Risk Management Wisdom

Abstract

Risk Management Wisdom: Risk-based management solutions are seen as a means to minimise the cost of operation. The belief is that if the cost of a bad event can be reduced then the cost of operation is also reduced. On the surface the proposition seems financially sound. The problem is to select strategies that realise the maximum cost reduction for the greatest period of time at the least cost of implementation. Few organisations achieve this aim, as can be evidenced by their high production and maintenance costs year after year. They make a fundamental mistake in managing risk and consequentially they cannot reap its greater benefits. This article takes a new perspective on the application of risk management. It explains how to identify the risk management strategies that continually provide the greatest short and long term financial, production and safety benefits to an organisation.

Keywords: business risk management, industrial risk management, operational risk management

Modelling Industrial Risk

The most often used definition of risk is reflected in the simple equation below.

Risk = Likelihood of Occurrence x Consequence of the Occurrence *(Eq. 1)*

By measuring the 'likelihood of occurrence' in frequency per year, and making 'consequence of the occurrence' a monetary value, the equation measures the annual cost of risks. Risk is given a financial value. With this equation you can quantify the yearly cost to the organisation of every bad (and good) risk it suffers.

Equations of this type are special. They are known as power laws and take the form $x = y.z^n$. They plot as straight lines on log-log graphs. Figure 1 shows plots of the risk equation as curves on normal linear-linear graph. Figure 2 shows the same equation plotted on a log-log graph but in this case they are straight lines at 45 degrees. *(Thanks to Peter Buckland for permission to use the graphs from his 'Boss, we need a new switchboard' presentation.)*

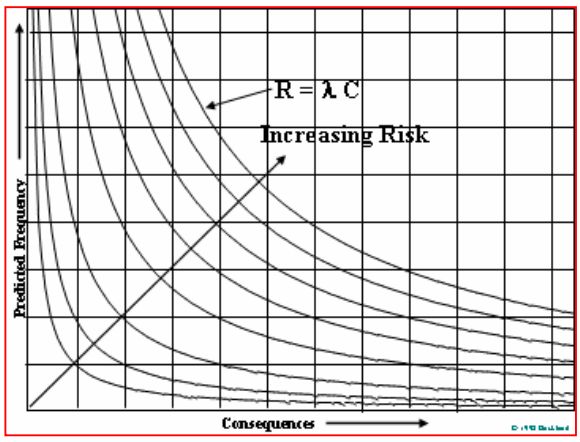

Figure 1. Risk Curves on Linear Graph

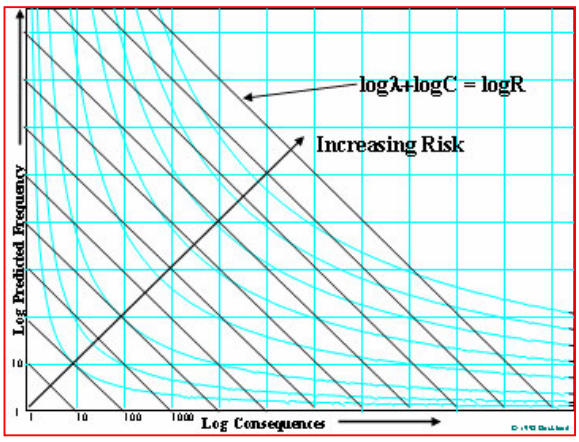

Figure 2. Risk Curves on Log Graph

There are two other equations that are critically important in industrial risk management and operational risk management. One is known as the Crow/AMSAA equation. This equation mimics the failure of industrial systems. It literally predicts when failures will next occur based on the previous history of the system. The second is the Weibull equation, which mimics the failure of industrial components using their historic failure data. It too predicts the failure of

man-made items but only at the component level. *(Paul Barringer, 'Predict Failures: Crow-AMSAA 101 and Weibull 101)*

In the context of this paper it is not necessary to know the details of the Crow/AMSAA and Weibull equations. Merely note that these two equations are also power laws. Power laws have particular properties.

