Chapter 8
Step 4 – Determine and Prioritize Your Risks

Step 4 of the Strategic Risk Management Process is the first task in the *Tactical* planning section. Earlier chapters focused on discovery and goal-setting to prepare for tactical planning, where you put your plans into action. Generally, goals are too broad to put directly into action. Therefore, the purpose of this step is to identify, quantify, organize and prioritize your risks so that you can find a manageable problem to address. Step 4 is very important since it's where you set the direction of your entire management plan.

The tools in this chapter will help you develop a comprehensive, but specific, list of the risks that you face. The tools will also help you prioritize which of these risks are the most important to manage later in the process. For example, as difficult as it might seem, sometimes you will need to ignore some risks because they don't have a big impact on you (or you simply can't have a significant influence on these risks). Other times, you just have to focus on what you have time to address. Most importantly, you will need to put most of your emphasis on those risks where you have the biggest combined impact; that is, areas that you can influence and that will cause significant problems for you if they are not managed. The tools in this chapter will help you to identify the risks you want to address so that you can develop a tactical action plan that specifies exactly how you will manage, ignore, retain, or insure against risk. Step 4 in this chapter will prepare you for the next three chapters in tactical planning: Step 5, Tools to Manage Risk, Step 6, Determining the Likelihood of Your Risks, and Step 7, Choosing Your Risk Management Plan.

As with previous chapters, this chapter is divided into three parts. In Part 1 we look at the EWS Farms case study. The Spragues have to prioritize which risks to manage and which to ignore. The SRMP will help them identify all the risks that may be important and then show the Spragues how to choose which ones to start managing first. The fundamental principles that scientists have developed to help identify and prioritize risks are presented in Part 2. For comparison, we define and discuss common sources of risk that are shared by most farmers and ranchers, like low prices or bad weather. Although most managers are very aware of the risks on their operations, it is probably insightful to review the kinds of risks that other farmers, ranchers and risk management experts have identified as common to agriculture. Finally, since not everyone likes the same approach, we describe five different methods that can be used to identify and prioritize risk. In Part 3, we develop a Risk Navigator Management Tool for our preferred method, called the Risk-Influence Calculator. This Risk Navigator tool can be used directly to help you organize and prioritize your own risks. You can find the Risk-Influence tool for this chapter on the website.

EWS farms is a perfect case study because it is a traditional farm and because Aaron Sprague needs to evaluate his risks as he contemplates how to include his family into the farm. As was the case in the strategic section, we apply each step to EWS farms in the first section of each chapter about each SRMP step to demonstrate that the Risk

Navigator tools and techniques can be used in real life settings,. This also will make it easier for agricultural managers to relate to the tools used and to apply them to their own businesses.

Part 1: The EWS Farms Case Study

Objectives

Like all farmers, the Spragues face a multitude of risks, including production, marketing, financial, institutional and human. However, managing risk is a complex process and the Spragues do not have the resources to address all their risks at one time. No one does.

The objective of Step 4 is*:*
to obtain a list of the Sprague family's risks and to prioritize the risks to address in a Tactical Plan.

[Header 8.1.2: Strategy]
The strategy utilized in this step is to interview the Spragues to determine their risk sources, then use one or more of the four Navigator tools to prioritize which risks to address. To ensure that we don't miss any risks, we'll begin with broad, big picture risks then narrow in on prioritizing the specific risks that are most important to manage. The goals that the Spragues developed in Step 3 can be used as a starting place to review broad risks. For other ideas, we have added a comprehensive discussion in part 2 about what other farmers, ranchers and risk professionals around the country have found to be important.

Next, we narrow the broad spectrum of risks to more specific, detailed risks. This way the Spragues can determine the risks that have the greatest affect on their operation, as well as the risks that they can influence. In the EWS Farms case study we narrow the Spragues' risk focus by using Risk-Influence Calculator Navigator tool. The Risk-Impact Calcultor helps the Spragues list and prioritize risks in the five risk categories: production, marketing, financial, human, and institutional. The Risk-Impact Calculator also helps the Spragues to manage the risks that will have the most impact of their operation, rather than to spend valuable time on controlling risks that might seem to be more convenient. A discussion about the other types of tools that could have been used can be found in Part 2 of this chapter.

Implementation

We will implement Step 4 for the Spragues in three steps:

- Review the Spragues' risk goals created in Step 3 and risks from studies
- Develop a list of the most important risks using the Risk-Influence Calculator tool
- Select risks to be prioritized in the tactical management plan.

Review Risk Goals

In Chapter 7, the Sprague family identified four risk goals for their operation:

- Financial - Ensure short and long term financial success by maintaining business profitability while expanding the overall business financial resource base.

- Family - Continue to live, work, and grow our families in a rural, agricultural environment. Encourage individual development and exploration in a manner that is consistent and flexible in order to allow all individuals to reach their full potential.

- Operational Structure - Continue to pursue organizational structures that fit the family dynamics of the operation as well as allow for strategic goal attainment. Also, increase the business activities efficiency of the operation.

- Integrated farm management - Manage our farm as a co-integrated unit while providing a step by step process for developing a strategic risk management plan.

It is very apparent that the Spragues' goals center on family growth. This is on the family's mind because Aaron's father is trying to make a living, while also making a place in the operation for two of his children's families. In addition, two more children are away in college and may want to return someday too.

Based strictly on the goals generated in Step 3, we would not conclude that production risks or price risks are a concern. Yet, after reading in the next section about the types of risks that other farmers and researchers had studied, Aaron has added several more basic, production-oriented risks to consider, like price risk and yield risk. This demonstrates the importance of using multiple risk identification approaches because different methods can influence the outcome. That is, if you look at something from more than one angle, you might see different needs. In this case, reviewing risks identified in studies influenced Aaron to add more basic risks to his list for consideration.

Develop a list of the most important risks

It is difficult for most people to just pull a list of risks off the top of their head, no matter how familiar they are with their own operation. Doing so chances missing important risks. To help people avoid overlooking specific risks, we have developed an extensive list and discussion about risks based on what producers have identified in various surveys and studies and present this information in Part 2. After reviewing his goals and reading about what others said about risks, Aaron identified the following risks:

Market/Price:

Corn Price ~ Will my price cover my costs?

Production:

Weather ~ Will rainfall support crop stand?
Hail ~ Will hail destroy half my crop?
Input (seed) ~ Will good corn seed be available at a reasonable price?

Financial:

Expansion ~ Can the family cover new land payments?

Human:

Family ~ Will my dad retire?

Institutional:

Water ~ Will irrigation water be restricted?

As discussed in the next section, Aaron entered these risks in the Probability-Impact Calculator and Risk-Influence Calculator tools in Navigator Risk-Influence Calculator tool, presented in Part 3.

Select risks to be prioritized in the tactical management plan]

The Spragues have little influence over some of these risks, like hail. However, the family has some influence over other risks, such as ensuring adequate water supply by updating their irrigation system. These risks can be plotted into a risk-influence chart as shown in Figure 8.1.1. This chart is developed by asking Aaron to assign a number from 1 (not likely) to 10 (likely) to each risk and a number from 1 (no influence) to 10 (extreme control) about how effectively each risk could be influenced or managed by the Spragues. For example, water shortage is a very high risk for dryland crops in Northeastern Colorado. It has a high probability and a big impact on crops. So, the Spragues assigned it a 10 to this risk. However, the Spragues have a high level of influence over water since they have installed irrigation systems on much of their cropland. Therefore, Aaron assigns an 8 to their level of influence. Aaron used the Risk-Influence Calculator to create Figure 8.1.1.

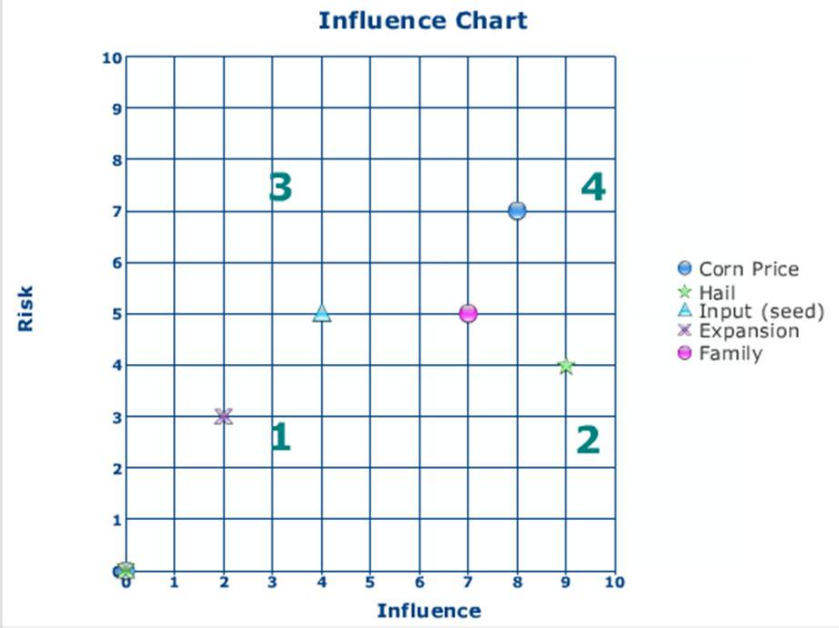


Figure 8.1.1: The Sprague Risk - Influence Calculator

The Probability-Impact Calculator can help determine the level of risk that is then entered into the Risk-Influence Calculator. "Risk" is a combination of probability and impact. A low risk would be unlikely and of little significance. A medium level of risk might be likely to happen, but of little consequence or unlikely and of significance. A high risk would be likely and have a significant impact on my farm. An example of the Probability-Impact Calculator is shown in Part 3.

