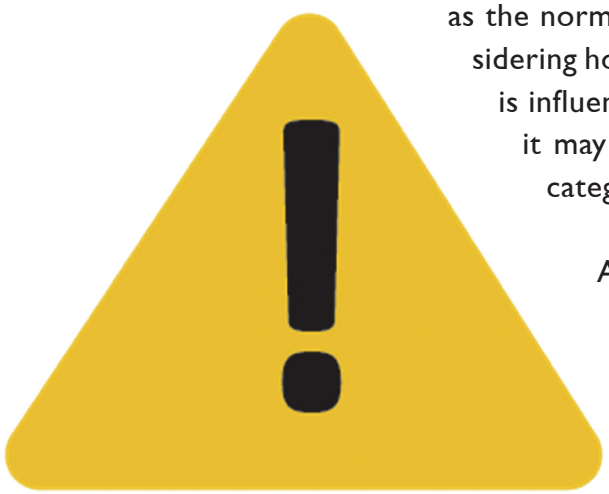
Generally, a *known future* is a sleight-of-hand or an illusion. It is not attainable in the ordinary circumstances of daily life. In fact, it is rare that we are able to list all the possible outcomes for a given circumstance, let alone the probabilities that one of those outcomes will occur. This holds true except in special situations such as games of chance like poker, slot machines, dice, and the like.

Gigerenzer suggests that our desire to make certain elements of our lives certain stands in our way to becoming more risk savvy, or able to manage in a world full of unknowns (*Risk Savvy*, 2014).

One common misunderstanding many decision makers have about the future is known as the *zero-risk illusion*. The zero-risk illusion is when someone mistakes known risk (known outcomes, known probabilities) for certainty. For this reason and others, it is important to be clear about our terminology and the meaning of those terms.

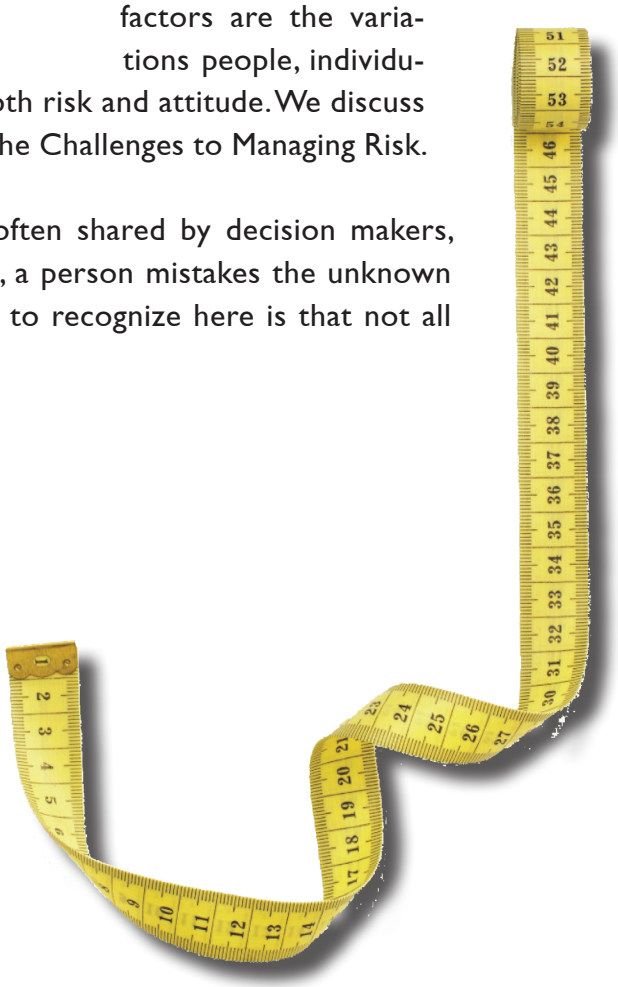
Unknown Future (Uncertainty)

Almost nothing is certain and, instead, uncertainty should be expected. Some authors describe risk as a special case of uncertainty: where the outcomes and possibilities are known (games of chance). The *unknown future* should be thought of as the normal or usual situation we encounter when considering how events might turn out. This future can be and is influenced by a number of factors. For our purposes, it may help to break these factors into three broad categories… risk, attitudes and human factors.



As already noted, risk is uncertainty that matters. The variation in outcomes make a difference to one or more decision makers involved in making management choices. Attitude may be thought of as a chosen response to risk. Human factors are the variations people, individuals and groups, bring to the consideration of both risk and attitude. We discuss attitudes further under the heading What Are the Challenges to Managing Risk.

Another illusion about the unknown future, often shared by decision makers, is named the *calculable risk illusion*. In this case, a person mistakes the unknown future (uncertainty) for known risk. The point to recognize here is that not all aspects of the unknown future are knowable.



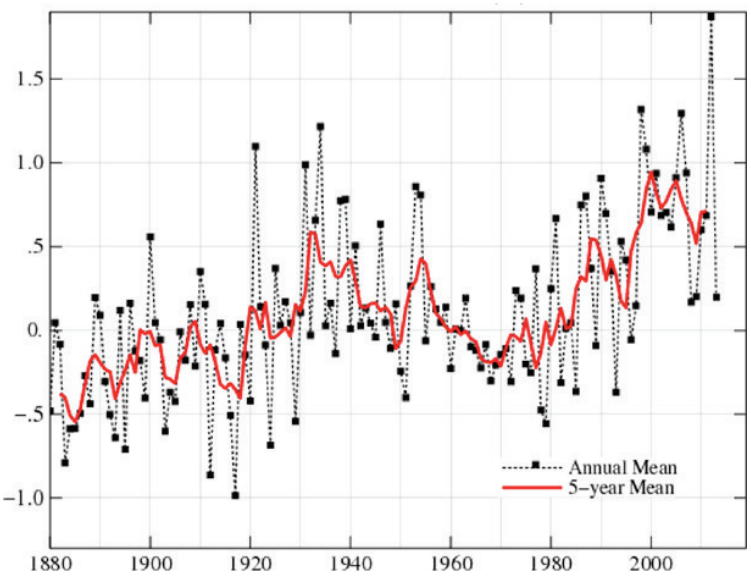
Variability (risk)

Future events are unknown to us due to two, separate and distinct factors. The first of these is variability.

Variability means alternative or different outcomes in the future due to the effects of chance. As a result, this type of change or variation in results cannot be reduced by further study or by any type of measurement. Variability is also what most managers mean when referring to *risk*.

Variability may be reduced, in some cases, through a change in the underlying system. Agricultural examples might include changing a calving system to include calving sheds, where calving in the open was practiced previously or upgrading the physical irrigation system or associated technologies, where flood irrigation practices were followed in the past. An example of changing the physical system in a game of chance might be using weighted dice where normal dice were used previously.

In each case, the outcome of future events remain unknown. However, the variability of those outcomes has changed, due to a change in the underlying system. Sometimes management changes increase the variability, other times consistency is increased. Decisions to manage variability generally focus on reducing the consequences of negative outcomes, increasing the likelihood of positive outcomes, enhancing the benefits of positive outcomes, or possibly all of the above.

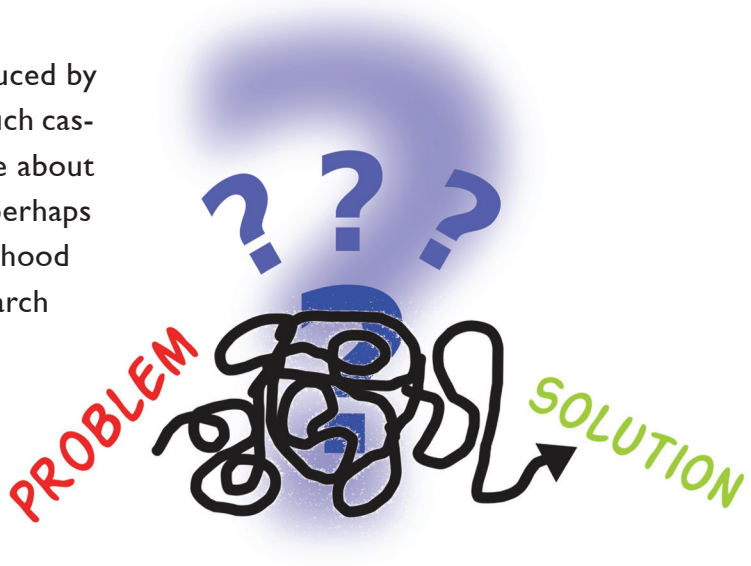


Another important point to realize is that not all risk is bad or represents a substantial threat to a business. Variations in genetic diversity may offer a competitive advantage to a seed-stock producer or plant breeder. In addition, it may offer a higher degree of resilience to a business operating in a risky environment.

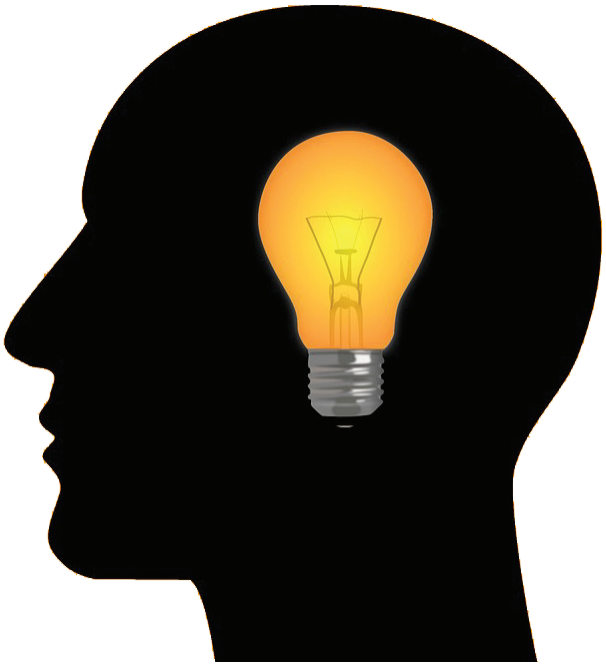
Uncertainty (indeterminability)

The second factor of the unknown future is uncertainty. *Uncertainty* refers to our lack of knowledge about the future. It may even represent our uncertainty about the meaning of current events and what it may imply for future outcomes.

Uncertainty can sometimes be reduced by further study or measurement. In such cases, a manager becomes more aware about the outcomes that are possible or perhaps is better able to estimate the likelihood of a set of outcomes through research on the underlying system.



Uncertainty may also represent the subjective nature of the individual making the evaluation. The perceptions of the decision maker about what outcomes are possible, as well as how likely those events are may or may not be accurate. However, the fact that the individual believes the assessment is correct and the degree to which those beliefs are taken into account when making decisions can lead to even greater uncertainty in decision making.