In many real life situations power laws can uncanny reflect the real world. With regards to the risk equation, it very closely represents what actually happens in the life of human endeavours. The insurance industry uses it to set premiums. Power laws are 'scale-free'. In the case of risk this means the risk equation applies to every size of risk. They are 'typically a signature of some process governed by strong interaction between the 'decision-making' agents in the system' *(Critical Mass by Philip Ball)*. This implies that risk does not arise entirely randomly; rather it is affected by the 'decision-makers' in a system. Situations that follow power laws have a higher number of large events occurring than those of a normal distribution. For risk this means that catastrophic events will occur more often than by pure chance. In power law mirrored events a few factors have huge impacts while all the numerous rest have little effect. For risk this means there are a few key factors that influence the likelihood of catastrophe (If controlled they increase the chance of success. We call these the critical success factors.).

We will get back to the importance of the risk equation being a power law a little latter in the paper. Now it is time to better understand the detail hidden in the risk equation.

Understanding the Risk Equation

Let us return to the risk equation and examine it closely. Equation 1 was written as:

Risk = Likelihood of Occurrence x Consequence of the Occurrence

For the purpose of interrogating its secrets it is better written as:

Risk = Chance x Consequence

The equation tells us that risk has two components - chance and consequences - or using other words - probability and severity. Reduce the chance of an event occurring and you reduce the risk. Lessen the consequences from an incident and you again reduce the risk. The implication is that risk can be controlled by altering the chance of its occurrence and/or altering the consequences resulting from an incident. Note that the two factors, chance and consequence, are multiplied together. This indicates that the impact of either factor has equal effect on the risk. Halving the chance is equally as good as halving the consequences. And this is the trap that most organisations fall into. They think that it does not matter how they reduce their risk because either path produces the same result. It is not true.

In reality the two 'paths' to reducing risk have totally different impacts on the prosperity of an organisation. This is best understood by modelling a business. Here we divert into the world of basic accountancy to continue the explanation of why the best path to take in industrial risk management is to reduce 'chance' and not 'consequence'.

The Effect of Failure Incidents on a Business

Figure 3 is a simple representation of an accounting model for an operating business that every new student of accountancy is shown. When a business operates it expends fixed and variable costs to make a product which it sells for a profit. The business has fixed costs that it must carry regardless of how much it produces. These include the cost of building rent, the manager's salary, the permanent staff and employees' wages, insurances, equipment leases, etc. There are

variable costs as well, such as fuel, power, hire labour, raw materials to make product, etc. From doing business a profit is made that keeps it trading.

