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Using Causal Analysis to Minimize Risk

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Introduction

Human behavior is the source of a great deal of study and inquiry. When the focus of an incident investigation is on human behavior, managers and others are primarily interested in learning how to get people to do the right thing at the right time. Attention is generally directed towards the risky actions taken by people. The desire is for people to be careful – to always watch out – to remember that everyone has a family at home – and to realize that risk recognition and management is first and foremost a personal responsibility. And so it is. However, a key element is often missing from the equation – identification and control of conditional causes that exist in conjunction with behaviors.

Basics of Risk

Change happens – there is no getting around it. And there is no reliable way to predict what changes will come our way, or whether these changes will be positive or negative. We are subject to a continuous daily stream of uncertainty about what the future holds for us. This uncertainty increases the farther into the future we look. Not all outcomes are possible. However, because so many outcomes fall within the realm of possibility, we do our best to calculate probabilities and act according to predictions of what is most likely to occur. But a calculation that yields the high likelihood of a particular outcome does not ensure the event will actually happen. Conversely, a low probability of occurrence does not guarantee that an event will not occur, to which anyone recently struck by lightning – or those looking at their latest 401k statement – can attest.

In industry, risk is understood to be a subcomponent of uncertainty. This is because many industry professionals define risk as the possibility that change will lead to an *undesirable* outcome, whereas uncertainty contains both the positive and negative possibilities the future may hold.

The following equation is frequently used to define risk:

Risk = Probability X Consequence

There are variations on this equation. Sometimes a variable is included that accommodates the presence or absence of a barrier that would mitigate undesirable consequences.

However, not everyone thinks of risk in a purely negative light. Observing how other disciplines view risk can shed light on the applications to safety. In the world of finance, for example, risk is not a subcomponent of uncertainty – it *is* uncertainty. Financial analysts see risk as the potential that the future price of an asset will be different than expected. Price volatility, measured statistically, provides an indication of risk. In the financial analyst's world, risk includes the potential for both positive *and* negative outcomes – not just the possibility that the price will go down. This is where the notion of a trade-off between risk and return comes from. To earn large returns in a short amount of time, the investor is required to take large risks. Of course, the arc of risk swings both ways.

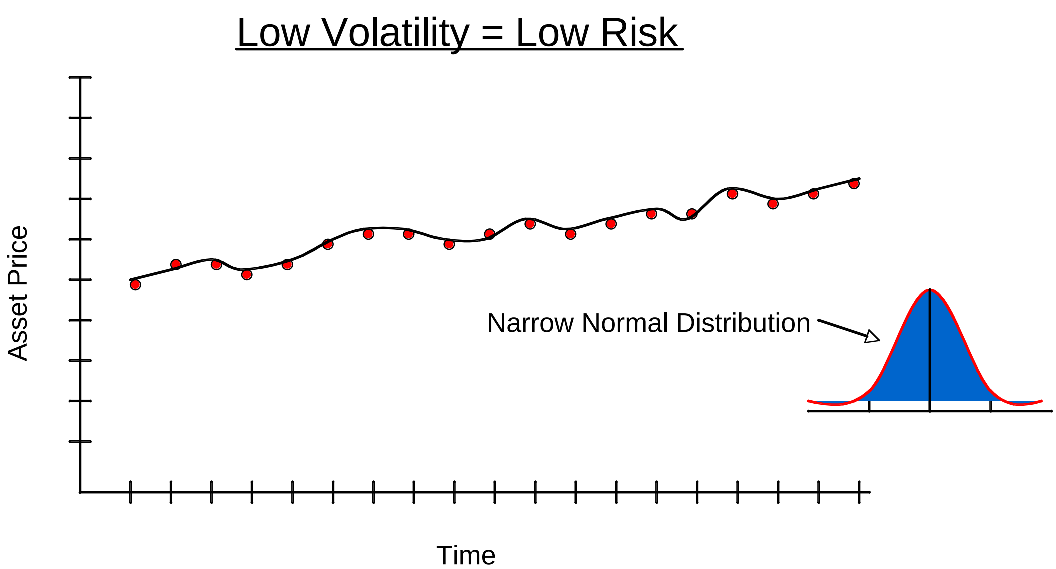

Figure 1: Lower volatility represents lower risk in that returns are more predictable, but often lower over time.