After looking at a Risk-Influence chart, Aaron decides to focus on a strategy to manage corn price risk because it is the only risk with a clearly high risk and that he has a lot of influence over. The family also feels that they have good control over most of their other high-risk options and wants to take advantage of Aaron's investment in his new Master's degree in Agricultural Economics from Colorado State University. You can see the actual Risk-Influence Calculator that Aaron considered in Part 3. Try downloading the tools from the website and change some of Aaron's assumptions to see how it affects the importance of managing each of the risks.

Part 2: The Fundamentals of Risk Identification

Most farmers and ranchers are well aware of the risks that they face. Nevertheless, it is always helpful to compare your experiences with others. Over time economists and risk experts have identified the following five common sources of risk found in agriculture (Hardaker, Brain, Hurine, & Anderson, 1997; Baquet, Hambelton, & Jose, 1997; Harwood, et al., 1999, and RMA, 1997):

1) Production Risk
2) Market or Price Risk
3) Financial Risk
4) Institutional Risk
5) Human Resource Risk.

These risks are defined, described and discussed in Table 8.2.1. The table defines each type of risk and summarizes sources and management controls. Each risk is described in greater detail below and in Chapters 13-16. We now proceed with a more detailed discussion about these sources of risk.

Surveys about Risk Sources

A good place to start the risk identification process is to look at what other producers and operators across the country have reported. Table 8,2.2 highlights one U.S. Department of Agriculture study that looks at six types of risk on fifteen different types of farms. On a four point scale, with 4 being very concerned and 1 not being concerned, the average producer rated changes in government laws and regulations as their top concern and changes in technology as their lowest concern. Producers also rated price uncertainty and crop yields as somewhat concerned. An interesting observation was that producer concerns varied by crop type. For example, cotton producers rated government programs

Table 8.2.1 here: Risk Management Sources and Management Controls

Risk	Defined	Sources	Management Controls
Production	Uncontrollable events such as weather, pests or disease make yields unpredictable. Changing technology makes a manager or capital obsolescent. Inputs are unavailable or low quality.	Weather, extreme temperatures, pests, disease, technology, genetics, inputs (availability, quality, price), equipment failure, labor, …	Diversification, insurance (crop, revenue), buildings, storage, vaccines, extra labor, production contracts (e.g. ensure input supply and quality), new technologies (e.g. automate watering)
Marketing and Price	Prices of inputs or outputs change after a producer commits to a plan of action. Price fluctuations stem from domestic and international supplies or substantial changes in demand.	Product quality (genetics, disease, handling, input/feed) Product price (quality, timing, global market, weather, government policy, contracts…)	Futures and options, forward contracting, retained ownership, quality controls, storage (timing), cooperatives, niche/value-added marketing…
Financial	Stems from the way a business is financed. Borrowed funds leverage business equity but increase business risks.	Market, production, legal and human risk, interest rate changes, natural disasters (drought), land market changes, foreign exchange, loan calls, …	Cash reserves, equity, borrowing capacity, reducing other types of risk (production, marketing, etc.), insurance
Institutional	Government or other institutional rules, regulations and policies effect profitability through costs or returns.	Taxes, contract disputes, regulations, government policies, law suits, ambiguous and/or unwritten agreements, neighbors, environmental programs …	Estate planning, tax planning, contracts, bonds (e.g. environmental liability), research and education about local laws …
Human Resources	The character, health or behavior of people introduces risk. This could include theft, illness, death in the family, loss of an employee, or a divorce for example.	Ambiguous and/or unwritten agreements, poor planning, miscommunication, health or other family disasters …	Family planning, including labor planning, clear contracts, training and goal setting, communication, estate planning …

much higher than did tobacco or vegetable farmers. Price risk seemed to be lower for nurseries and vegetables than for most other producers.

We also compared and contrasted results of three risk surveys in Table 8.2.3. Musser and Patrick (2002) surveyed top producers in workshops at Purdue University in Indiana. The producers agreed with producers in the national study that price risk and yield uncertainty were top concerns. However, in contrast, these producers identified laws and

regulations as their last concern. The reason for the difference may lie in the fact that risk arises where we have the least control. Perhaps top producers in the Musser and Patrick study better addressed legal and institutional problems than the USDA producers.

In a study of Nebraska and Texas cattle producers, Hall et al, (2003) found drought to be the most important risk. This is not surprising as this region was in the midst of a devastating drought at the time. This phenomenon serves as a warning that current events can dominate our thinking. Risk management should encompass all risks, not just those that have recently occurred. Similar to other studies, price uncertainty was also a top concern. The producers also cited input costs as a serious concern, although these producers did not think labor, disease, cold weather or government were significant threats.

Production Risk

It might be helpful to discuss the different types of risk one at a time. We will start with production risks, and base our discussion from comments made by Iowa corn growers (Mickelsen and Trede, 2001).

(Numbers at the end of each bullet indicate rating, 0 = no concern, 4 = large concern)

Crop Production Risk

- Weather, wind, hail, etc.- 4.22
- Disease, insects, weeds - 4.00
- Use of new crop varieties - 3.64
- Adoption of new technology - 3.52
- Consolidation of input suppliers -3.42

Livestock Production Risk

- Adequate market outlets for livestock - 3.68
- Disease - 3.51
- Initial investment cost of facilities - 3.29
- Regulations on production practices - 3.16
- Adoption of new technology/methods - 2.97
- Obsolescence of facilities - 2.65

Note that the participants in this study identified weather-related yield risk as the most threatening, followed closely by disease, insects and weeds. Livestock producers fear the lack of adequate markets most, followed closely by disease. Both crop and livestock producers also report risks related to investments in technology or facilities as a significant factor. Risk can also stem from the input side. Crop producers sited the consolidation of input suppliers as a threat.

Market/Price Risk

Market risk is related to the price that producers receive for their crop. Price can be affected by the quality of a product, which is often within a producer's control. However, most price risk occurs off the farm and there is very little a producer can do about it. For example, corn price can be improved with proper management of moisture content. But the price is also influenced by domestic and international markets, government programs,

Table 8.2.2: A national survey of farmer's degree of concern about factors affecting the continued operation of their farms] Source: ERS, 1999, p. 5

How concerned are you about each factor's effect on the continued operation of your farm?	Other cash grains	Wheat	Corn	Soybeans	Tobacco	Cotton	Other field crops	Fruit/nuts	Vegetables	Nursery/greenhouse	Beef	Hogs	Poultry	Dairy	Other Lifestock	All farms
	Mean scores[1]															
Decrease in crop yields or livestock production	3.35	3.51	3.20	2.98	3.16	3.68	2.53	3.05	2.85	2.78	3.09	3.53	3.20	3.40	2.41	2.95
Uncertainty in commodity prices	3.41	3.83	3.40	2.93	3.15	3.75	2.48	2.88	2.82	2.63	2.96	3.31	3.09	3.54	2.47	2.91
Ability to adopt new technology	2.52	2.38	2.39	2.33	2.21	2.77	1.92	2.34	2.09	2.24	2.25	2.63	2.60	2.45	2.12	2.23
Lawsuits	2.43	2.47	2.03	2.46	1.89	2.78	2.07	2.39	2.66	2.06	2.36	2.70	2.32	2.36	2.00	2.26
Changes in consumer preferences for agricultural products	2.65	2.55	2.39	2.40	2.40	2.86	2.13	2.44	2.59	2.69	2.58	3.01	2.79	2.76	2.30	2.47
Changes in Government laws and regulations	3.31	3.36	3.15	2.79	2.77	3.54	2.88	2.97	2.75	3.09	3.03	3.23	3.34	3.31	2.88	3.02

[1] 1 = Not concerned, 2 = Slightly concerned, 3 = Somewhat concerned, 4 = Very concerned

Table 8.2.3: Sources of Risk Identified in Producer Surveys

Sources of Risk[a]			
	Purdue University Top Farmer Crop Workshop 1999 (Musser and Patrick, 2002)	National Study- Economic Research Service (Harwood et al., 1999) Table 1, page 5)	Beef producers in Texas and Nebraska (Hall et al., 2003)
Price Uncertainty	1	3	2
Yield Uncertainty	2	2	
Business Contracts	3		
Cost of Capital Goods	4		
Government Commodity Programs	5		ns[b]
Technology	6	6	
Inputs/Costs	7		3
Injury, illness or death	8		
Laws/ Regulations	9	1	ns
Legal (lawsuits)		5	
Consumer preferences		4	
Severe Drought			1
Cold weather			ns
Livestock Disease			ns
Labour availability			ns
Credit/cash reserves			

a- Sources names are adapted to integrate across studies.
b- ns means rated, but neutral or less importance in the study

and global events. In the Mickelsen and Trede survey, producers ranked narrow operating margins, largely due to price, as one of their top concerns. They also cited accessibility to markets and volatility of prices as great concerns. In today's world, global markets are also on people's minds.