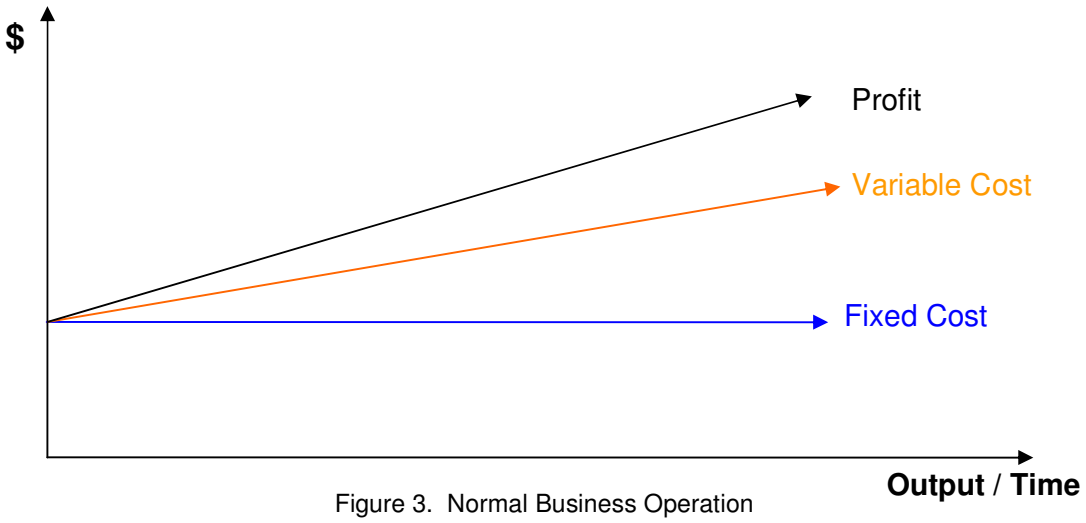

Figure 3. Normal Business Operation

Let us now introduce a bad incident into the model - a production failure.

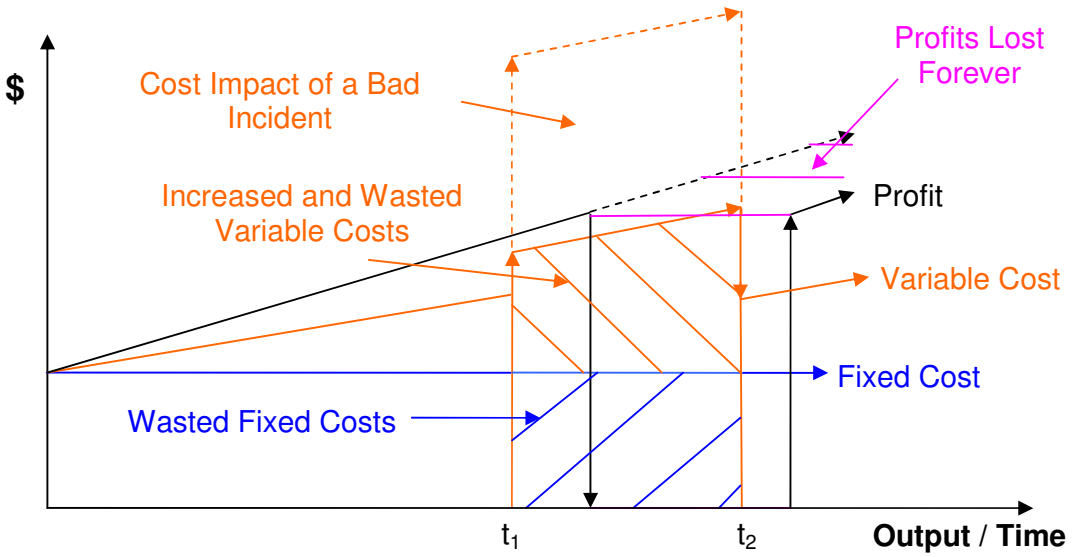

Figure 4. Effects on Costs and Profit of a Bad Incident

Figure 4 shows a failure incident affecting production starting at time t_1 which stops the operation. A number of things immediately happen to the business. Future profits are lost because no product can be made (though inventory can still be sold until it is gone). The fixed costs continue accumulating but are now wasted because no product is being produced. Some of the variable costs will fall because they are not used, whereas some, like maintenance and management costs, will suddenly rise in response to the incident. Other variable costs are retained in the expectation that the equipment will get back into operation quickly. These are also wasted because they are no longer involved in making saleable product. Usually workers are put onto other duties they are not meant to be doing. Losses and wastes continue until the plant is back in operation at time t_2. The cost for repair from a severe outage can be many times the profit that would have been made in the same time period (the dotted outline in Figure 4). There is much more to be said about the huge cost consequences of failure incidents on business profitability, (See the 'Instantaneous Cost of Failure' article at http://www.lifetime-

reliability.com/Instantaneous%20Cost%20of%20Failure.pdf) but for our purposes it is sufficient to realise failure incidents have serious consequential impacts on operating cost and future profit.

The situation with production and profit gets much worse if there are many failures. Figure 5 shows the effect on our model business operation of repeated failures. Clearly the operation is bleeding profit from a death of many cuts.