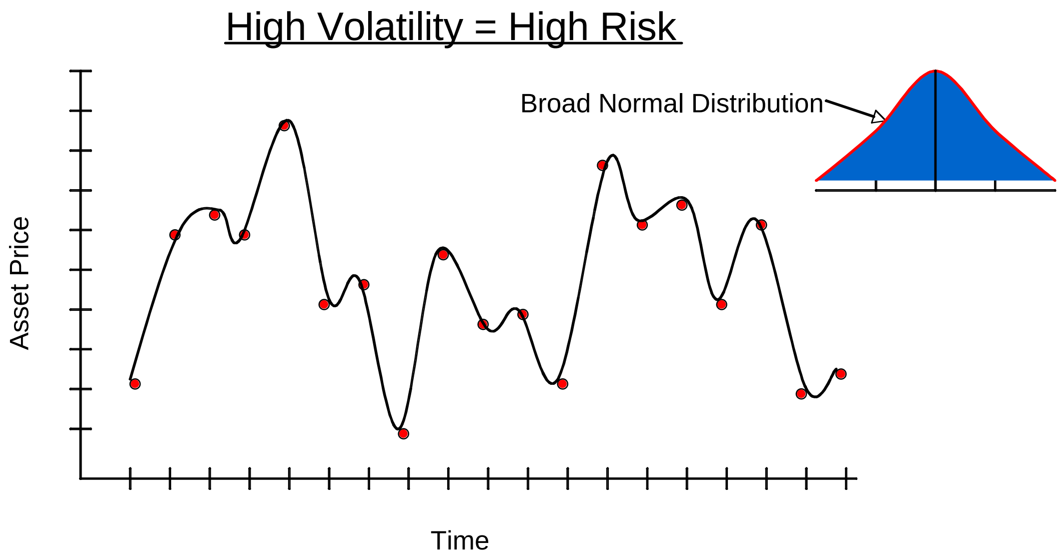

Figure 2: Higher volatility yields a broader normal distribution. It can lead to higher returns, or greater losses. High volatility assets are harder to predict.

Simply put, financial analysts measure total risk as a combination of two components – "systematic risk" and "unsystematic risk." Systematic risk is the risk shared by all firms in a given industry. Unsystematic risk is the risk associated with any individual firm. One can think of systematic risk as the risk associated with the business environment. For example, all banks share the same environmental risk component – all are subject to the ups and downs of the financial services industry. However, each individual bank has risk factors that differentiate it from its competitors. This individual risk is the unsystematic risk component.

This two-part concept of risk has validity beyond finance. For example, the Bering Sea is an environment which subjects all vessels to an inherent risk level. Any vessel that sails the Bering Sea chooses to subject itself to a constant level of systematic risk. This level of risk represents a "risk floor" that cannot be lowered. Unsystematic risk is associated with any individual vessel that ventures out into the environment. For instance, if the crew has access to safety equipment, wears appropriate PPE, conducts rescue drills, and continually works in a safe and conscientious manner, it will have a lower level of unsystematic risk compared with other vessels. Other variables, such as size and age, also gauge the unsystematic risk level of any vessel. The key distinction is that individuals in any environment have a degree of control over their unsystematic risk (their choices, actions, etc). However, they can do nothing to lower the systematic risk floor of the Bering Sea itself. Both types of risk combine to equal the total risk to which any individual is subject.

Human Behavior – The Primary Cause of Risk?