Considered in this light, some refer to uncertainty as indeterminability or ambiguity. The point being that some aspects of uncertainty are unknowable and, as a result, unmanageable. Stated another way, it is impossible to know much of anything about the unknown unknowns!

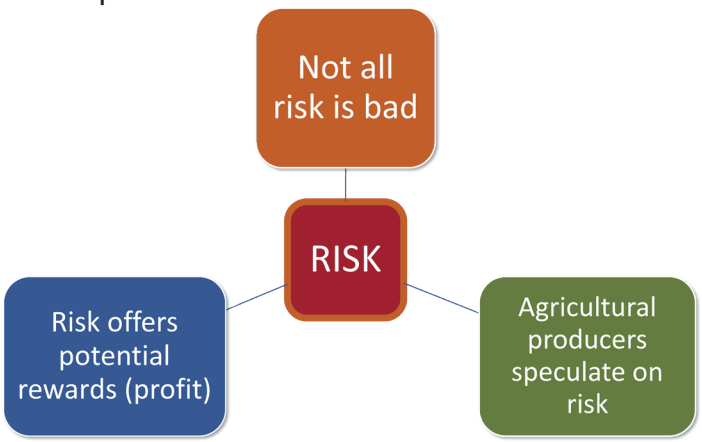
Risk In Agriculture

Most managers think of risk as a variation in future events for which the outcomes are unknown or uncertain and where that unknown future matters. It follows from our previous explanation that managers may benefit from looking further into the possibilities for managing the *variability* in the system. However, they will benefit very little from attempting to manage the *uncertainty (indeterminability)* in the unknown future.

When considering the sources of risk in agriculture, most decision makers agree that there are five, main sources of risk. These sources of risk may be additive or distinctly separate in their influence on the operation.

The five sources include: market risk, production risk, institutional risk, human risk and financial risk. Marketing and price risks include the prices of inputs or outputs that change after the manager has committed to a plan of action. Production risks might be described as uncontrollable events such as weather, pests or disease that make yields, quality, or outputs unpredictable. Institutional risks include government or other institutional rules, regulations and policies which effect profitability through costs or returns. Human risk arises from the character, health or behavior of the people involved in the business. Finally, financial risk is the extra risk that is attached to borrowing outside capital to make the business function and the rate of return on saved or invested monies for future use by the business.

Managers encounter a number of different terms, as well as familiar words used to refer to unfamiliar concepts, when they begin to investigate risk and how to improve management decisions. Clearly, it is important to understand some of the basic concepts, if we are to understand their implication for management.



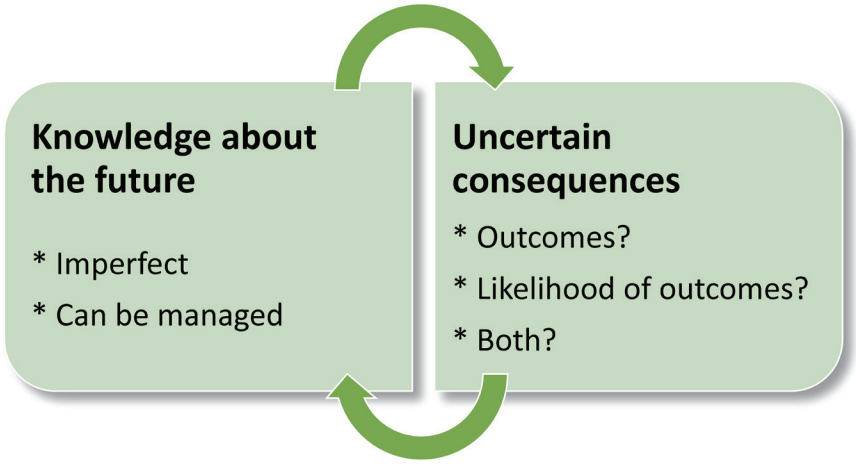
Risk vs opportunity

One of the first concepts to recognize is that not all risk is bad. Think of it this way, if the future was known, every manager would understand exactly which decision to select, which strategy to follow, as well as what to expect as the future unfolds. The opportunities for profit taking and healthy competition are greatly reduced, if not removed, with no risk involved.

Risk is usually associated with potential reward. Agricultural producers speculate on risk all the time. That's where a lot of the profit in farming and ranching exists. However, this should be done with careful evaluation of the potential impacts and the willingness to accept the probability of those impacts.

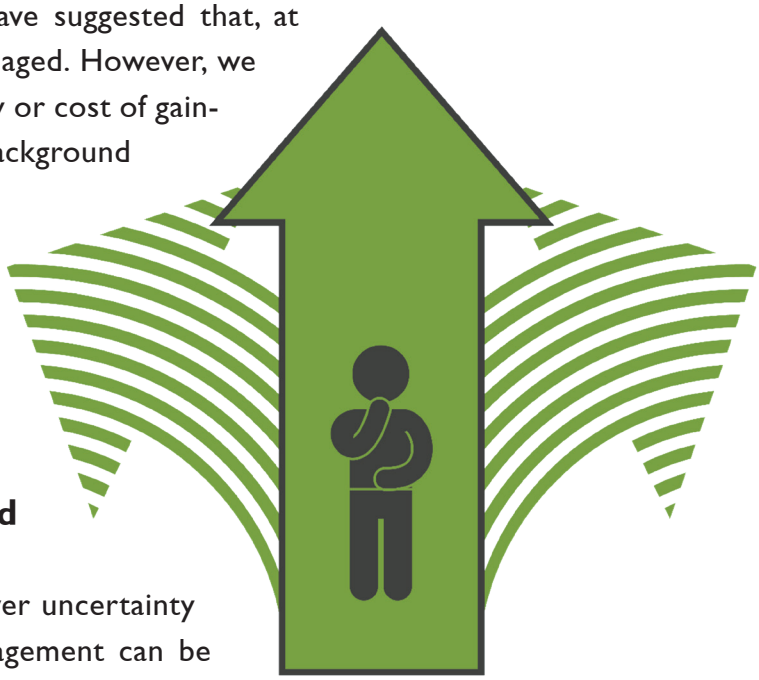
Imperfect knowledge vs uncertain consequences

As noted earlier, *uncertainty* refers to our imperfect knowledge about the future. While this certainly contributes to a future full of unknowns, it does not imply that we are able to manage that aspect of the future.



On the other hand, to state that the future holds uncertain consequences implies that either the outcomes are unknown, that the magnitude of those outcomes are unknown, or both. This we have

defined this as uncertainty and have suggested that, at least in some cases, it can be managed. However, we have neither discussed the difficulty or cost of gaining the necessary knowledge or background to allow us to make informed decisions, nor looked into whether every risk that can be managed represents a large enough threat to the business to warrant attention.



Good consequences vs bad consequences

Most managers prefer certainty over uncertainty in many aspects of life. Risk management can be thought of as one or more strategies created with the goal to reduce the likelihood (chances) of negative (bad) outcomes, to reduce the effects of negative consequences (outcomes), to increase the likelihood (chances) of positive (good) outcomes, or to increase the magnitude (benefit) of positive consequences, or possibly all of the above.

Strategies for managing risk or the consequences of a negative event, should it occur, vary by source of risk and level of protection already in place. In general, the options range from avoiding the risky practice entirely (minimizing the risk) to accepting the risk (self-insuring). Between these two extremes are several possibilities for managing the risk to a more acceptable level by: reducing the risk, transferring the risk, or increasing the capacity to bear the risk.

Relative vs absolute risk

The proactive risk manager will also want to understand the difference between relative and absolute risk. *Relative* risk is a measure of risk outcome in terms of the relative improvement (or worsening) over the previous situation. On the other hand, *absolute* risk is a description of a risk

outcome in terms of the absolute improvement (or worsening) over all other situations possible. (*Risk Savvy,* 2014).

For example, where the objective is to improve absolute profitability, we probably wouldn't compare this year's returns with just last year (relative improvement). Rather, we would compare this year's results to profit estimates for all previous years of operation (absolute improvement).

Both relative and absolute risk can be important concepts when discussing whether a given risk management decision, practice or strategy will improve the current situation and by how much.

Known risk vs unknown risk

Known risk are situations where the manager is able to describe both the outcomes and the likelihood of those outcomes occurring. This is really only possible with games of chance and is a narrow subset of what we have referred to earlier as *variability*.

Unknown risk, conversely, refers to what we have suggested as uncertainty or indeterminability. Circumstances where the decision maker neither well-understands the outcomes, nor can make reasonable estimates of the likelihoods that they will occur. Unknown risk is very difficult, if not impossible, to manage and represents random change in the *unknown future*.

Situational influences

Hillson and Murray-Webster offer several factors that can influence or modify our perception of risk in a given situation, including:

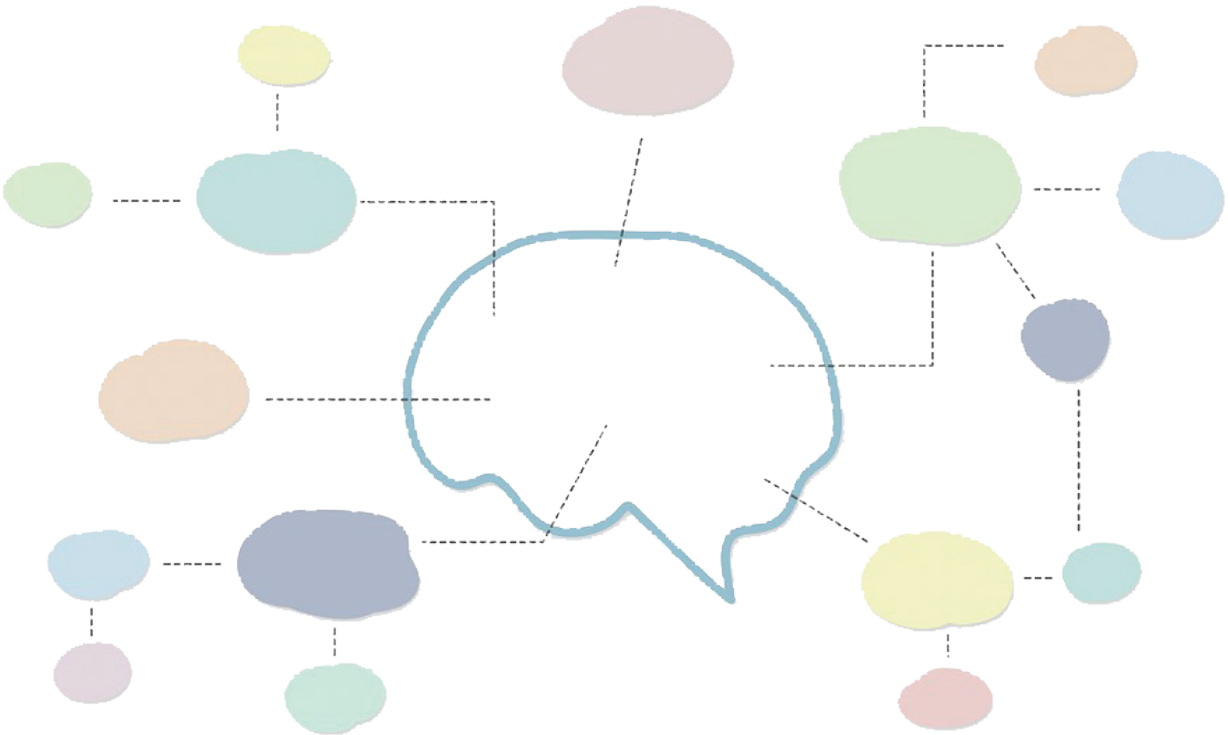
- Level of knowledge or expertise – how much or how little does the decision maker know about the situation?
- Perception of probability or likelihood – how likely are events to take place?