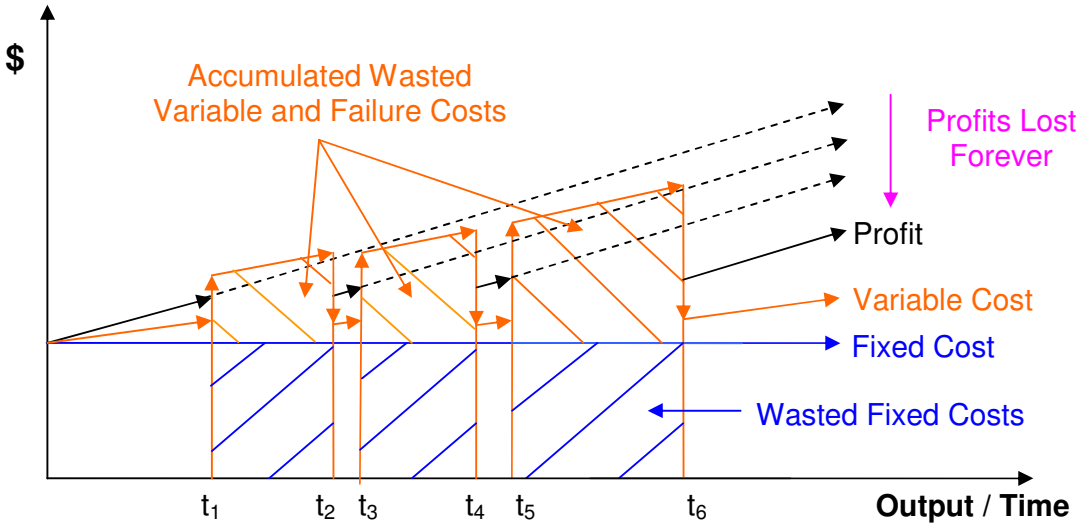

Figure 5 Effects on Profitability of Repeated Failure Incidents

Now it is time to introduce risk management into out rapidly failing business. We will individually apply the risk equation components - chance and consequence - in our risk management efforts so we identify their effect on the operation. Figure 6 shows the effect on profit by reducing the consequential time loss from the failure incidents while all other consequences remain the same. Clearly profit improves and costs are held down if we get our operating plant back into production quickly.

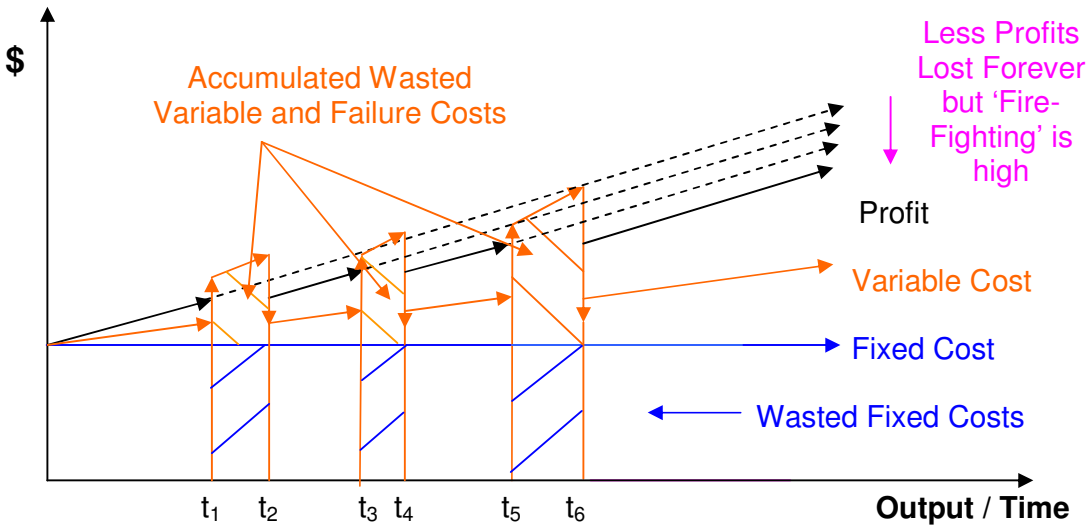

Figure 6. Effect on Profitability of Reducing Consequence Only

What is interesting with the model in Figure 6 is that there will be much activity and 'fire-fighting' happening in this operation. If we minimise risk by reducing its consequences we are in fact saying that we will accept failure incidents as a normal way of doing our business and

