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CEOs and Boards Responsibility to Asset Maintenance Success

Abstract

CEOs and Boards Responsibility to Asset Maintenance Success: The future asset, maintenance and reliability success of a business is mostly decided in the Boardroom. People at the top of a company deeply influence enterprise asset performance. Company Boards make good asset management and maintenance choices by setting life cycle strategies and policies that reduce risk of operating equipment failure. Little can be done to correct bad asset maintenance strategy and policy once a business is in operation except to throw them out and start again.

Keywords: life cycle costs, asset maintenance management, operational management

Here is a story is about the lasting financial consequences for two organisations with different strategic views on operating equipment reliability.

Some years ago a maritime operation brought three diesel engines for a new ship. At about the same time, in another part of the world, a railway brought three of the same model diesel engines for a new haulage locomotive. The respective engines went into service on the ship and the locomotive and no more was thought about either selection. Some years later the opportunity arose to compare the costs of using the engines.

The ship owners had three times less maintenance cost than the railway. The discrepancy raised interest. An investigation was conducted to find why there was such a large maintenance cost difference on identical engines in comparable duty. The engines in both services ran for long periods under steady load, with occasional periods of heavier load when the ship ran faster 'under-steam' or the locomotive went up rises. In the end the difference came down to one factor.

The Board of the shipping operation had made a strategic decision to de-rate all engines by 10% of nameplate capacity and never run them above 90% design rating. The railway instead ran their engines as 100% duty, thinking that the engines were designed for that duty, and so they should be worked at that duty. That single Boardroom decision saved the shipping company 200% in future maintenance costs. Such is the impact of CEO and Board decisions on future maintenance success.

I wonder if any of the shipping line's Board Members understood why their wise Physics of Failure decision to de-rate 10% produced such a profitable result.

Figure 1 shows how excessive stresses suffered during operation lower the capacity of materials to accommodate future overloads. A portion of the material strength is lost with each high stress incident until a last high stress event fails the part. These excessive stresses are not necessarily only the fault of poor operating practices. They are more likely to be due to the acceptance of bad engineering and maintenance quality standards that increase the probability of failure in stressful situations.

In reducing the stresses suffered by their engines' parts the Board gave their machines extra life and their people extra room to make mistakes that did not end in plant and equipment failure. That one Boardroom policy choice guaranteed decades of lower operating costs because it produced less need for maintenance and allowed for the unknown and unknowable stress events that happen to

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plant and equipment from time to time. An alternately good decision would have been to buy oversize equipment for the service.