- Perception of magnitude of impact – will the impact be large or small, will the effect be limited or does it have the potential to spread to other areas of concern?

- Degree of perceived control in the situation – are options available to limit the impact, control the spread, or reduce the chances of occurrence?

- How soon the uncertain events may take place – are the uncertain events about to take place or might there be time to make preparations to manage the impact?

- Potential for direct consequences – will the consequences influence one or more individuals of concern, a core group, the entire business, or the entire industry?

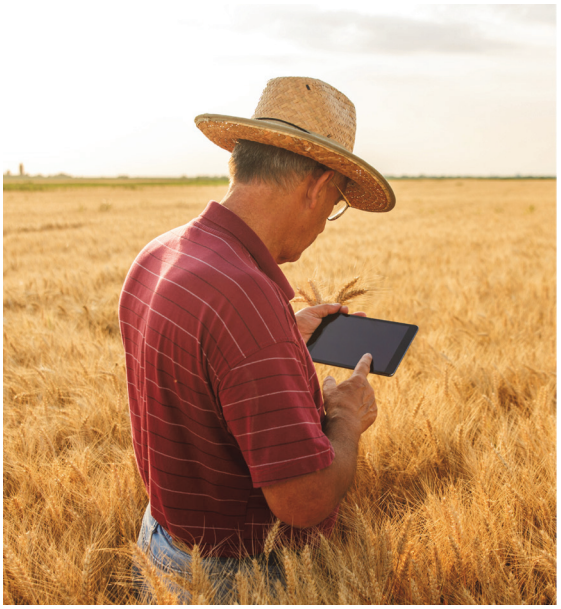


Does Risk Matter?

Risk Matters

Not all unknown future events are created equal. *Risk* represents *variability* where the unknown outcomes matter to the decision maker. In addition, risk does not always imply a negative or bad outcome. The unknown future may include good, bad, or neutral outcomes. The likelihood of one or more of the outcomes may also be unknown. Risk management is really about selecting between alternative management strategies, where negative consequences are possible.

Stated in another way, the goal of risk management is to maximize the well-being of the decision maker and/or the business. The goal of risk management is not to minimize risk, rather it is to manage risk to a level acceptable to the individuals involved.



Risk And Threat

Not only is it possible that future events may be good, bad, or neutral, but it is also possible that they do not represent a substantial threat to the business. The consequences may not be great enough and/or the likelihood may not be high enough to require a management response. Stated in another way, not all risk must be managed.

Threats to the business must be taken into account and management strategies developed where the risk is greater. This occurs when objectives become more uncertain where the consequences of a bad or negative outcome become:

1. Larger in potential effect – Management may decide that the potential negativeconsequences would be substantial enough to threaten the future viability of the business if they occur. Even where the business might be able to continue operations, expectations for future profitability may be so low that carrying on might not be justified.

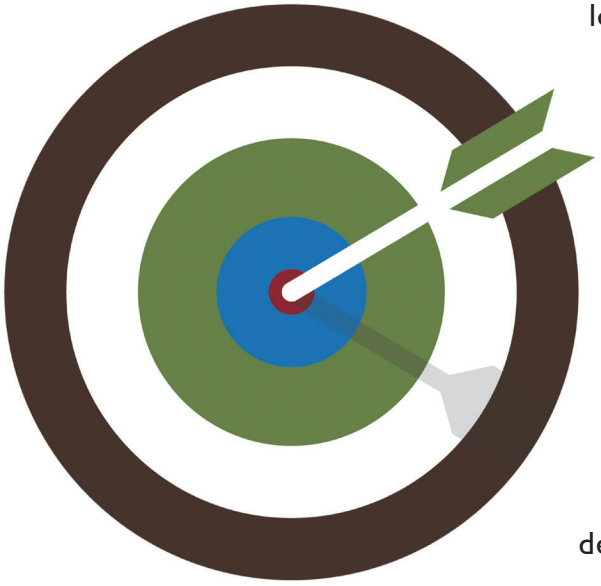
2. Less known, less knowable – Even with a reasonable investment of time and effort, it is not possible to know about all the outcomes of every management decision. In cases where the choices are less clear or the alternatives less well understood, the chances of a substantial threat increase.

3. Negative consequences become more frequent – The manager may decide, after fully evaluating the alternatives available, that a strategy which includes the possibility of negative outcomes with a high likelihood is the best choice. In such cases, a strategy for managing the risk should be carefully considered, as well as the potential cost.

Circumstances that include increasing *uncertainty* represent another case that may threaten the future of the business. Given that uncertainty is difficult or impossible to manage, alternatives that include a high degree of uncertainty represent a greater threat to the business than those that do not. In addition, they may represent a greater threat to the business than alternatives that include a higher level of *risk* or *variability*. (See Variability and Uncertainty above for clarification of these terms.)

Objectives Are Not Met

Risk also matters where management objectives are not met, cannot be met, or where control is lost due to the *variability* of outcomes. This could happen where a manager does not complete a risk management plan designed to limit losses, where the cost of managing the risk was judged as too high, or the likelihood of occurrence was evaluated as too low.



Identifying objectives to accomplish is part of properly framing a decision, especially regarding risk management. Why might this be important? Because the objectives form the decision criteria, help determine what information to seek, help explain the decision choice to others, and help determine how important the decision is to the people involved, as well as how much time and effort should be spent in making it.

The business likely does not move forward where objectives are not met. Furthermore, where business objectives are not met, profitability likely suffers or is lost, potentially threatening the future of the business.

Can Risk Be Managed?

Risk management may be accomplished at several levels within a business. At the highest level—the strategic level—management makes decisions regarding the allocation of resources across business activities, the timing of the application of those resources, and the level of resource use. Such decisions represent "big picture" or macro-level decisions about the business and its activities.

Risk management at the strategic level identifies the direction the business wants to go with its risk management decisions and allocates the resources to get there.

At the next level down, decisions are made regarding how those resources will be applied within the individual profit center or enterprise. Risk management decisions can be, and often are, made at both the strategic and at the enterprise or division level of management.

Obviously, management of the various risks faced by the business is best accomplished where the risk strategies adopted are well-coordinated across all levels of management and are in agreement with the risk management objectives of the business.

Risk management might be generally defined as taking deliberate action to shape the *variability* of the outcomes, the *consequences*, or both for any management decision that might be made.

Variability (alternative outcomes)

As noted earlier, *variability* refers to alternative or different outcomes in the future due to the effects of chance. Variability is also what most managers mean when referring to risk. Risk may be reduced, in some cases, through a change in the underlying system.

Consequences (outcomes)

Consequences: noun, results or outcomes are defined as "...something produced by a cause or necessarily following from a set of conditions." (*Merriam-Webster Dictionary,* online 2019).

Another dimension of risk management comes from management attempts to adjust or alter the consequences (especially the negative outcomes) when events move against management interests. This might be accomplished through the purchase of insurance, through contracting, or forward pricing arrangements. In each of these alternatives, the objective is to share the cost of any negative outcomes, should they occur, in trade for a fee charged whether the consequences occur or not.

In this light, risk management is a necessary, but sometimes frustrating, activity. Even very good risk management strategies can still lead to a bad outcome due to the uncertainty of how the future will actually turn out. As a result, the quality of a risk management strategy should be judged based on the information available at the time the strategy is selected and not solely on the final results. Although results are obviously important, even high-quality risk management strategies don't come with guarantees in the face of significant uncertainty. Good strategies should lead to more positive results more consistently.

What Are Challenges To Managing Risk?

Attitudes

Risk attitude may be thought of as a chosen response to *variability* and *uncertainty*. They may be influenced by changes in perceptions about a set of alternatives, by gaining new information, or through a shift in emotions. Attitudes, even about risk and uncertainty, may change over time.

In addition, the human factors may lead to differences in response to risk between people, individuals and groups. These alternative viewpoints often have to do with both the source of variability and attitude. One person considering the same risk alternatives and expressing the same risk attitude may choose one option, while another may make a vastly different choice. Personal preferences, past experience, and other human factors influence our choices in many ways.

It is also important to note that risk attitudes are neither right nor wrong. Different individuals can have well-reasoned arguments for the alternative choices they make, even when those choices vary over time. That does not mean, however, that the consequences of those choices will be the same each time, nor that they are good choices, even if the outcomes are consistently positive.

It bears repeating, where the thinking is somewhat counter to our natural way of responding to *variability* and *uncertainty*, the quality of a risk management strategy should be judged based on the information available at the time the strategy is selected and not solely on the final results.