then react to them once they happen. Reducing the consequences of risk only, makes work for everyone. And of course this work is all wasted time, money and effort because people and resources are diverted away from making product to fixing problems; instead of spending that time, money and effort improving the business.

Let us now look at what happens to the operation and profit if our risk management efforts are targeted at reducing the chance of failure incidents occurring. In Figure 7 there is only one incident during the same period as there were three in Figure 6, while all else remains the same.

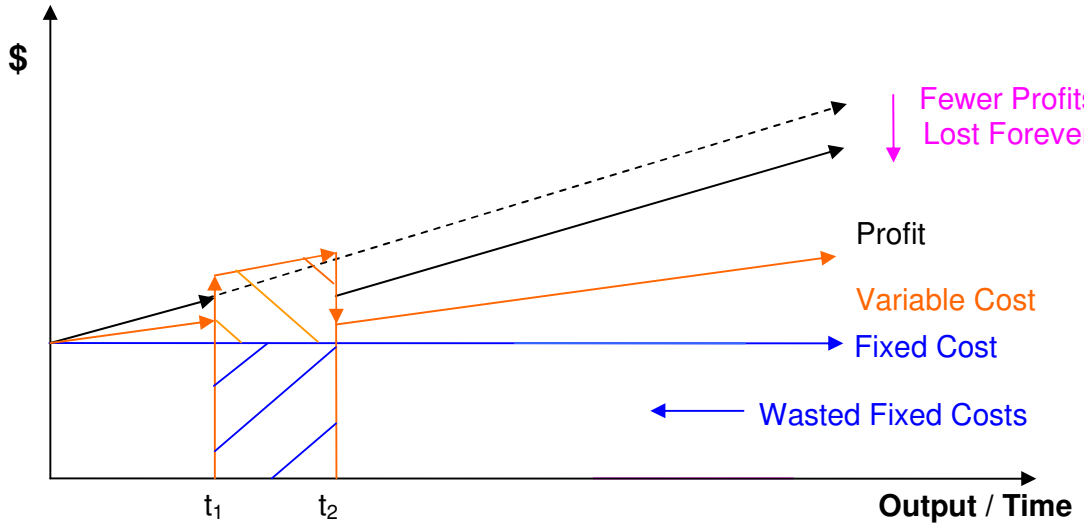

Figure 7. Effect on Profit of Reducing Chance Only

Here we can see that profit is also improved, as you would expect if there are fewer failure incidents in a given period of time. Whether there is more profit to be regained by using chance-reduction strategies or consequence-reduction strategies is not evident in the graphical models. All that can be said is that risk is reduced and profit is improved if risk management strategies target either the chance, or the consequence, of an incident. Obviously if both factors are targeted at the same time the maximum profit is retained. This outcome is evident in Figure 8.