- Narrow operating margins 4.33
- Accessibility to markets to sell products 4.17
- Volatility in commodity prices 4.14
- Global economic conditions 3.99
- Fluctuating costs of inputs 3.94
- Trade agreements (NAFTA, etc.) 3.73

Financial Risk

In this study, supply of capital (money to borrow) was the number one financial concern. However, almost as important were the ability to recover from depressed times and to find lenders with sympathetic to agriculture.

- Adequate supply of capital 4.05
- Recovery time from depressed ag. economy 4.04
- Lenders knowledge of agriculture 4.01
- Business cycles in agriculture 3.69
- Volatility in interest rates 3.64

Institutional and Human Risk

Institutional and Human risks are a little bit outside the sphere of what producers generally think about when they think of risk. Institutional risk focuses on the impact institutions, like government and the legal system, can have on producers. For example, the creation or elimination of government price and income support programs (or a special farm tax) can have a huge impact on producers. Since capital equipment has a high price tag, a change in the interest rate can have an enormous impact on cash flow. In recent years, environmental controls have also impacted many producers. As shown below, Iowa farmers were most concerned with changes in policies or regulations, including farm programs. Fears of increasing pressure from international groups also followed closely behind.

- Changes in government policy/regulations 4.05
- Changes in government farm programs 4.04
- Foreign restrictions on products (GMO, etc.) 3.96
- Export trade barriers (tariffs, etc.) 3.91
- State/federal environmental regulations 3.87

Human risks stem from human behavior. For example, a divorce or death in the family can devastate a farm. The behavior of family members and employees is important, and the more critical the role of the operator, the greater the human risk in that operation. Operators told surveyors that they were most concerned about the death of the operator. Injury was also a concern.

- Death of owner/operator 4.18
- Injury to owner/operator 4.08
- Lawsuits 3.69
- Injury to hired help 3.53
- Divorce of owner/operator 3.53

Internet Resources

There is also a wealth of information readily available on the internet to help you determine which risks are most important. Some examples are shown in the adjoining box; more can be found at the RightRisk.org website. From the RightRisk website, you

can link directly into the Western Risk Management Library or the National Ag Risk Education Library. Each has thousands of papers, ranging from practical to academic.

Box 1: Internet Risk Sites

Finding Information on the Internet

- Risk Management Education (US Department of Agriculture) http://www.usda.gov/rma/rme
- Weather (National Oceanic and Atmospheric Administration) http://www.noaa.gov
- Markets (Agricultural Marketing Service) http://www.ams.usda.gov/marketnews.htm (Chicago Board Of Trade Market Plex) http://www.cbot.com/mplex/
- Statistical Information (National Agricultural Statistics Service) http://www.usda.gov/nass (USDA Economics And Statistics System) http://usda.manlib.cornell.edu/usda/usda/html
- Economic Information http://www.ers.usda.gov (Economic Research Service)

Many websites provide graphs, tables and charts and some even let you download data in Excel. For example, the severity of price and yield risks for crops in the United States is presented in figures 8.2.1 and 8.2.2. The first figure shows how volatile corn prices are around the country. Price volatility is a measure of how much price varies over time. The higher the number is, the more volatile the price (see chapter 13 on market risk for more information about price volatility). Dry edible beans had the highest volatility measured, and beef had the lowest. Figure 8.2.2 shows how variable yields are around the United States by charting the coefficient of variation (see chapter 10 for a description). The coefficient of variation shows how much yield varies around its mean. It is interesting that much of the country has corn yields that vary less than 20 percent plus or minus from the average yield. These are just two examples of the information you can find about risk on the internet. Unfortunately, there is no easy, one-stop internet site to provide you information. It takes some hard work and ingenuity to find what the information you need.

As we leave this section, it is important to emphasize that we cannot possibly list all of the risk resources on the World Wide Web. Spending a little time surfing could payoff big.

Prioritization Techniques

Most risks faced by farmers, ranchers and agribusinesses are very complicated. Despite often extensive efforts to identify and to quantify key relationships, it is frequently difficult to integrate all of the potential risks that enter into a risk management decision. As with other chapters about each step, this segment presents you with an array of tools to assist you to identify and prioritize your risk. We recommend that you use the Risk-Influence Calcultor. However, reading over the examples of the other methods is also recommended as it will help cement the concepts for listing and prioritizing decisions. In addition, any of these other methods can be used if you prefer

Figure 8.2.1: Price volatility of selected commodities, 1987-96
Source: ERS, 1999

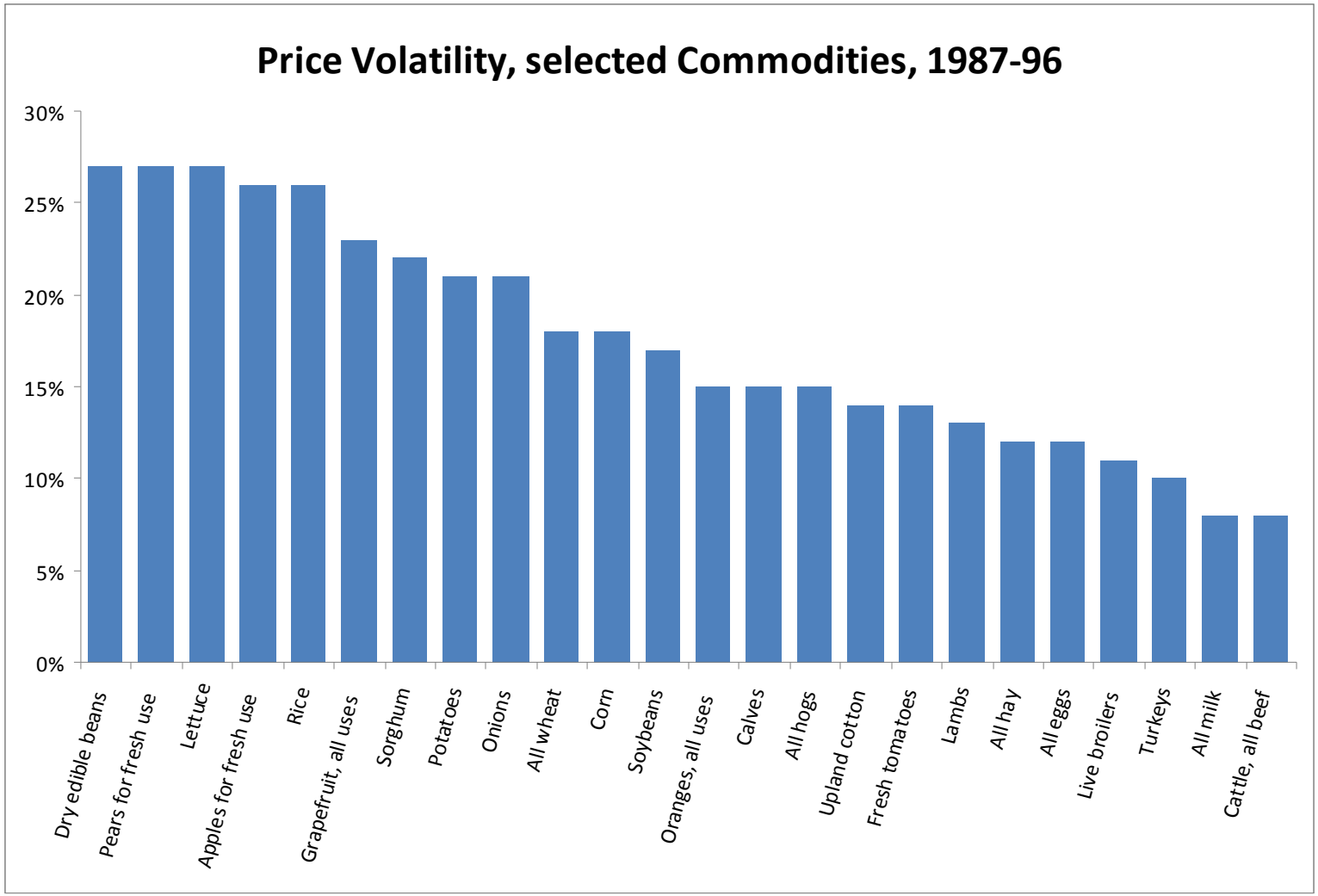
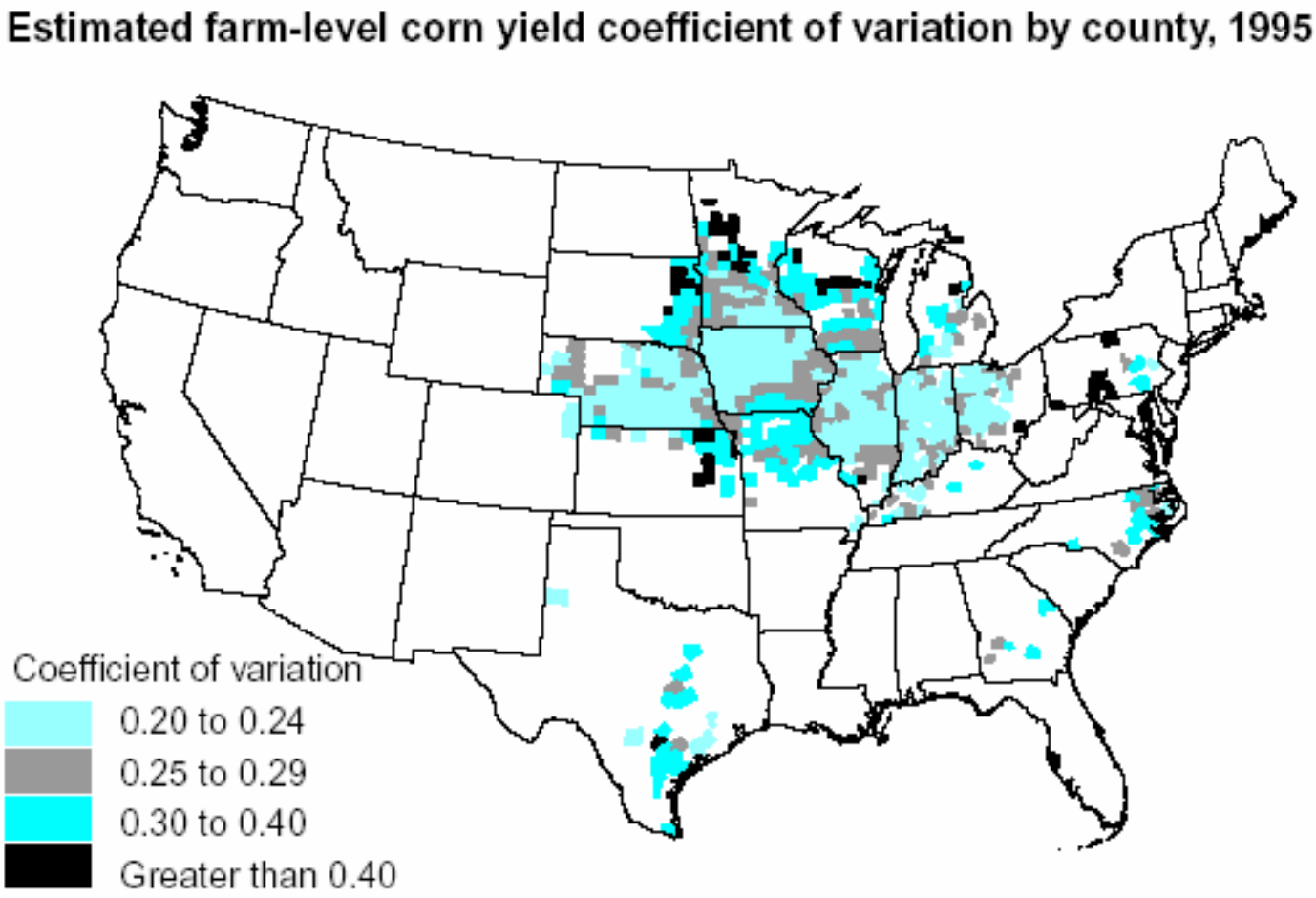