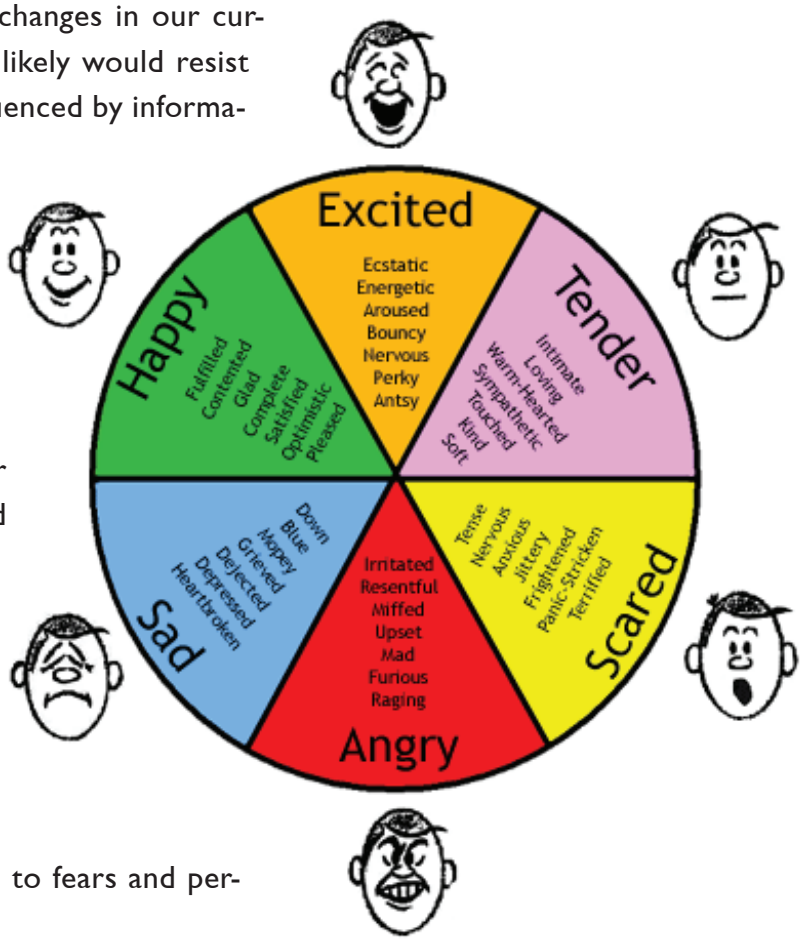
I. Situational responses

Attitudes about risk, especially those we may face in the future, are often situational. That is, our attitudes vary or may change depending on several factors. Factors could include the time of day, the stage of the production year, whether the commodity marketing approach used last year coincided with an upswing in prices, current forecasts

for next year's weather, the manager's stage of life, or the financial status of the business. In addition, they may vary based on our perceptions about the future, rather than today's facts.

2. Attitudes can be modified

Recognition that attitudes about risk and uncertainty can be modified flows naturally from our understanding that those attitudes can change depending on the situation. It is easy enough to see that we may adjust our approach as we receive new information about changes in our current environment. However, we likely would resist the notion that we might be influenced by information intended to steer our perceptions about the future in one direction or another.



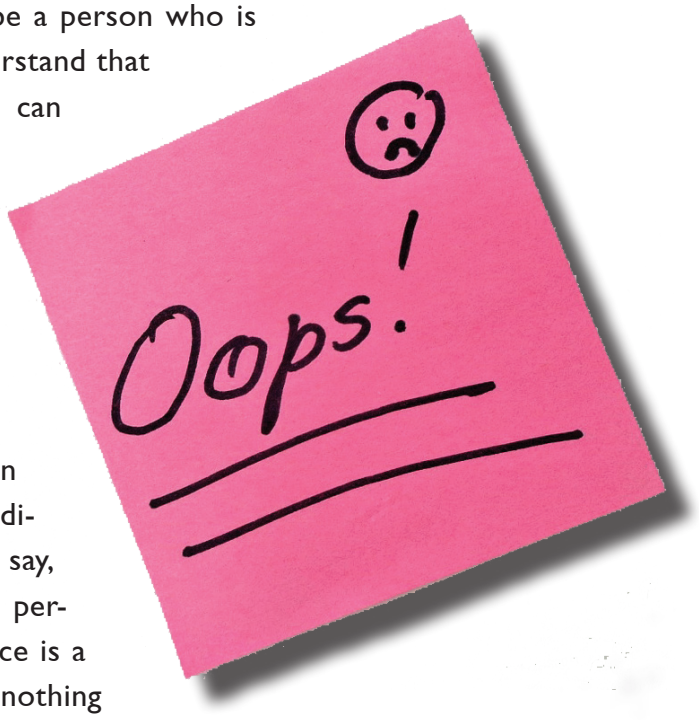
Perhaps it is more important to recognize that, as we work to better understand what forces and factors influence our attitudes about *variability* and *uncertainty*, we can simultaneously learn to manage our responses to those same forces and factors. Business management, in the face of an unknown future, can follow a disciplined and orderly response, rather than a reaction to fears and perceptions.

3. Emotion and risk behavior

Where attitudes are shaped by perception and understanding, they are also shaped by *emotions*. Our feelings, moods, and temperament at the moment all influence our outlook and chosen response. When considering our strategy for managing *variability* and *uncertainty* in the future, we do well to acknowledge that we not only can be, but likely are influenced by our emotions.

Emotional intelligence is a term becoming more common place and is used to describe an enhanced awareness of the role of emotions in making choices. *Emotional literacy*, stems from

that understanding, and is used to describe a person who is able to recognize different emotions, understand that emotion may influence their reasoning, can accurately and appropriately express those emotions, as well as deal with those emotions when considering their choice of action.



Manager response to *variability* and *uncertainty* is shaped by many, often times conflicting, signals and factors. However, in most cases those influences cause the individual or the business to act. That is to say, they influence the chosen behavior of the person or the company. Sometimes that choice is a choice to do nothing. However, even doing nothing is a choice selected from several alternatives and results in consequences whether they be judged good or bad by the individuals involved.

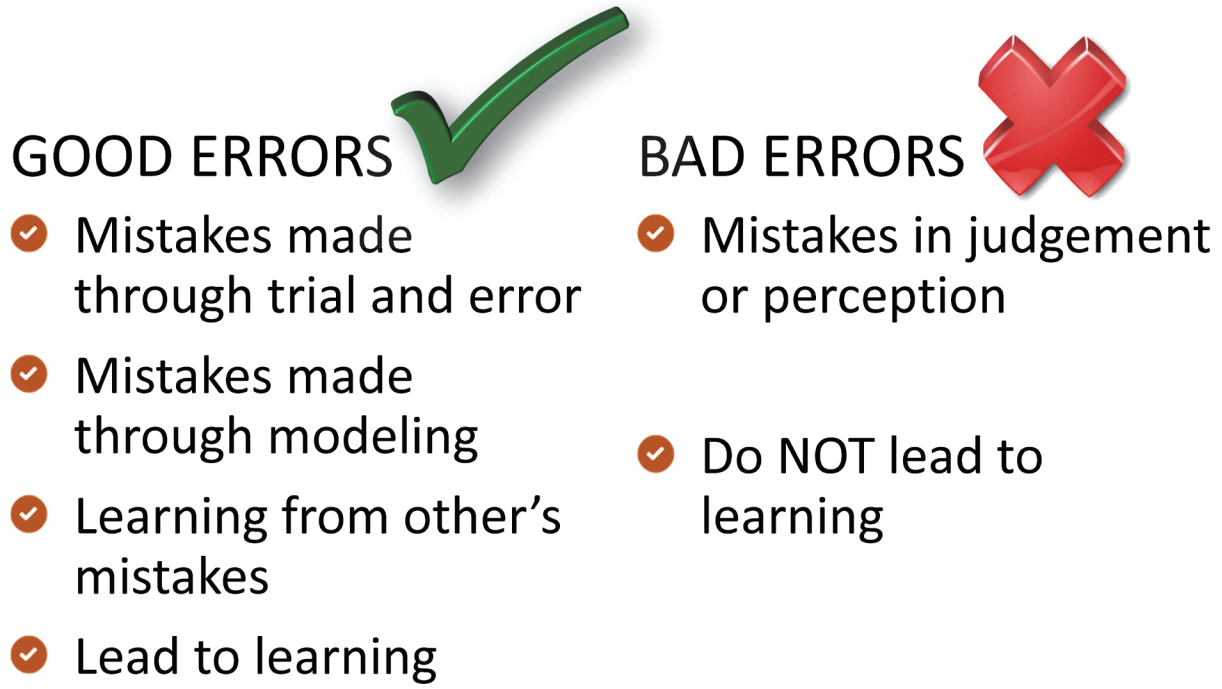
It has been said that humans only learn by making mistakes but do not learn much from success. Often the goodness or badness of a situation and our fear of those two alternatives when considering the future cause us to act or react without even consciously thinking about it.

I. Good errors vs bad errors

Good errors are mistakes that need to be made through trial and error, modeling, or even learning from other's mistakes. Decision makers can learn from such an approach, not only to refine their capacity to weigh alternatives, but also to make selections.

Bad errors, on the other hand, are mistakes in judgment or perception of a situation. Bad errors do not lead to learning or to refinement of the decision maker's capacity to function better in the future.

One example of a bad error is judging the quality or correctness of a risk management strategy on how things turn out. This is particularly true where a strategy was neither carefully thought through nor put down on paper for later reference. Instead, such strategies are often formed in the head of the decision maker as only one of many available alternatives and only generally given preference over the others. As the future unfolds, the strategy may even adjust to facts and events as they become known. As the decision maker looks back, perhaps at the end of the year, they judge their strategy as good, since it led them to where



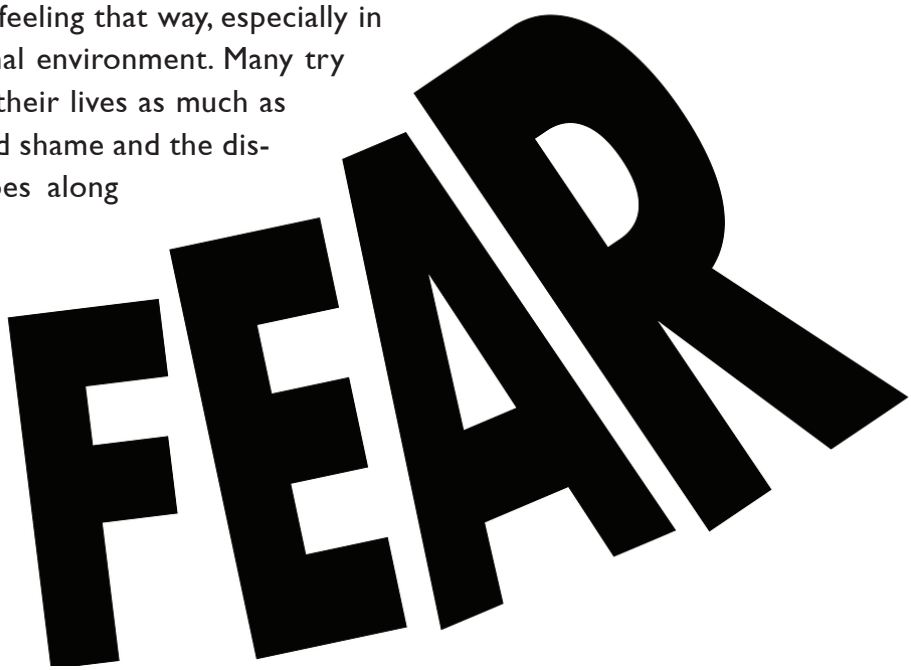
they are, rather than recognizing that they never actually developed a strategy and did not make management decisions that caused a strategy to be implemented.