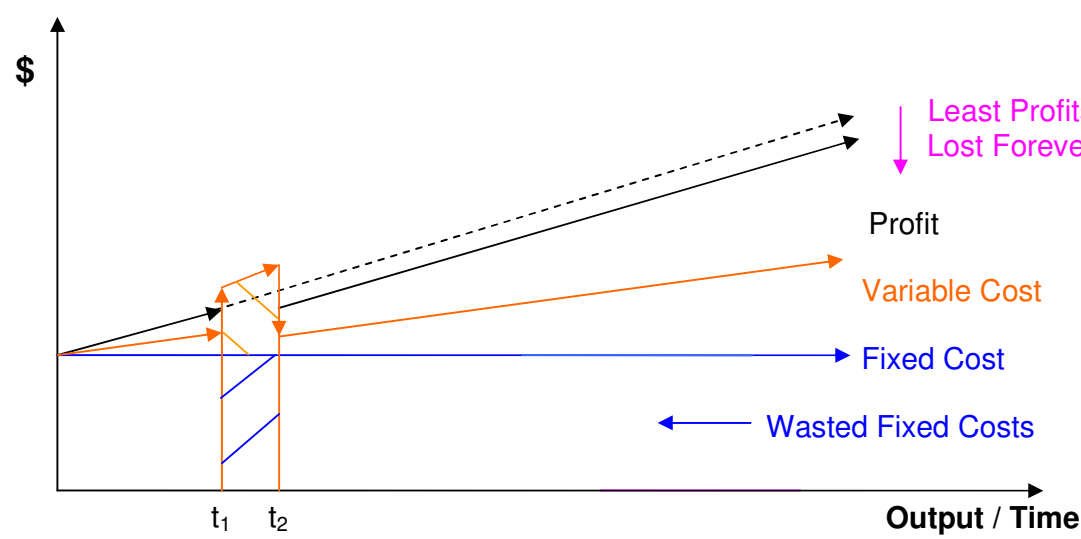

Figure 8. Effect on Profitability of Reducing Both Chance and Consequence

We will need to look a little deeper into the resulting effects of selecting chance-management strategies or consequence-management strategies before we can be sure which path is the best one to use for our business.

Returning to our risk equation let us identify the characteristics of chance-management and consequence-management strategies. Figure 9 lists a sample of the industrial risk management strategies which are used to address the individual components of the risk equation. Other strategies are not shown due to space limitations.