Figure 8.2.2: Farm coefficient of variation by county for corn
Source: ERS, 1999



Notes: Shaded areas include counties with at least 500 acres planted to corn. Lower corn yield variability indicates that farm yields fall within a narrower range. Based on farm-level data, 1985-94, and long-term county-level trend.

Risk management involves significant judgment on the part of the decision-maker to evaluate the risks of different events and the probability that their actions will alter those risks (Greenspan, 2003). This process can be made easier through the use of "decision analysis tools"—tools that help you quickly organize information into a format that helps you make better decisions. These tools are often available in electronic format. We examine five different decision analysis tools that can help you identify risks:

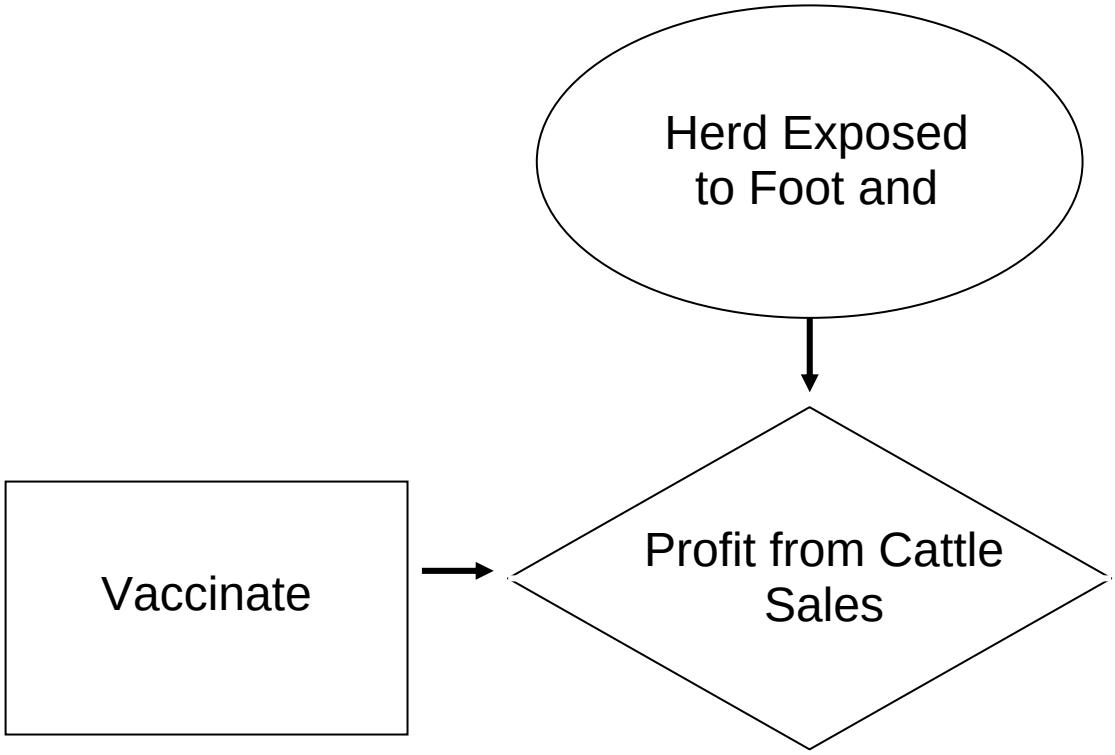
1. Influence Diagram (ID)
2. Contributing Factor Diagram (CFD)
3. Risk Influence Diagram
4. Decision Trees
5. SWOT Analysis

Influence Diagrams

An Influence Diagram (ID) is a graphical diagram with enough structure to organize complex and confusing relationships. ID's are discussed here because they are probably the most intuitive method available. For our purposes, a pencil and a lot of scratch paper is all that is needed to develop a useful ID for scoping out your problem in broad terms. The concept is highly recommended as a starting point. However, it is very difficult to develop a detailed ID for a comprehensive problem, so we recommend other techniques to advance through step 4. If you wish to develop a formal ID, there are software programs that can help.

An ID formally uses shapes, like circles, rectangles and triangles, to represent decisions, outcomes, probabilities and other factors. Formally, rectangles represent decisions, ovals represent chance events, and diamonds represent payoffs (Clemen and Reiley, 2001), as shown in Figure 8.3.1. Arrows show how these occurrences are connected. We can demonstrate how to use an ID to evaluate the risks associated with the decision of whether to vaccinate cattle against Foot and Mouth Disease. Cattle will be worth next to nothing if exposed to the disease. As shown in Figure 8.3.1, a firm's losses (profits) will depend on the chance that the herd is exposed to Foot and Mouth Disease and whether a decision was made to vaccinate the cattle against the disease. Profit will be highest if the producer does not vaccinate and the herd is not exposed to the disease. Of course, this strategy also subjects the producer to the most risk because he stands to lose a substantial amount of money if the herd is exposed to and contracts the illness. In other words, profits will be lower if he vaccinates, but the likelihood of disease will be lower, as well.

Figure 8.3.1: Influence Diagram of Foot and Mouth Vaccination Decision



Influence diagrams can be made very complex, if you draw every single box, triangle and oval and connecting arrow. Try this simple exercise for a farm, ranch or other business that you own or are familiar with. Put the objective "profit" in a diamond in the middle of a piece of paper. Start adding circles and rectangles to represent decisions and chance events that could have an effect on EWS Farm's profit. For example, add crop yield and cost of production in circles. Add sell crop as a decision in a rectangle. Be sure to draw every arrow connecting any two figures that are related. Remember, costs effect yield and yield effects costs; so there needs to be a two-headed arrow between them. And each of them needs an arrow to profit. Then, for the second layer, add circles and rectangles that you think could have an effect on the first circles and rectangles you drew. Continuing our example, yield is affected by insects, water, nutrients, and weather. Insects, in turn, are affected by weather and the decision (a rectangle) to control them. Costs of production are affected by how you control pests and random events like the price of fuel. Finish drawing all of the arrows between all shapes that represent related components.