2. Risk aversion

Most people, including business managers, would prefer certainty over *variability* and *uncertainty* in many or all aspects of their lives. However, almost nothing is certain and, instead, uncertainty should be expected. Individuals with a high need for certainty are referred to as *risk averse*. Such individuals focus a great deal of their attention on planning things out and are confused when things are ambiguous and unclear. Aversion to an unknown future is also observed in business managers.

Aversion to the unknown is a human trait. For some it stems from a fear or even anxiety over making an error. Either they dread the unknown consequences, should they make a poor choice, are afraid of making the wrong choice, or instinctively want to avoid situations they don't have control.

Others may be motivated by a mortal fear of shame. Shame is something we have all experienced. Often persons can recall incidents from their early childhood that made them feel literally like "they were a little kid." Most individuals would like to avoid ever feeling that way, especially in their work or professional environment. Many try to limit the unknown in their lives as much as possible, in order to avoid shame and the disgrace they anticipate goes along with it.



Unfortunately for managers of businesses with a high degree of *variability* and/or *uncertainty* the fear of error or dread of shame can influence thinking more

than conscious thought. In addition, there is little to no formal education offered on risk at any level of our education systems. This is an obvious gap in helping managers to become more effective. Even worse, it can lead to a phenomenon of *defensive decision making*. These are cases where individuals or managers choose to not make a decision or procrastinate at great lengths in order to avoid responsibility; it is easier to blame the markets, world trade relationships, or this season's weather than shoulder the responsibility for making poor choices.

Finally, taken to an extreme, attempts to avoid *variability* and *uncertainty* can be a source of friction within the business, preventing the efficient allocation resources. A manager who chooses to manage by making as few management decisions as possible is *not* an active manager. Instead, the manager lets the circumstances of the day dictate the terms of how business plays out and attempt to point fingers at outside forces and factors as the culprit for the failure.

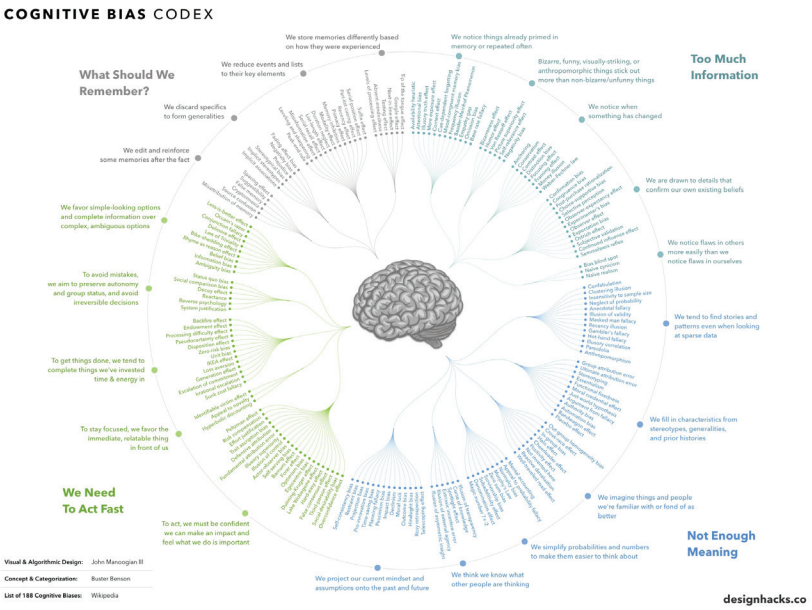
3. Biases

There are many sources of bias that influence our consideration of alternative decisions. Recent research by behavioral economists, neural physiologists, psychologists, sociologists and others has led to development of lists of biases. In fact, one source lists 188 cognitive biases that can or do shape how we view the challenges of an unknown future.

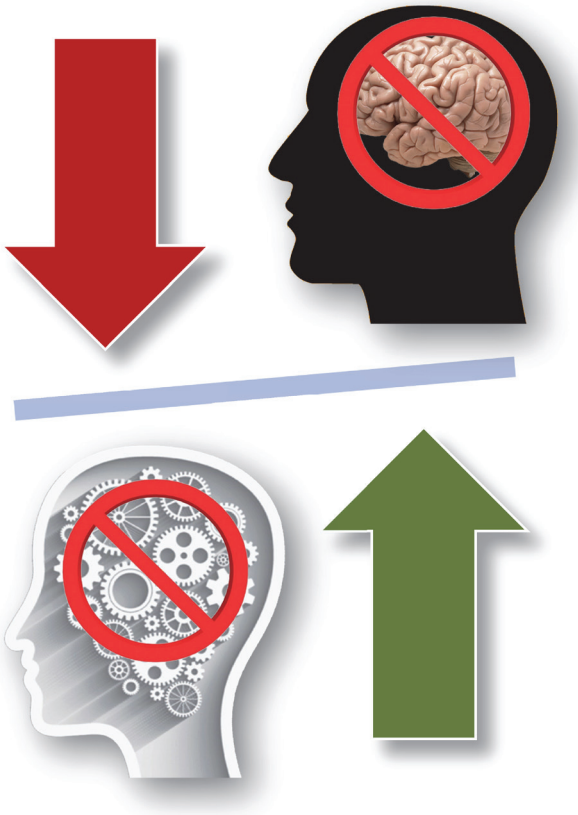
These biases, whether explicit or implicit, can and do influence our perceptions of risk. The influence may be subtle, as in the case where they influence our emotional state or cause us to be vaguely uncomfortable with certain options. The affect may be more powerful where we feel anxious, experience poor physical health, or find ourselves avoiding certain locations, persons, or situations because of the discomfort they imply.

Interestingly, there are two apparently conflicting views of bias and how it may play out in daily decision making. One camp suggests that biases are failures of the human computational

machine. Emotions and other human factors lead managers to make poor decisions due to: lack of time, unfamiliarity with the analytical approach required, or lack of knowledge on how to conduct the appropriate analysis.

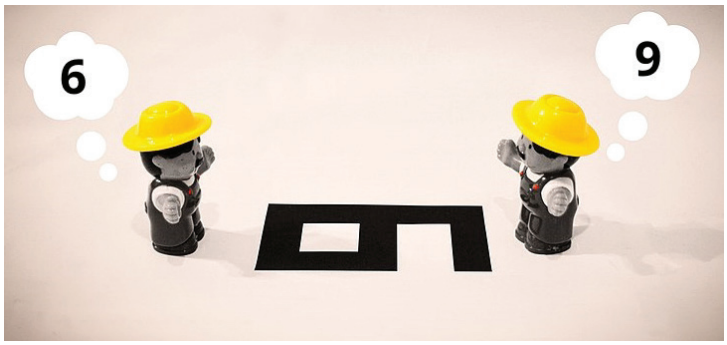


A second group of researchers hold the view that biases and the human response to complex, difficult-to-analyze situations allow us to have a response, even when analysis would be difficult or not possible. In addition, those responses can be devised in a timely manner and without significant expense.



Of course, it is possible that both groups are correct. Clearly, it is not possible to have all the information the decision maker would like to have ready every time a decision must be made. To do so, would be extremely expensive and would require too much time in data collection and analysis. On the other hand, to suggest that the best decisions are those made "by the seat of the pants," is also not realistic. There is clearly a place for well-conceived analysis to contribute to good management decisions. With all that said, it is also true that biases are unavoidable. Good managers will recognize that they have them and will take steps to ensure that their biases don't overly influence rational consideration of the alternatives.

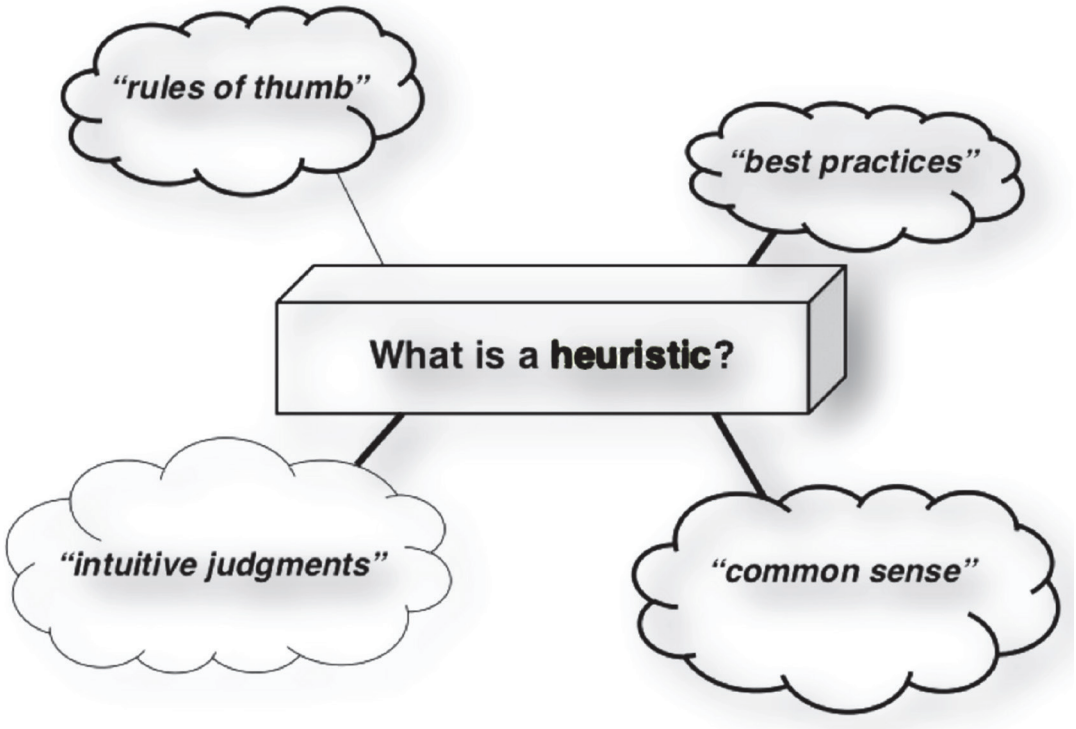
How risk information is presented can influence our expectations and can bias our view of the likelihood of future events. It can be and often is very confusing. For this reason, when communicating risk information it is important to differentiate what is known and what is unknown. Additionally, it is important to make sure that the person receiving the information understands what is being described when statistics are used to provide the background and details of the situation.