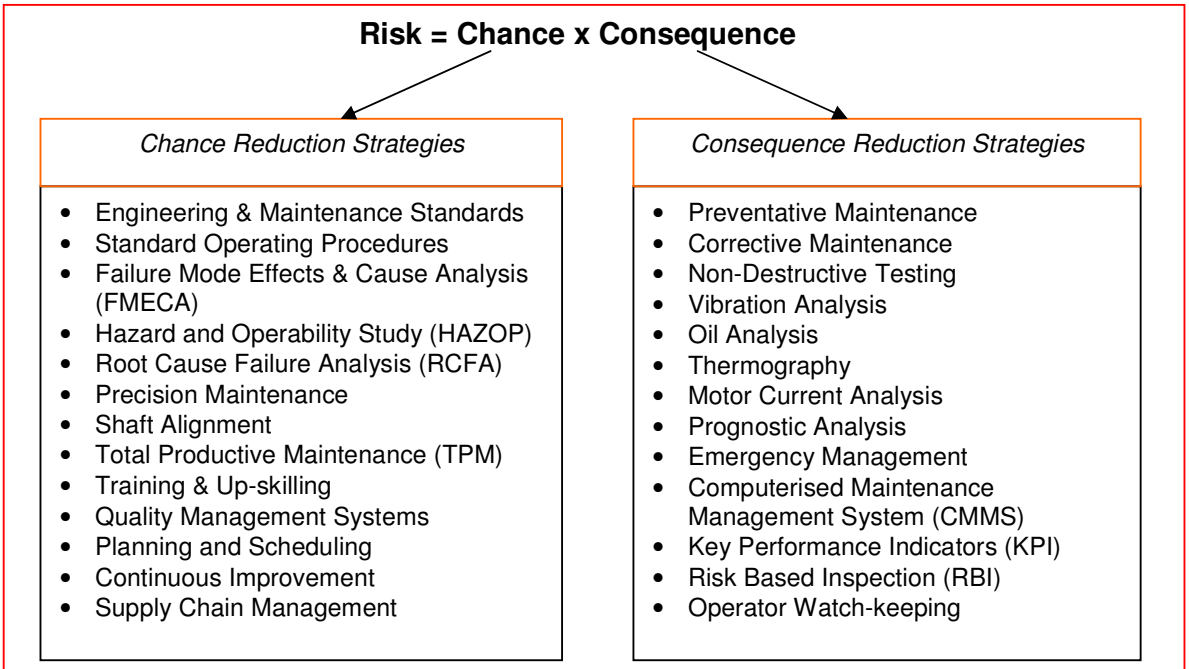

Figure 9. Risk Management Strategies

Several observations can be made when viewing the two industrial risk management 'paths'. Consequence reduction strategies all require an incident to occur. The failure happens and then the strategies are used to manage it so least time, money and effort are lost. The consequence reduction strategies live with failure and its losses as normal and accept that it is only a matter of time before the operation will be severely affected. If you look at the list of consequence reduction strategies you will notice that many require high levels of technology and specialists skills to support them. Using high-technology based strategies commits organisations to on-going support costs and the use of dedicated technical specialists.

In comparison the chance reduction strategies focus on identification of future problems and the application of system changes to prevent the introduction, or re-introduction, of failure causing agents. The chance reduction strategies view failure as avoidable and preventable. These methodologies rely heavily on improving the business systems rather than improving failure detection methods. The time, money and effort are expended early and problems identified and fixed so the chance of future failure is minimised. The organisations that truly apply chance reduction strategies have set-up their business to ensure decreasing numbers of failures.

Power Law Implications

As indicated previously the risk equation is a power law. Power laws that reflect the human world also tell us much about the situations from which they arise. Perhaps the most important understanding from the risk equation being a power law is the presence of 'decision-making agents' within the system to which it applies. Philip Ball in his book, 'Critical Mass', points out

that “Physicists’ long experience with power laws … leads them to believe that such laws are the universal signature of interdependence. A power law generally emerges from collective behaviour between entities through which local interactions can develop into long-range influences of one entity on another.”

This statement also explains why the Crow/AMSAA and Weibull equations are so predictive of real life. They take data generated by the behaviour of a system, and because the future system remains as it was in the past, they can predict with confidence the future outcomes from that system. The only way to change the future outcomes from power law systems is to change the constituents, or the properties, that cause the system to behave as it does.

Our simple risk equation now takes on far greater and menacing implications.

Risk is affected by the presence of ‘agents’ working uncoordinatedly within a system. The effects of these ‘independent agents’ move through the system in unknown ways but the results of their uncoordinated, and most likely perfectly justifiable, efforts is to increase the risk. Perhaps it now becomes clear why chance reduction strategies are more successful than consequence reduction strategies in reducing long-term organisational risk. The chance reduction strategies work on the systems in a business. They align and coordinate masses of people and information, thereby removing the randomness of ‘independent agent’ influence which unwittingly act to increase the causes of risk and failure in a system.

Gradually and continually the chance reduction strategies act to align and organize the efforts of the mysterious ‘independent agents’ so the randomness of their actions and effects are reduced and finally removed. Chance reduction strategies are the total opposite to consequence reduction strategies, which live with risk and failure as normal. Instead chance reduction strategies forever reduce risk. Because they strike at the random behaviour of the ‘independent agents’ within a system they align people, decisions, actions, behaviours and the over-arching system toward achieving the same organisational outcomes using a specific agreed approach. Randomness and unplanned interactions are removed from the system so the resulting consequences are known!

Conclusion

It is in your organisation’s best interest, and it will generate the most profit consistently for the least amount of work, to focus strongly on the use of chance reduction strategies.

Consequence reduction strategies cannot be forgotten, they are important and necessary. Once a failure has been initiated you must find it, address it and minimise its effects so you lose the least amount of money, but they will not make your organisation hugely successful and incredibly profitable. Only chance reduction strategies can do that.

Mike Sondalini
Lifetime Reliability Solutions
'*Profit From Operations and Maintenance Excellence'*
www.lifetime-reliability.com
Fax: (+ 61 8) 9457 8642
Mob/Cell: (+61) 0402 731 563