Human behavior is often the focus of an incident investigation. What action did someone take (or omit) that contributed to the outcome of the event? Many solution recommendations attempt to control human behavior in one manner or another. Recommendations such as writing better procedures, sending people to additional training, and implementing best work practices abound. These are good starting points, but more can be done. These solutions address only the unsystematic risk components of an event – not the systematic environmental risk. Why not drop the 'risk floor' to a lower level by addressing the systematic risk? Wouldn't this subject all individuals to a lower level of risk from the start?

One answer is that decision makers often do not have the information required to identify systematic risks. Or, the information is presented in a way that is not consistent with a strategy to reduce risk yet still provide an acceptable return on investment.

Using Root Cause Analysis to Minimize Risk

A comprehensive root cause analysis (RCA) program can help organizations better understand and mitigate risks of human behavior. Two methods of RCA are widely used and accepted: The Five Whys and the Fishbone (Ishikawa) Diagram. The author acknowledges that these methods have been enormously helpful and were important steps towards a more structured approach to problem solving. However, in order to effectively reveal systematic risk elements, RCA must go beyond the traditional Five Whys or Fishbone methods.

Drawbacks to the Five Whys:

The Five Whys method, in its simplest form, requires the analyst to ask 'why' five times. The answer to the fifth 'why' is the root cause. While the strength of this method is its simplicity, this is also its downfall. In creating a Five Whys analysis, the user is forced into applying a linear analytical method to an event that is non-linear in nature. This "forced pruning" of concurrent branches ensures a work product that is invariably missing a great deal of important causes. Five Whys analyses ultimately limit the analyst's solution options to a very few causes… and not surprisingly, these causes tend to point to individual actions or omissions.

A classic Five Whys analysis tends to identify causes that relate to the unsystematic risk of individuals. Ignored or discounted are the causes associated with systematic risk.

Drawbacks to the Fishbone:

The Fishbone method is a structured brainstorming approach. Causes are brainstormed by the analytical team and then grouped according to category. Classic categories are manpower, methods, machinery, and materials – however, a variety of modifications to these categories exist. These categories are helpful in that they prompt the analyst to identify a variety of possible contributors. However, there are two primary drawbacks to any categorical method:

1. Different people choose different categories to describe the same event.
2. Categories seldom reflect the specificity required to generate effective solutions.

Different people tend to choose different categories to describe the same event because the exact meaning of any particular category, while objective in training, becomes subjective in practice. For example: A person uses the wrong tool for a particular task. One analyst may categorize this as a manpower cause since the person decided to use the wrong tool. Another may choose to categorize this as a machinery cause, focusing instead on the tool. Yet another may decide that the most appropriate category is methods – since the method or procedure used by the individual must be incorrect.

Categories seldom provide the specificity needed to offer an effective solution. Continuing the example in the last paragraph, if the cause is "person used wrong tool," what is the solution? Use the 'right' tool? In order to offer a specific solution, an analyst needs a specific cause. What was 'wrong' about the tool? Why was the 'wrong' tool chosen? These are important questions that will remain unanswered by a method that relies on categories.

The Fishbone method tends to miss opportunities to reduce unsystematic risk because the use of categories forces the analyst to generalize. This generalization tends to identify solutions that focus on the unsystematic risk elements of an event.

There are certainly exceptions that attempt to overcome the limitations of the Five Whys and Fishbone with varying degrees of success. Generally though, these two methods are employed 'out of the box' without modification.

The purpose of this paper is *not* to illustrate the downside to these widely used methods, but to explain elements of more advanced alternatives that will provide greater visibility into environmental/systematic risks. These more advanced RCA methodologies have specific differences, but generally include a variation of the following steps, keeping in mind that each proprietary root cause analysis method uses different terminology.

Problem Definition

The first step in any thorough analysis is to define the problem. It cannot be assumed that each team member initially understands the problem in the same way. In fact, the best teams contain diversified representation. This virtually guarantees initial disagreement on the exact nature of the problem. The first step is to reconcile these diverse perspectives so that everyone understands and agrees what the primary focus of the investigation will be. Once the focus is determined, additional information such as time, date, location, and significance are documented.