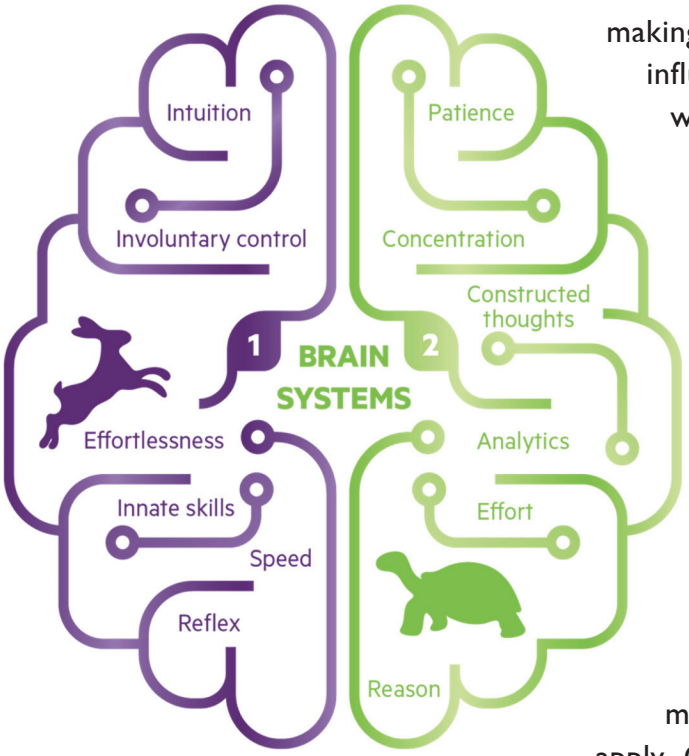


4. Heuristics

Heuristics are rules-of-thumb we all use to make frequent decisions or when we don't have a lot of time. They help avoid long, drawn-out analysis of alternatives that may require data collection from various sources and lengthy analysis in order to reach a decision.

Although heuristics are often used, they don't always result in the best choice. When it comes to risk and the highly subjective nature of the process used to select between alternatives, heuristics are formed from biases that shape our outlook, our attitudes, as well as our feelings regarding a set of alternative actions, as well as the underlying uncertainty that may accompany each option.



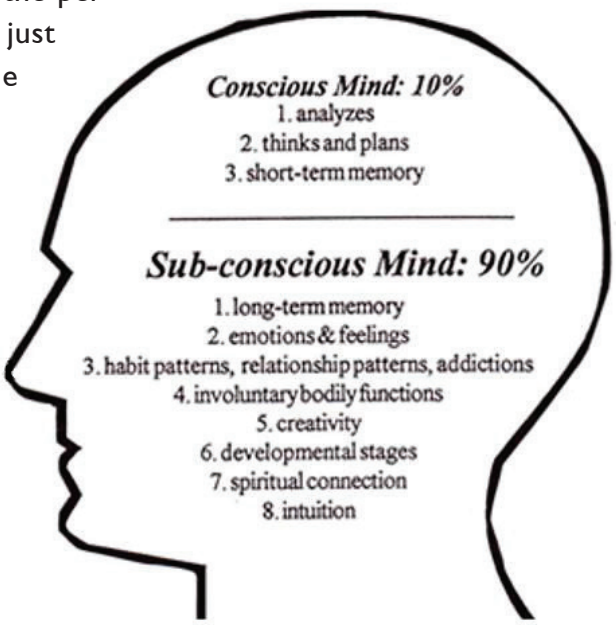


Risk heuristics can be helpful in decision making, but they can also be a source of bias influencing the alternatives we are even willing to consider.

In general, heuristics are developed where the decision maker is: 1. attempting to simplify the decision process, 2. looking for ways to reduce the amount of data required to reach a decision, or may be 3. exploring ways to reduce the amount of time required to select an alternative.

Some authors portray this as if the decision maker goes through some mental process to choose heuristics to apply. Others, perhaps more reasonably, describe the use of heuristics as an approach to decision making based on previous experiences, that they are often developed sub-consciously but can usually be applied consciously, and that they can systematically influence responses to risk.

Often heuristics and the course of action they suggest are not well understood by the individual. In fact, the person may simply explain that a certain option just feels "right" or that their intuition suggests one choice is preferred over another. Although it is tempting to dismiss this approach as irrational, it has been shown by many authors to be a more effective and rational method for decision making when: time is short, data is not readily available, there are many alternatives, or there is a high degree of uncertainty.



Separating Variability And Uncertainty

One of the biggest hurdles to good risk decision making is the separation of *variability* and *uncertainty*. Insights into the correct approach for evaluating the alternatives available can be gained where the manager is able to sort the unknown future into variability (due to chance) and uncertainty (due to a lack of knowledge about the future). A manager can see only a clouded view of the future where the two factors remain mixed and little understood.

In the case of each factor, a forecast can be made for the range of values possible, as well as the likelihood across that range. In the case of *uncertainty*, the range and the likelihood may be influenced by collecting more information. In the case of *variability* more information would not lead to a more certain future.

Collecting more information or further study may offer new ideas where *uncertainty* is the bigger issue. In addition, seeking the advice of an outside expert may reveal additional options that were not previously understood. Finally, where the uncertainty has a greater relationship to the decision maker's beliefs or biases about the future, these too can be modified through additional information.

Evaluating options for making changes to the underlying system is a more reasonable approach where *variability* is the main challenge. Collecting more data would not be of any help in reducing the range of possibilities in the unknown future, where that range is due purely to chance.

Separating *variability* and *uncertainty* can offer suggestions to management on where to apply new or additional effort. The next logical question is to consider whether that further analysis is justified or if following a rule-of-thumb (*heuristic*) would be the more practical alternative.

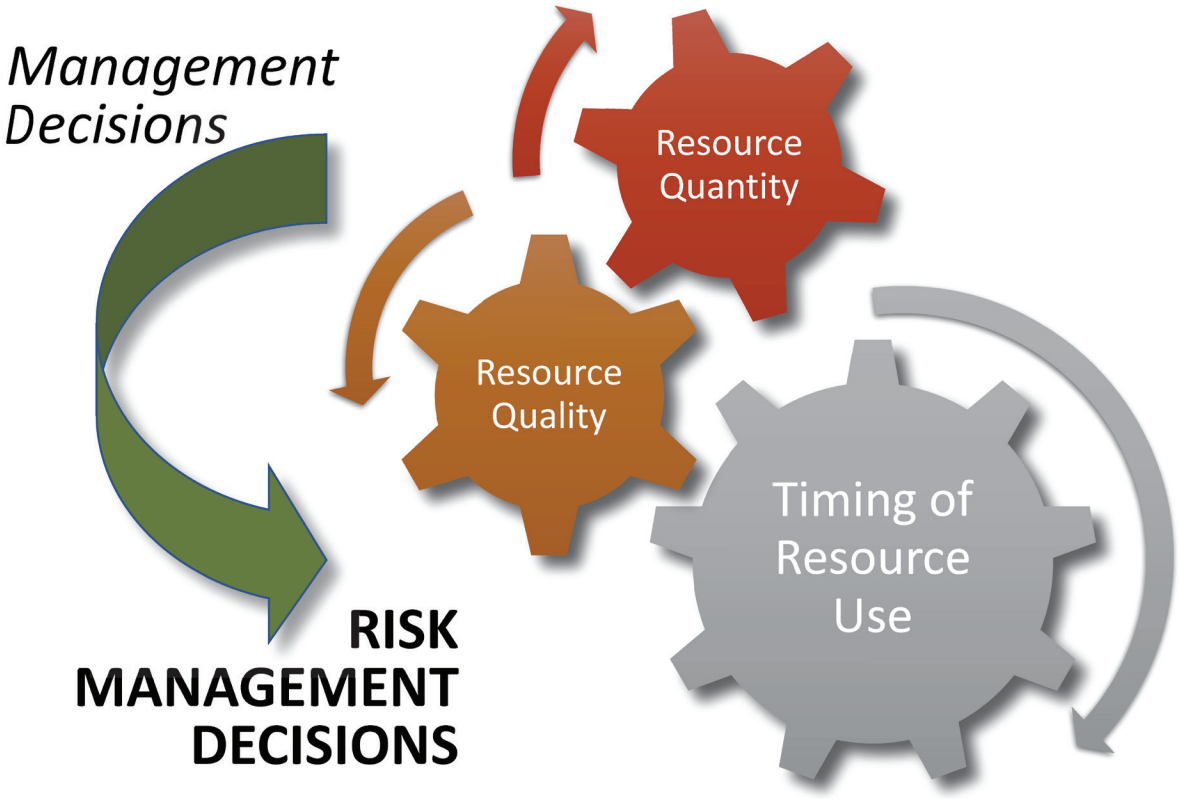
When Is Risk Analysis Justified?

Risk analysis is about developing an understanding of the risk. Risk analysis can be undertaken with varying degrees of detail depending on the risk, the importance of the analysis, and the availability of information, data and resources. Management decisions about the quantity, quality, and timing of resource use and management action are risk management decisions. The methods used for selecting the actions are the techniques for risk management.

In general, a manager will consider several aspects of the decision before making the choice to complete further analysis:

I. Identify threats, describe consequences

The manager will first carefully consider the source of risk that is the greatest threat to



the success of the operation. Threats, in this case, represent potential consequences if a bad outcome were to occur. The greatest threat may be the one with the greatest consequence or the threat that comes up most often. It may also be the threat with the consequences that are expected to happen first in time; the most immediate consequence. A single source of risk may represent several different consequences.

2. Evaluate likelihood of occurrence

Managers must also consider the likelihood of a consequence occurring. For example, the possibility that irrigation water supplies could fail may represent a very significant consequence for the success of a growing crop, perhaps complete crop failure. However, if irrigation water supplies have never, or only rarely failed, then the likelihood is not very great. As a result, the overall magnitude of the threat is not large either.

3. Consider existing strategies

Proactive managers should also consider the effectiveness of existing risk management strategies. This would include risk

controls already in place by the business, but might also include strategies that are known to mitigate or reduce the risk of concern. Where existing strategies have not reduced the risk to the desired level, it is because it is not possible to manage the risk at that level using the control selected, the risk criterion was not reasonable for the source of risk, or the strategy was not properly implemented to achieve the level of control desired. Alternatively, management may decide that the current level of risk control is adequate, given the cost and expected benefits of the alternatives available.

How Are Risky Choices Evaluated?

Threats That Warrant Treatment

The purpose of risk evaluation is to assist the manager in making decisions affected by risk. The outcomes of risk analysis include identification of which risks need treatment and a prioritized treatment implementation. This involves comparing the desired level of risk management with the current level of risk. In general, if the level of risk does match up, then the risk should be further considered for treatment.

Clearly a detailed risk assessment would be completed only when the threatening consequences are significant, when they are judged likely to occur, or both. How does a manager decide if this approach is worth the time and effort?

There are certain circumstances where the need for a detailed risk assessment is clear:

1. When a particular decision is *repeated over time* – in such cases, a refined response, based on careful analysis can leave the enterprise and the entire business in a better position. Examples here could include strategies for commodity

marketing, choices about crop amendments or pest control, or criterion for the timing of pasture rotation. Careful consideration of the alternative strategies and the trade-offs of associated benefits and costs can pay big dividends where the management decisions are repeated over time.