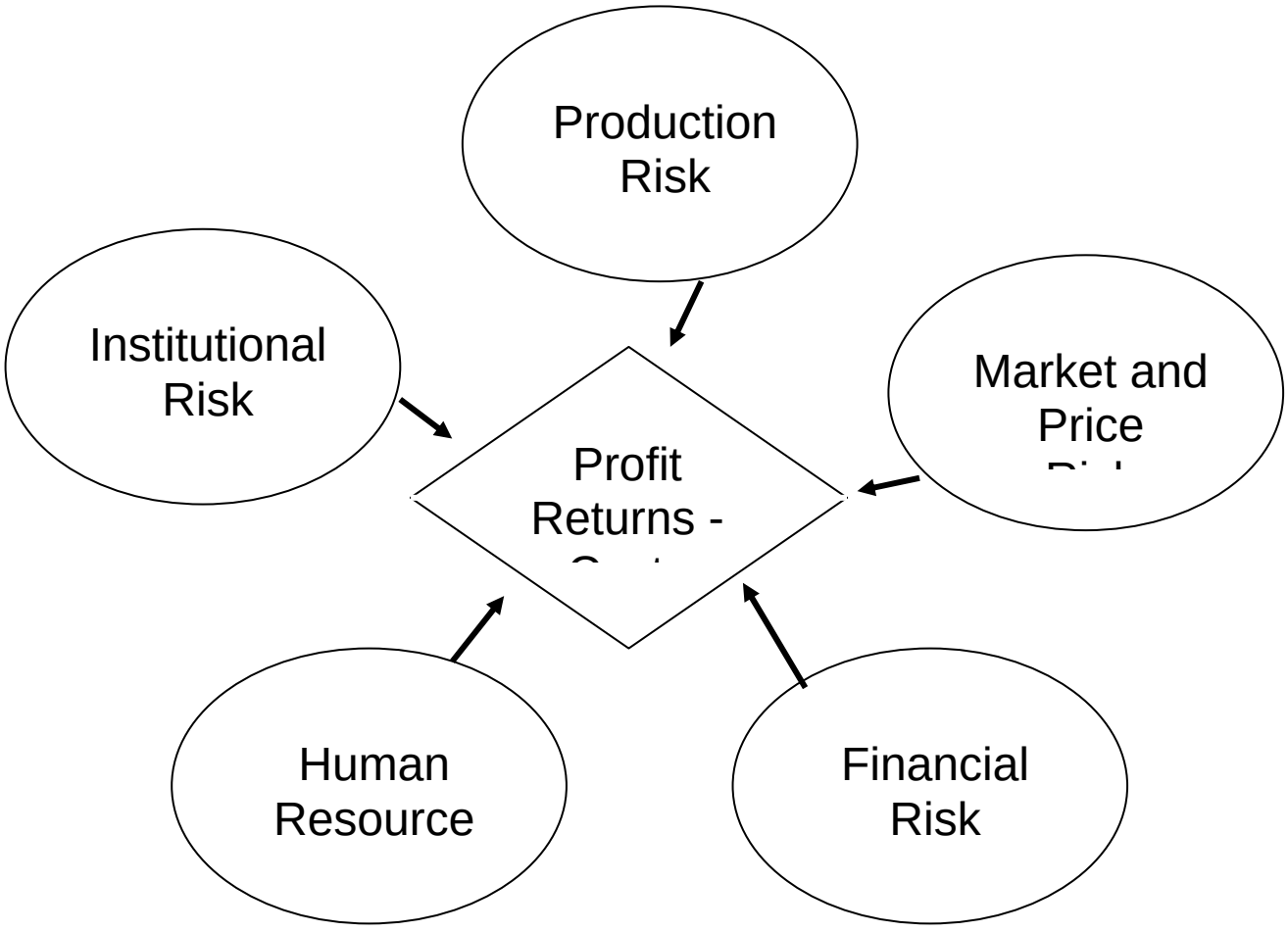
Does it seem like you could go on forever? A colleague coined these "spaghetti" diagrams since a complex ID can look like a plate of noodles with round, square and triangular meatballs when there are a lot of arrows. A good bit of judgment and practice may be required to find that balance between too little information to be realistic and too much to be practical. However, highly visual learners often prefer this type of decision analysis tool, and it is a popular method. Software programs are available for those of

you that would like to use the ID method, like STELLA (iseeSystems.com), which builds models based on influence diagrams for systems thinking. Many public domain programs can be found on the web, free for the looking.

Contributing Factor Diagram of Foot and Mouth Vaccination Decision

To counterbalance the complex Influence Diagram, we turn to a special and simpler kind of influence diagram called a contributing factor diagram (CFD). The CFD focuses only on relationships between variables that contribute to a factor of interest, like profit. Figure 8.3.2 is an example of a contributing factor diagram. Compared to the ID in Figure 8.3.1, the CFD does not include all of the peripheral information like how a disease is contracted, whether an exposed animal contracts the disease, the impact of temperature on infection rates, or the many factors that might have an impact on the efficacy of the vaccine.

Figure 8.3.2: Contributing Factor Diagram of Market Price Risks



CFD's are not flow charts, because events are not listed in sequence. Notice that CFDs are free flowing, with arrows that indicate where one item affects another. Generally, a person works backward in a CFD, starting from the problem, and then working back to

the things that contribute to the problem. In this case, we will assume that most businesses start with the fundamental definition of profit below:

Profit = Returns – Costs

Working backward as shown in Figure 8.3.2, we focus only on how profit is affected by our five types of risk. We can then get more specific about where each risk comes from and then prioritize how to affect that risk. That is, a decision maker could choose price risk for example, and move on to define it. Let's continue this example, since that's exactly what Aaron chose when he prioritized price risk for corn production. The CFD is expanded to illustrate the price risk decision on our case farm as illustrated in Figure 8.3.3. The net price a farmer receives is a function of how weather affects national supply, how the government sets price support program loan deficiency payments and three decisions:

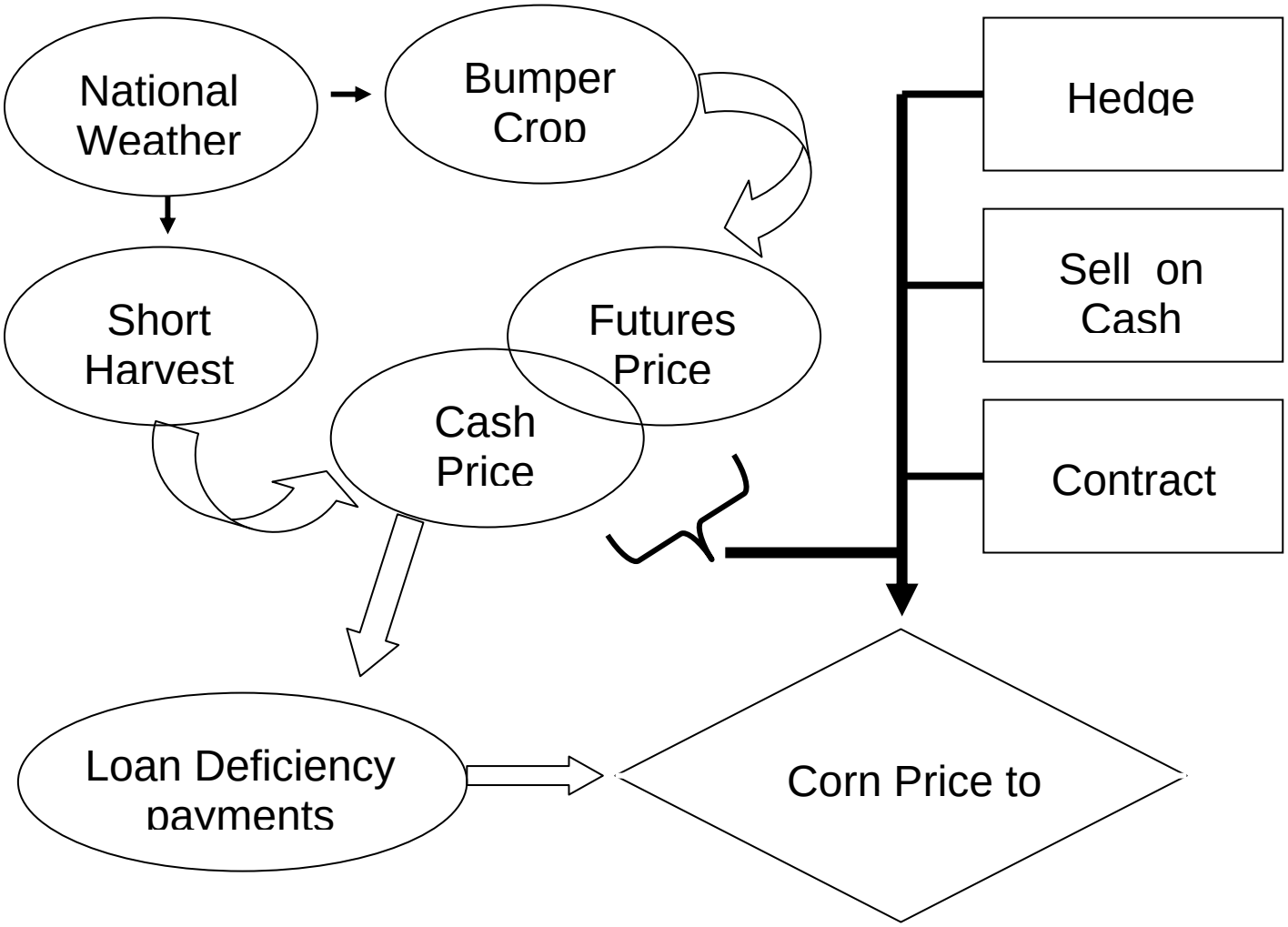
- Whether or not to sell on the cash market
- Whether or not to forward contract
- Whether or not to hedge on the futures market.