It is a good idea to do a risk assessment during the problem definition step. What is the risk that this problem could have yielded a different outcome? What is the risk of recurrence? The process of assessing problem risk can be formal or informal. Regardless, it can play an important role later in the analysis when deciding which solutions to recommend.

Causal Analysis

Once the problem is defined, the causes of the problem need to be identified. There are multiple proprietary methods for accomplishing this task. Causes should be supported with evidence as evidence minimizes the influence of conjecture on the analysis.

Regardless of the specific terms used, those methods that account for both action-type causes (such as "Operator opened valve") as well as conditional causes from the environment (such as "System under pressure") are going to most effectively compare to the financial risk model. These methods consider any effect to have a combination of causes. A good analogy for this is a simple equation. For example:

Loss of Containment = Opened Valve + System Under Pressure

While the logic is similar, the format can be better represented graphically. For instance:

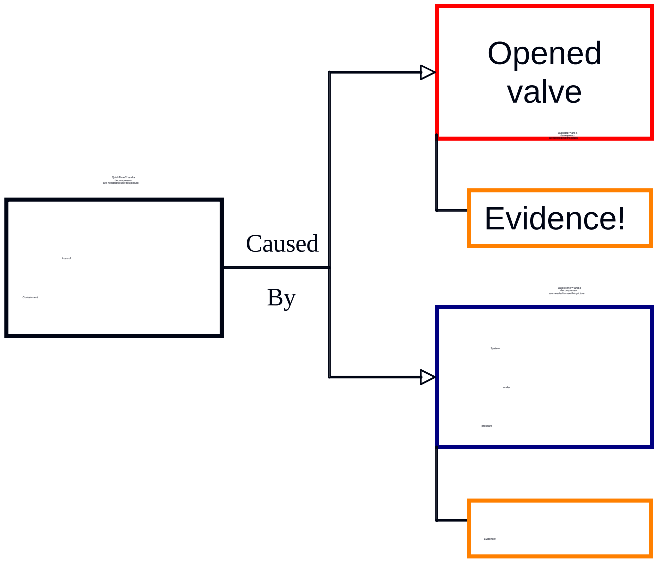

Figure 3: 'Opened valve' is an action-type cause because it's momentary. 'System under pressure' is a conditional cause in that it exists over time. Causes should be supported with evidence

These types of logic-based methods help illuminate risk because the action causes are more uncertain than the conditional causes. Actions are usually momentary and generally involve people. The risk associated with conditions is often lower because these causes are highly predictable and generally stable over time.

Figure 3 above shows only one level of analysis. Each cause identified can also be considered an effect with its own action/condition causes. There is no limit to how large the analysis can be, ensuring that the analyst has ample conditional cause options for solutions.

Identify/Implement Solutions

Effective solutions are effective only because they control one or more causes of the event. Since both actions and conditions are logically required in order to create an effect, removing either or both reduces the risk of recurrence. The best solution recommendations mimic the diversification strategy of a well-balanced financial portfolio. They control multiple causes, which helps reduce the risk of recurrence.

How does the Human Element – people's actions, decisions, behaviors – affect risk?

Returning to the discussion earlier on systematic and unsystematic risks, let's now look at behaviors as variables in the causal equation. Recall that actions and conditions come together to create effects. Conditions generally represent the systematic risk in any environment. Actions – particularly when associated by human behavior – represent the unsystematic risk. Total risk is the combination of each.

The work environment *can* be controlled – and it can be done much more easily than changing a worker's decision-making process. This does not mean that awareness campaigns, training, and even *occasional* discipline should not be a part of a solution strategy. But the fact is, pound for pound, dollar for dollar, risk can be controlled more effectively by controlling the constants (*conditions*) in the environment – not the variables (*actions*). A root cause analysis program – based on a methodology that's proven to be effective – is the best way for an organization to identify opportunities to reduce systematic risk.

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