2. When a decision includes *large financial consequences* – investing the time and effort to minimize those financial consequences should be carefully pursued. However, the likelihood of those consequences should also be taken into account. Preparing for a terrible disaster that is unlikely to occur could be an inefficient use of management time. On the other hand, failing to prepare a management strategy to address drought conditions and their significant financial consequences when they are a regularly recurring event does not represent proactive risk management.

Threats And Opportunities For Management

Risk management is intended to assist management to implement concrete actions and strategies to maximize opportunities and to control threats. For this reason, the operator should carefully consider the threats by source of risk. Not all threats are equal. The mismatch between the desired level and current level of risk may provide a clue to which risks are of greatest threat. In addition, a thorough evaluation of management's risk perspective (tolerance) and the current levels of risk may provide further insights.

Opportunities may arise for the business to be managed to a new level of performance. In some cases, opportunities are not recognized for what they are when concerns about risk are the manager's primary concern. Understanding the strategies available for managing risk, the level of control possible, as well as how the business might perform when existing barriers are removed, may offer additional prospects for management not previously considered.

Where the threat is judged to be great enough to justify the effort, the manager should spend time developing and evaluating alternative risk management strategies. Where alternative strategies are available, these should be compared across several levels, including:

- The resource costs and returns, including financial, for implementing the strategy and what the outcomes would look like should a bad outcome occur.
- The management effort and attention required to keep the strategy viable in the face of changing conditions.
- How quickly the strategy could be implemented following a bad outcome.
- How effectively the strategy would address all or most of the consequences that result from a threatened bad outcome.

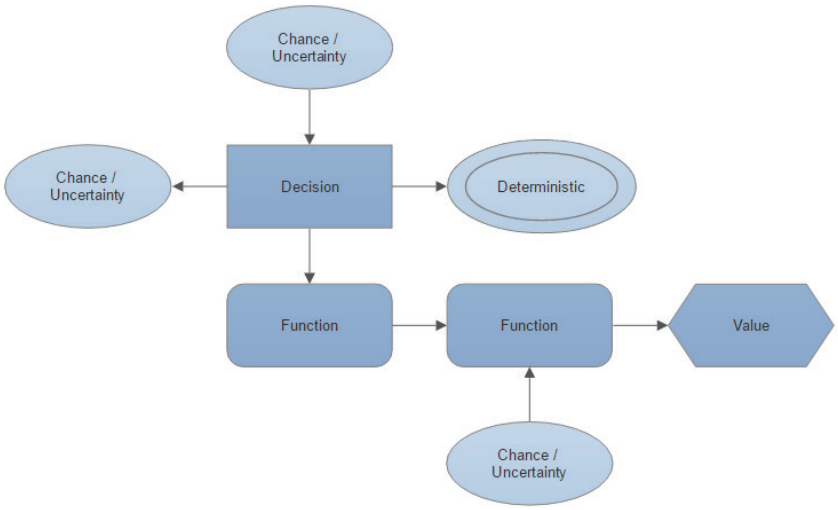
Where there is *variability* and *uncertainty* are about the future, it is challenging to describe to those who are uncomfortable with the concepts and implications. The terminology and concepts are focused on events and outcomes that have not yet taken place. Many decision makers find forecasting the future difficult, if not impossible.

The fact that risk is focused on uncertain outcomes is clear. However, a closer look suggests that those outcomes may be uncertain because it is difficult to describe how *likely* they are to occur (*probability*) or because it is difficult to determine the *quality* of the outcome (how much, how often, good or bad, etc.)

I. Influence diagrams

In general, risk is estimated by making projections about the probability and the potential impact on the person or business. Sometimes just getting the various points of the problem down on paper can be a big help. An influence diagram is one of the most basic starting points for understanding the challenges.

An influence diagram indicates chances (ovals), decisions (boxes), and consequences (diamonds) and their relationship to one another via arrows. In this way, the decision maker can understand what comes first (chance), what decisions or remedies may be possible, as well as what the expected consequences might be. Obviously, this offers only a very basic understanding of the situation, and yet that understanding may help the manager gain a more complete understanding of the overall situation.



2. Probability – Impact grid

Another, descriptive approach for organizing the details in the unknown future is a probability-impact grid. In such a table, the decision maker lists possible events of concern, along with the expected likelihood and impact. Simple ratings of high/medium/low probability and high/medium/low impact for each future event can be presented in a 3x3 grid to help decision makers compare high probability-high impact with low probability-low impact results. Such a table can then be used to prioritize the events and the associated risks for management attention.

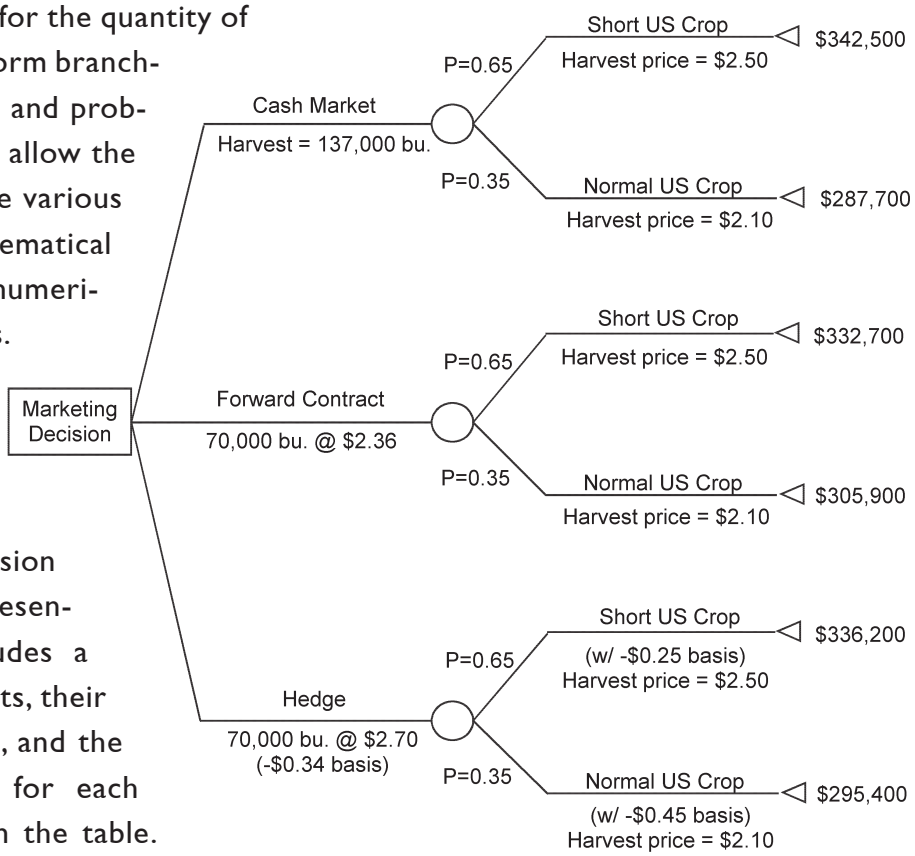
For example, events that are more likely and/or have the potential for a large impact on the business should receive the most attention and perhaps the highest priority. Conversely, events that are unlikely or would have a low impact on the business likely should receive less attention.

This approach, however, does not take into account how soon the events may occur. When an event might occur should also be taken into account when deciding the order and priority for management action.

		Probability (Likelihood)		
		Low	Medium	High
Impact (Consequence)	High	0	2	1
	Medium	3	1	1
	Low	4	2	2

3. Decision trees

A third alternative for organizing risk information is to estimate the threat represented by alternative events using a quantitative approach. In this case, the decision maker makes an estimate of the probabilities associated with alternative outcomes, as well as assigning values for the quantity of output. The outcomes form branches on the decision tree and probabilities are assigned to allow the manager to evaluate the various possibilities using mathematical approaches to suggest numerically-better alternatives.



4. Payoff matrix

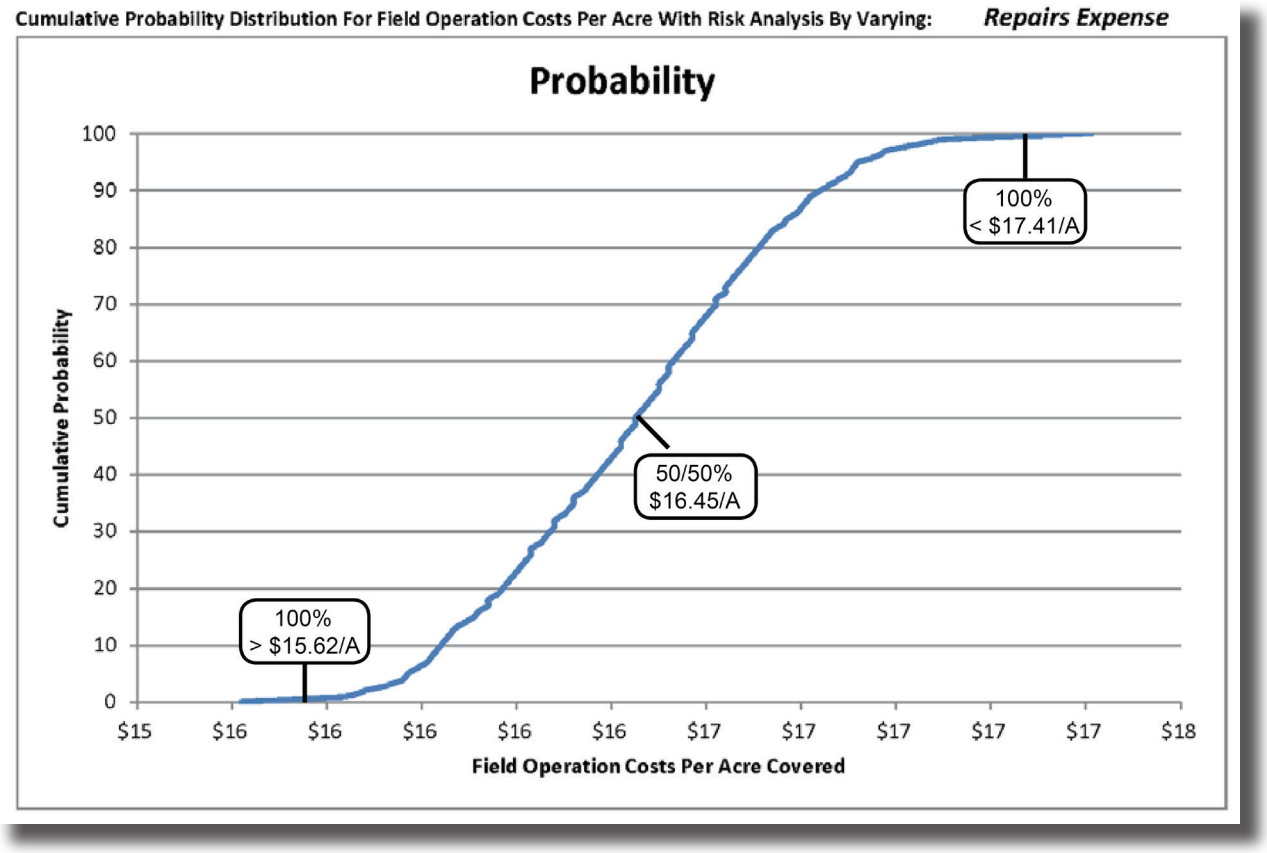
A payoff matrix organizes the same information used in a decision tree into a tabular presentation. The table includes a description of the events, their associated probabilities, and the corresponding payoffs for each combination as rows in the table. This approach can make analysis of the data a bit easier, particularly where using a micro-computer. However, it is not well suited to situations where the possible events may be more complex or where there is an obvious order or progression from one to another. These are likely better evaluated using the decision tree approach.