The decisions shown in figure 8.3.3 are typical for producers facing price risk, including Sprague farms. The Spragues would like to receive the highest price possible for their corn crop. They can sell on the cash market at harvest, or store the crop hoping for a better price later. They also could forward contract with the local elevator. Their other option is to hedge on the futures market. (Note that storage is not represented in our simple illustration above). The Spragues develop a marketing plan, described in chapter 13, that allows them to choose any of these options, including a combination such as selling one-third of the crop in each option.

[Heading 8.3.3: The Risk-Influence Calculator]
Up to this point we have discussed some rather elaborate methods for identifying risk. One of the most straight-forward methods is called a Risk-Influence Matrix (e.g. Clark and Timms, 1999). The concept of a risk-influence matrix is to rank each risk by how much impact it has on you and how much influence you have on it, as demonstrated in Figure 8.3.4.

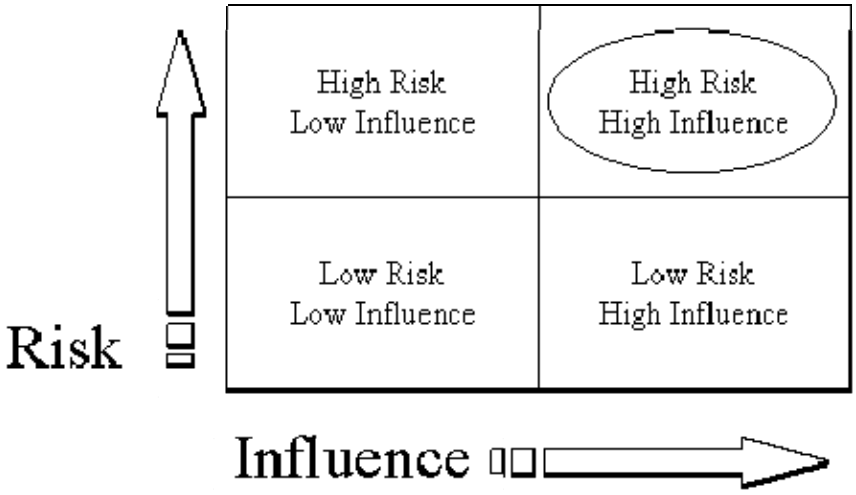
As can be seen in this simple illustration, some risks have a bigger impact on producers than others. For example, a hail storm might be considered a bigger risk than an equipment breakdown. This could be because the probability of the storm is greater than an equipment breakdown, because the impact on profit is greater for a hail storm, or a combination of both. A manager or producer also has a varying degree of influence over different types of risk. There is little that can be done to reduce hail damage, but most

Figure 8.3.3: Contributing Factor Diagram on EWS Farm Decision



producers are skilled at keeping equipment going. The purpose of the matrix is to identify where risks are high and where the operator has the most influence to address the risk. This area is indicated by the circle in figure 8.3.4. Generally, you would prioritize managing the risks in the upper right-hand corner and setting aside those in the lower left-hand corner.

Figure 8.3.4: The Risk - Influence Matrix



You can build your own customized matrix with the Risk-Influence management tool in Part 3. The tool allows you to compare impact and probability, which determines risk, and then to compare risk against influence. A detailed example can be found in Part 3.

Decision Trees

Decision trees are an important tool that can provide a clear graphical representation of decision problems involving risk. The main value of decision trees lies in their construction (Rae, 1994), which requires the decision maker to identify all relevant courses of action, events, and payoffs while being clear of the order of time in which they occur. As we saw earlier with influence diagrams, decision trees use a standard set of symbols to represent various elements of the decision problem. Branches or forks in the tree represent alternative actions or events. A rectangle is used to represent a decision node, circles are used to represent a chance event node, and triangles represent payoffs. In general, action forks and event forks appear in the tree from left to right in the order they occur over time. How is this better than the first two methods?

Consider the decision problem represented in the earlier example where the Spragues are deciding whether to market their corn crop on the cash market or via a forward contract. We are going to expand this model to include the choices and events for Sprague Farms. In doing so, we will build the decision tree in Figure 8.3.5 representing three possible marketing alternatives for 137,000 bushels of corn produced on Sprague Farms. For simplicity, we'll only consider the following three marketing alternatives: 1) market the

entire 137,000 bushels on the cash market at harvest; 2) forward contract 70,000 bushels at $2.36 per bushel and market the remaining 67,000 bushels on the cash market at harvest; 3) hedge 70,000 bushel at $2.70 (a -$0.34 basis) now and market the crop on the cash market at harvest. In reality, there are an infinite number of combination marketing strategies that could be used utilizing the cash market, forward pricing, and/or hedging. The decision tree forces the decision maker to define specific choices thus clarifying the analysis. Also, notice that the figure depicts these choices as mutually exclusive alternatives meaning that only one can be chosen. This is not always the case and the decision tree is an important tool that can be utilized to distinguish whether or not this is true.

In terms of the market risk, or chance event, Figure 8.3.6 shows there are two possible outcomes. There is a 65% probability of a short US crop resulting in a harvest cash price of $2.50 and a local basis of -$0.25. There is a 35% probability of a normal US crop resulting in a harvest cash price of $2.10 and a local basis of -$0.45. The six payoffs for each decision alternative/event outcome combination are shown in terms of total marketing revenue. Notice that none of the decision alternatives dominants another alternative. That is, when comparing the payoffs, no alternative is better than any other alternative 100% of the time.

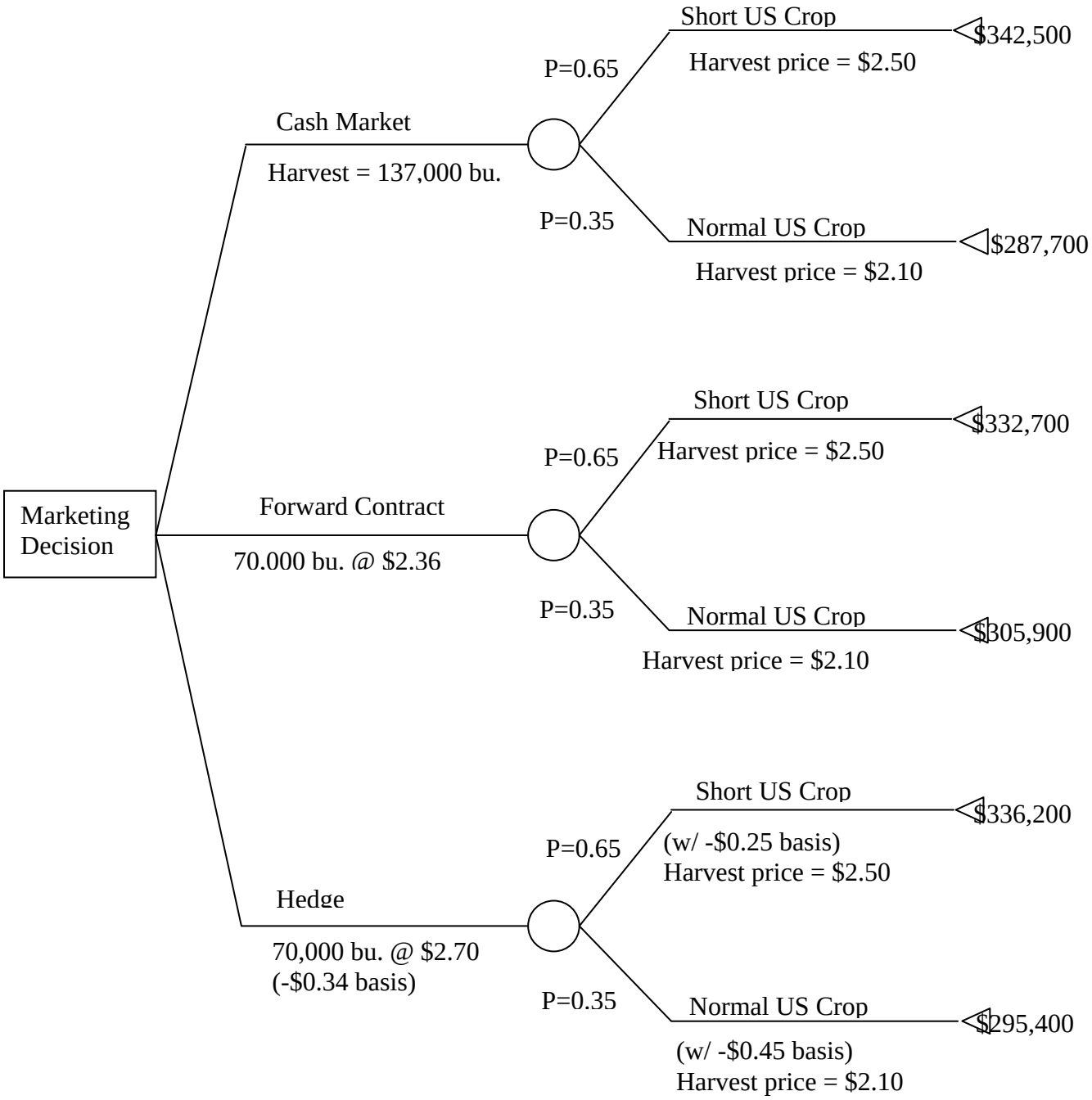
The decision problem in Figure 8.3.5 also can be summarized in a **payoff matrix**. The advantage to a payoff matrix is that it is more compact, less graphically intense, and it naturally fits into a spreadsheet tabular form where summary statistical calculations can be presented with little additional work. The probabilities and the payoffs for each decision alternative can also be graphed as a probability density function creating a **risk profile** for each alternative. Risk profiles and payoff matrices are discussed in more detail in the next two chapters.