				Decision Alternatives		
				#1 Cash Market 137,000 bu.	#2 Forward Contract 70,000 bu. @ $2.36	#3 Hedge 70,000 bu. @ $2.70 (-$0.34 basis)
Risk Outcomes	Harvest Cash Price	Harvest Basis	Probability			
Normal US Crop	$2.10	-$0.45	35%	$287,700	$305,900	$298,200
Short US Crop	$2.50	-$0.25	65%	$342,500	$332,700	$339,000
			Expected Value	$323,320	$323,320	$324,720
			Standard Deviation	$38,749	$18,950	$28,850

5. Other approaches

Risk decision analysis can be taken even further by using probabilities and more sophisticated statistical techniques. These approaches describe possible outcomes using mean, deviation, variance, and other statistical measures to help managers better-understand the outcomes possible.

These same statistics can also be used to develop mathematical functions that can be depicted graphically. *Probability density functions* (PDF), *cumulative probability distributions* (CDF), and others can be used to provide a description of the range of various outcomes, as well as their likelihood from information provided by decision maker.



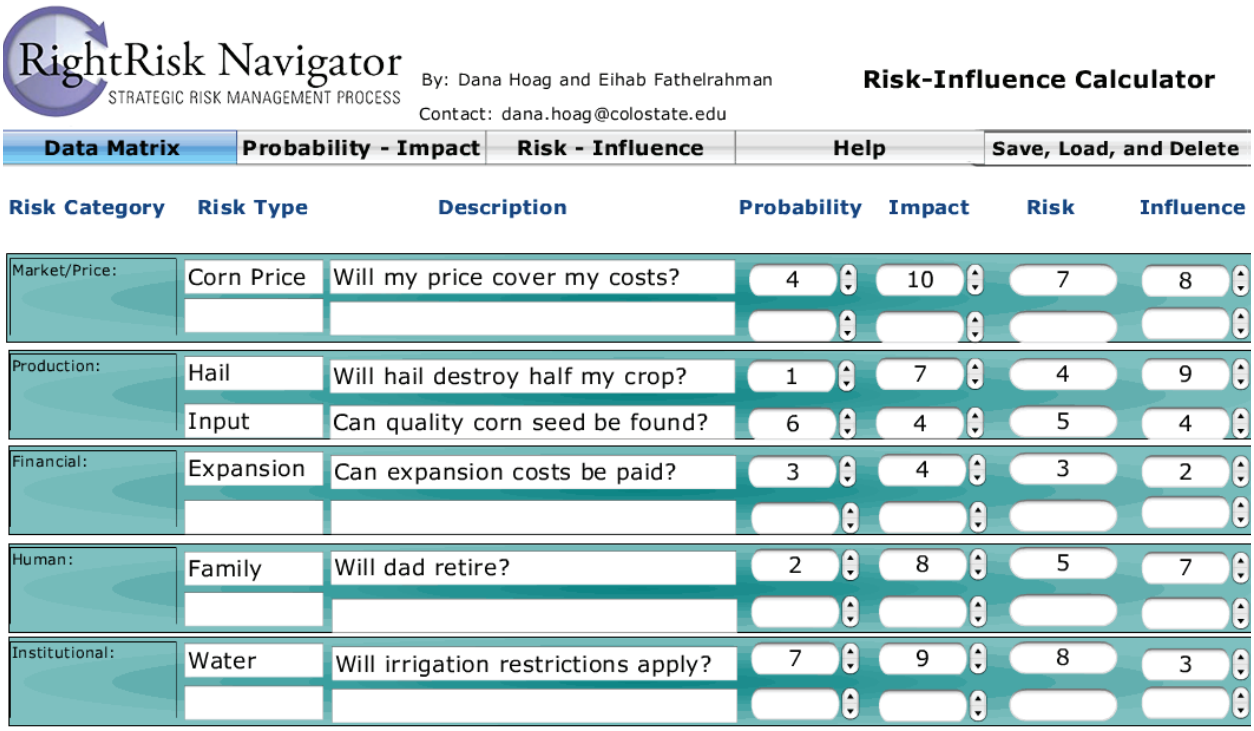
How Is Risk Included When Making A Decision?

Risk Influence Calculator

The *Risk Influence Calculator*, found in the RightRisk – *Risk Navigator* Toolbox, is designed to help prioritize threats to the business. The Risk Influence Calculator generates a risk influence chart that provides a visual map of priority for each of the possible risks to address.

The tool is based on a risk-influence matrix which ranks each risk by the impact it may have on the business, as well as how much influence management has over it. Obviously, some threats have a greater impact on a particular business than others. For example, a late-spring snow storm might be considered a bigger threat than machinery breakdown. This could be because the probability of the storm is greater than the probability of a breakdown, because the impact on profit is greater from a late snow storm, or both.

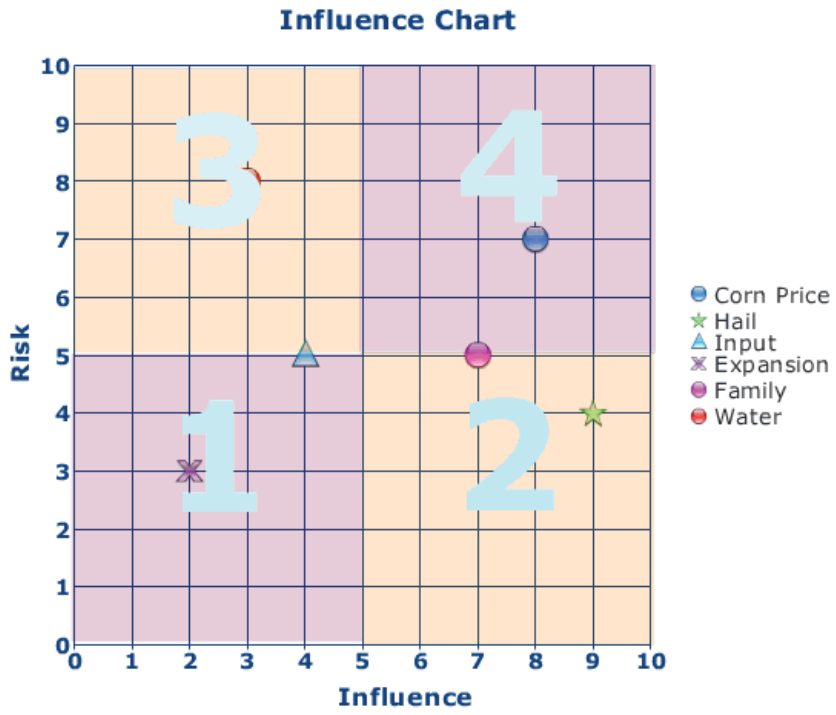
In addition, a manager has varying degrees of influence over different types of risk. The risk-influence matrix can help identify where risks are high and where the operator has the most influence to address the risk. In general, a manager would prioritize threats that fall in the upper-right, quadrant 4 (high-impact, high-probability) for management attention. Threats that fall in the upper-left, quadrant 3 (low-impact, high-probability) or lower-right, quadrant 2 (high-impact, low-probability) might be classified as a concern, and may need to be addressed as soon as resources become available. Finally, threats that fall in quadrant 1, lower-left of the matrix (low-impact, low-probability) would be of a low priority for management attention.



Using the Risk-Influence Calculator to rank threats to the business can help to generally inform the manager, as well as compare the impact and probability of various threats.

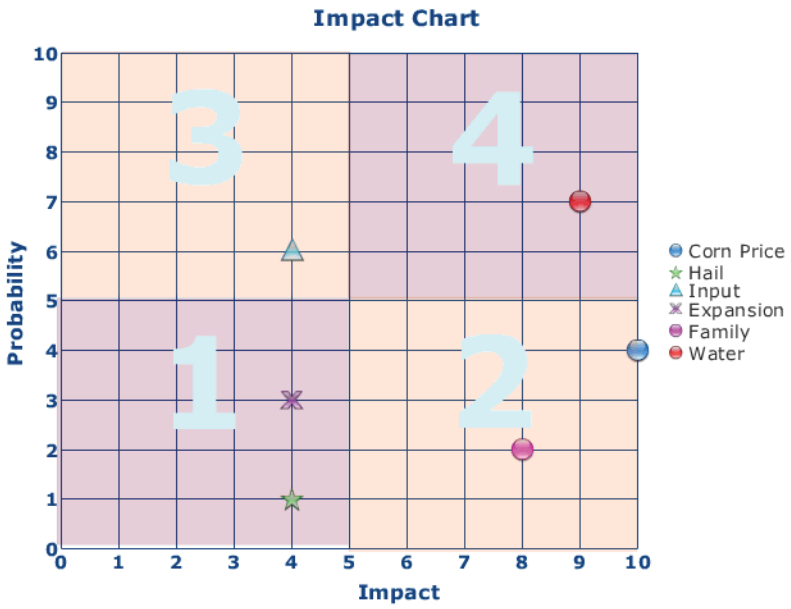
Application in day-to-day decision making

The Risk Influence Calculator can be helpful in prioritizing threats. Once a risk management strategy has been formulated, the Risk Influence Calculator can help evaluate how effective that strategy might be by comparing the initial matrix with the version suggested with the new risk management practices in place.



The risk influence chart provides a visual map of priority for each of the possible risks to address, both before and after the management strategies are applied.

While risk is generally understood to mean future events for which the outcomes are unknown or uncertain. Understanding the definition of risk and how a manager chooses among risk management strategies are important first steps to designing and implementing a risk management plan. There are many tools and strategies for an agricultural business manager to increase the likelihood of achieving business goals.



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