SWOT Analysis

The last tool that we will look at is a SWOT analysis. SWOT stands for Strengths, Weaknesses, Opportunities and Strengths. It involves the strengths and weaknesses internal to your business. For example, strengths on your farm or ranch could include good weather, well working equipment or facilities, solid training, or a strong genetic line in a livestock herd. Weaknesses could include the opposite of any of the strengths, such as being in an area prone to hail damage. Strengths and weaknesses are internal to the business. Opportunities and threats, however, can come from inside the business or from external sources. An on-farm threat would be a recurrence of disease or weeds. An off farm threat might include policy changes, rezoning, or your landlord terminating your lease.

The purpose of the SWOT analysis is a little different from the previous tools. SWOT helps you think about what your risks are by looking to where your SWOTs are, rather than by looking at where your risks are. For example, suppose you were considering what career you would most like for yourself. You might fancy NBA basketball player,

Figure 8.3.5: A Simple Decision Tree of the EWS Marketing Decision



followed closely by Polo star. However, after considering your SWOTs, you might scrap being in the NBA, since you are only 5 feet 10 inches tall and can't even touch the hoop when you jump, and give up on your polo dreams too since you drive a 1998 Dodge Neon and have trouble finding gas money. Your strength is your education in computer science, and you have an opportunity to get a job at Dell.

Figure 8.3.6: SWOT Analysis on EWS Farms

On Farm	Off Farm (External)
Strengths Grew up farming in the area, father available for consultation and other help, family nearby, masters degree in Agricultural Economics	
Weaknesses New Farmer, limited access to capital, rented land	
Opportunities On-farm storage, family help	**Opportunities** Crop insurance, rented land and water, government price support programs
Threats Estate claims by siblings	**Threats** Possibility of losing irrigation rights, hail

Consider Figure 8.3.6. At 25, Aaron Sprague is a young farmer, and he has a wife and two kids to support. This poses a serious weakness, given how much capital and experience it takes to farm. Nevertheless, Aaron has a supportive family and is farming near where he grew up. He can take advantage of his family's extensive experience and capital reserves, including land, equipment, and even finances. On the farm, Aaron has some opportunities to use his families help and crop storage facilities. But sooner or later the family will have to decide how to split the home farm and assets. Aaron's sister and her husband also farm, while another his brother and sister have not yet decided what they wish to do. Off the farm, Aaron has an opportunity to rent land and water, to insure his crops and to use government programs. He is constantly threatened by hail and his source of groundwater is subject to a regional lawsuit with neighbouring states.

Part 3: RightRisk Navigator Management Tools

While we discussed several methods in the previous section, we focus our management tool on the Risk-Influence Calculator. The purpose of this tool is to draw a visual map of risks in a way that helps you prioritize which risks need to be managed most. You will be asked to list up to ten risks then indicate the probability each will occur, the impact it will have on your operation if it occurs, and how able you are to influence or reduce it.

Risk Navigator Management Tool: Risk-Influence Calculator

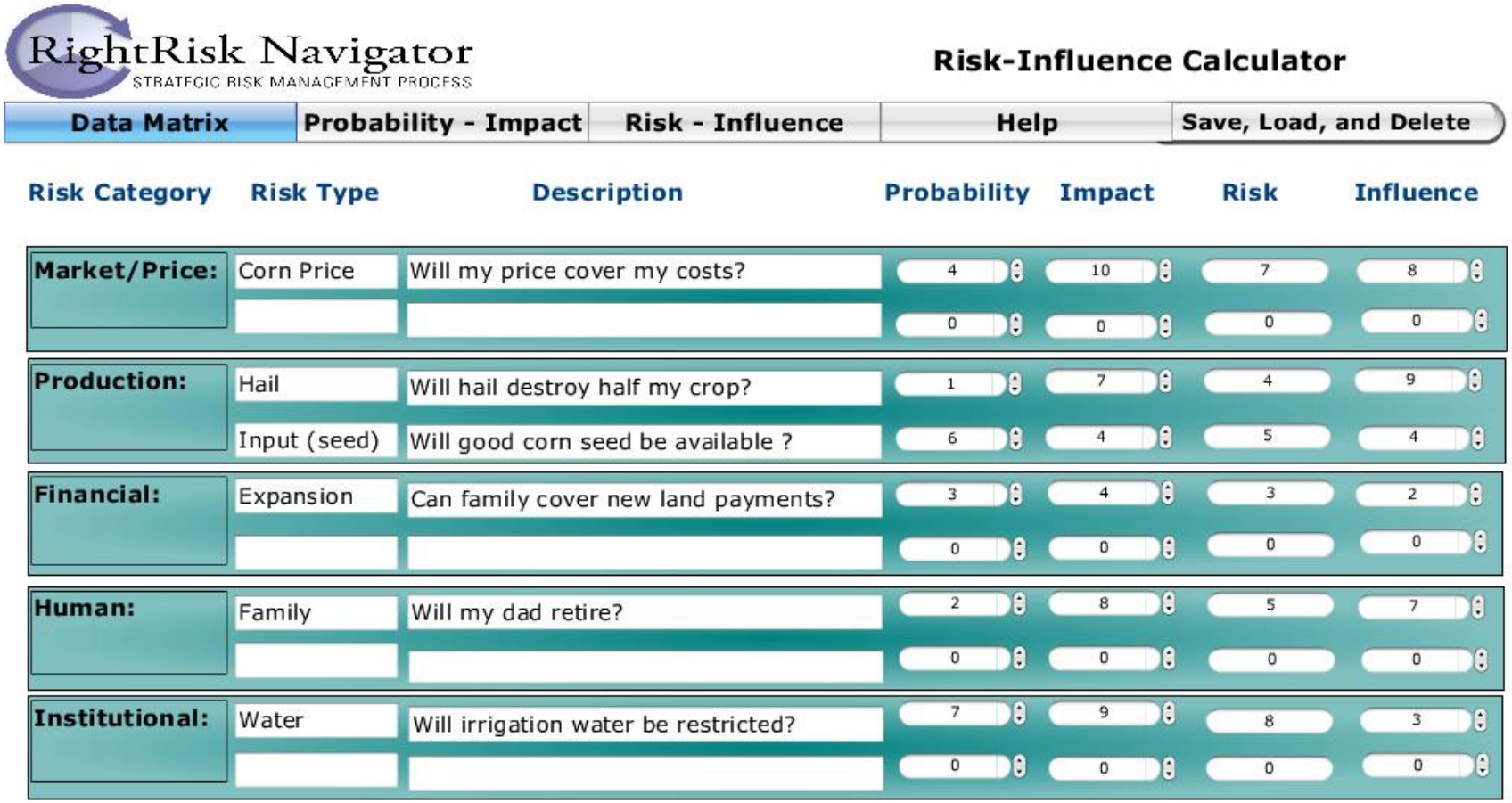
This tool is divided into three steps. In the first step, you are asked to enter the risks that you wish to consider for prioritization. You are provided two slots in each risk category: market, production, financial, human and institutional. You may ignore the risk category when you enter risk types if you like. That is, you can enter more than two risk types by entering extras in other risk categories and ignoring the risk category label. The objective is to assign a level of risk and influence to each risk. Start by naming each risk and writing a brief description. Then enter the level of probability and impact for each risk type-- risk will be determined automatically. Risk is equal to the (probability score + impact score)/2, rounded downward to the nearest integer.

The example in Figure 8.4.1 shows what we entered for Aaron from Part 1 above. Notice that you have to be careful to be consistent to present all risks as a bad outcome. That is, when you assign a 1, there is little chance of a bad outcome and when you enter a 10, there is a high chance of a bad outcome. Notice that Aaron asks "Will my price cover my costs"? Enter a 1 to mean that the costs will be covered and 10 to indicate that costs will not be covered. Likewise, enter 1 when the impact of the risk is very low and 10 when it is very bad. Finally, we want to know how much influence you have on the risk. Enter 1 if you have no effect and 10 if you can control it perfectly.

The scores that Aaron Sprague used come up automatically in the tool if you download the EWS Farms example; otherwise the tool comes up empty and ready to use.

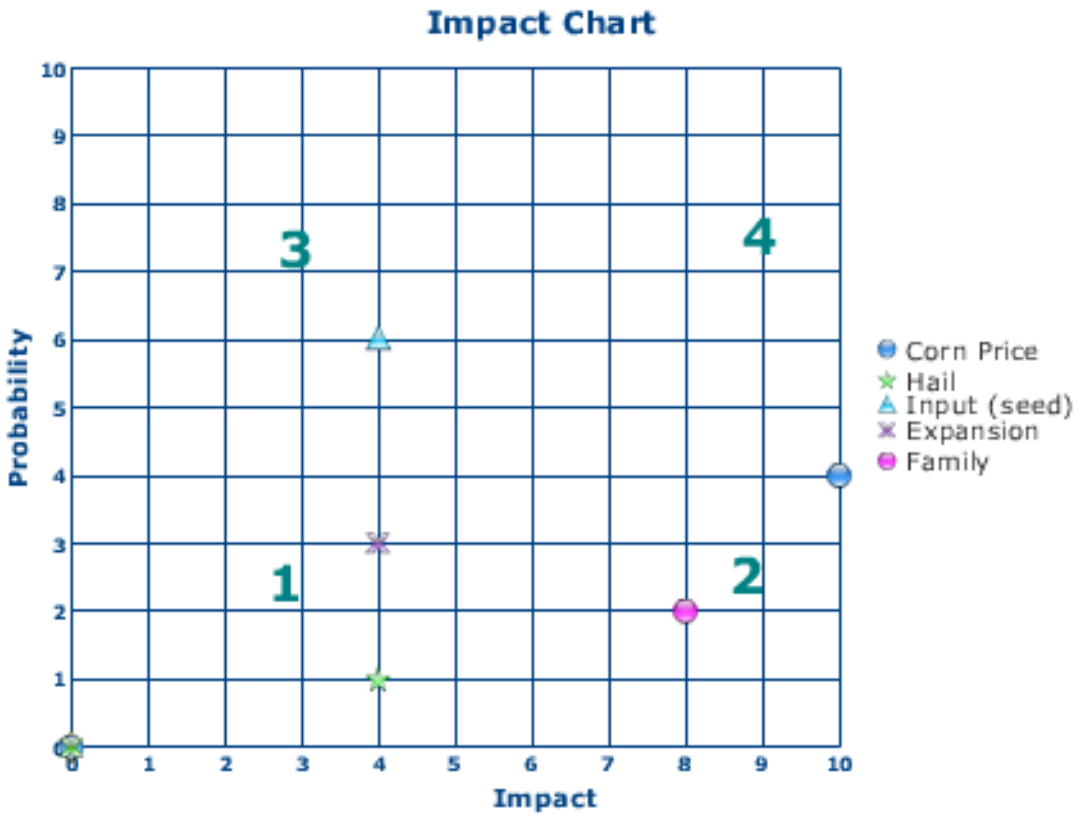
In Aaron's case, he assigned a relatively high probability of not being able to find good corn seed and to getting his irrigation water cut off. Aaron is probably concerned that corn seed might be short due to the increased plantings in recent years. And in Eastern Colorado, farmers are embroiled in several battles that have resulted in them losing water rights. He felt that a severe hail storm was unlikely and that his dad would probably not retire any time soon. When probability is combined with a high impact, the risk was high only for a low market price and loss of irrigation water. Aaron enters his influence last. He felt that he had a lot of influence over the price of corn because he just did his Masters degree in Agricultural Economics at Colorado State University where he learned a lot of advanced marketing techniques. He assigned a low influence score to being able to do much about irrigation water should he be cut off. The reason Aaron provided a high influence score for hail damage was not because he could control whether it hailed but because he could buy crop insurance to cover his losses.

Figure 8.4.1 1 risk-influence



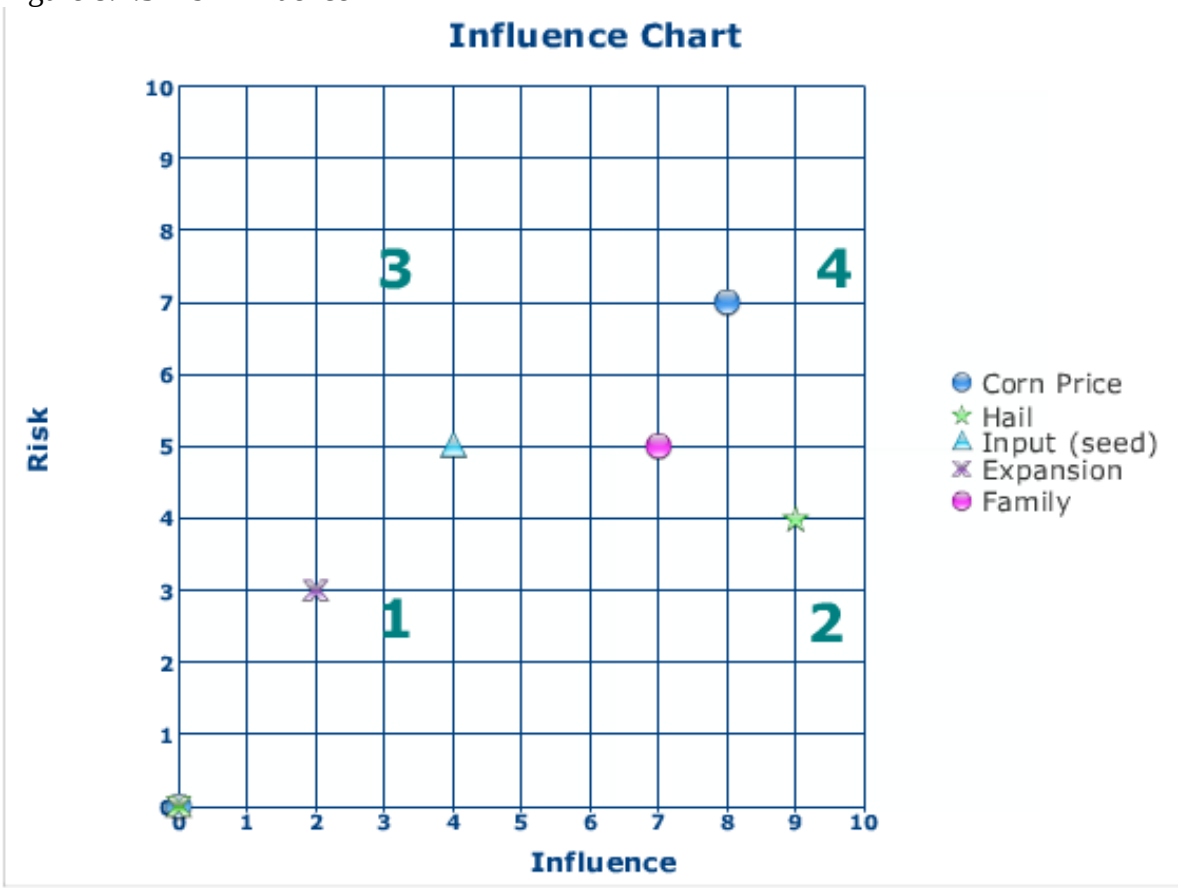
The second step is to examine your results and decide which risks to prioritize. Start by clicking on the Probability-Impact tab. Risk is a combination of probability and impact. Use the probability-impact chart to examine where your risks are coming from. Risks in the upper right quadrant (4) are a priority because they have a high chance of happening and will have a big impact if they happen. Risks on the lower right (1) are not a priority. Risks in quadrants 2 and 3 are of concern. For example, a risk with a probability score of 7 and an impact score of 6 would have a risk score of 6, which will plot into quadrant 4 in the risk-influence chart ((7+6)/2, rounded down).

Figure 8.4.2 probability-impact



Finally, in step three, you can determine your risk priorities. Click on the Risk-Influence tab. We can see the risk level of corn price is 6, as described above. Aaron assigned an influence score of 8 to this risk, so it lands in quadrant 4 as our top risk to prioritize. Hail has a high enough influence score to be a priority, but is only a 4 on the risk level, so it lands in quadrant 2. The risk of Mr. Sprague retiring lands on the boarder in quadrant 4, so it should be taken seriously.

Figure 8.4.3 risk-influence



You can print or save your results. It is also a good idea to readjust your numerical estimates to make sure the charts represent what you really think.

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