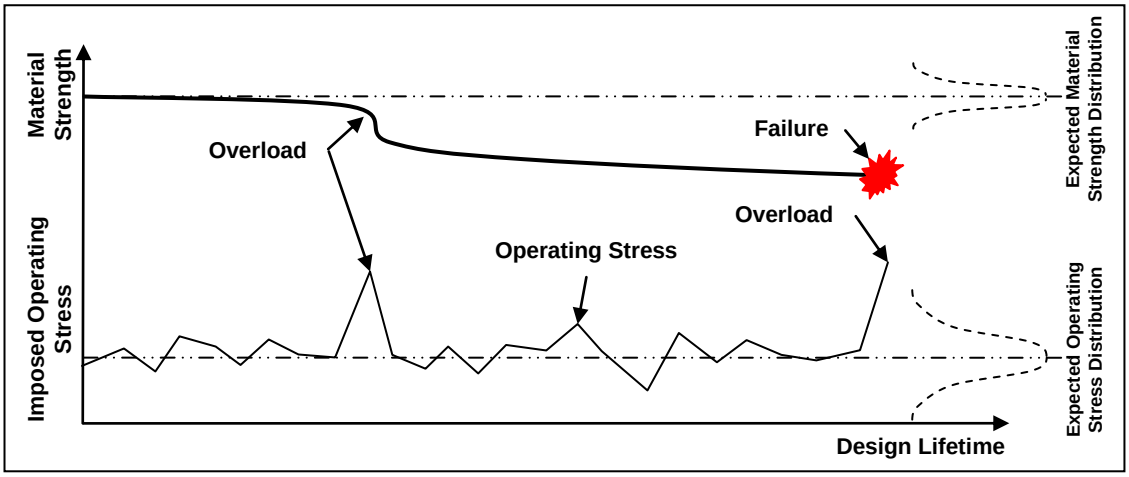

Figure 5 – Effects of Overload Stresses on the Failure of Parts

Asset maintenance success is almost wholly a CEO and Board decision because they set business strategy and policy. The great operational benefits that accrue by removing stress from equipment parts through de-rating and over-sizing machinery is a Boardroom strategic option. By making sound reliability choices in policy the Corporate Executive initiate a strategy certain to return them more operational profits. There are many other CEO and Board level decisions that are as strategically valuable to operational success as those that reduce their equipment parts' working stress. Some of the more notable ones are introduced below.

Know the Operating Consequences of Project Choices

Perhaps prior to the publication and dissemination of Blanchard's 1978 research on life cycle costs[1] one could have excused CEOs and Board Members for not fully understanding the impact of their capital project selection decisions on future operating costs. Figure 2 shows a plot from Blanchard's research. It makes clear how vitally important early project decisions are to future operational costs. Clearly, the decisions and selections made during project conception and design phase set the vast majority of the future operating expenses. Once you have installed your plant and equipment you are stuck with it! If during the project you create a 'dog' of a business instead of a 'star', your hound will chase you around for the rest of its life.

Today we understand why early phase project choices and decisions are so vital to operating success. Reliability insights warn us that the business life cycle is a series arrangement of consecutively linked steps. As shown in Figure 3 it is a sequence of activities with each one depending on the success of those done before it. The operating period, when the capital investment is returned, is at the end of a long chain of choices. Bad feasibility and design choices, bad construction and installation practices all cause bad operating costs forevermore.

[1] Blanchard, B.S., *Design and Management to Life Cycle Cost*, Forest Grove, OR, MA Press, 1978

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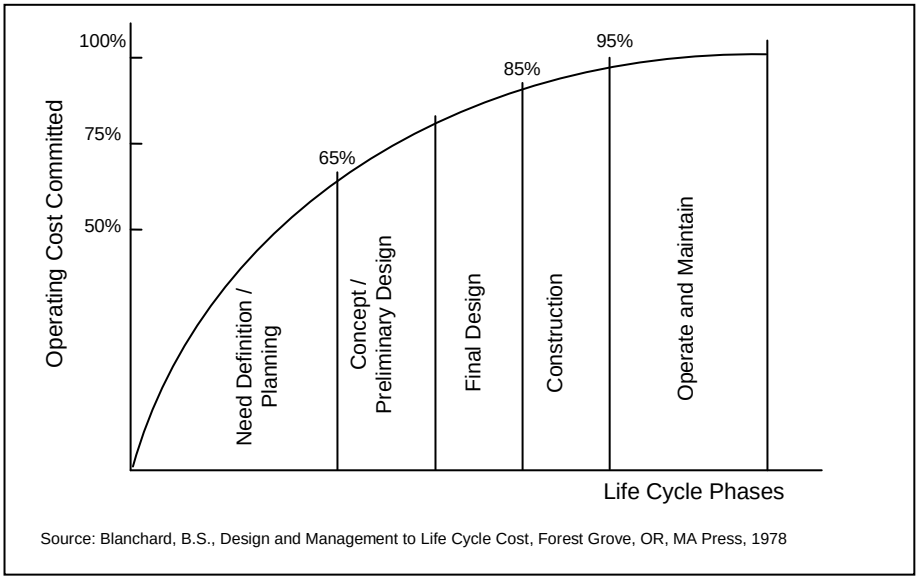

Figure 2 – When Operating Costs are Committed

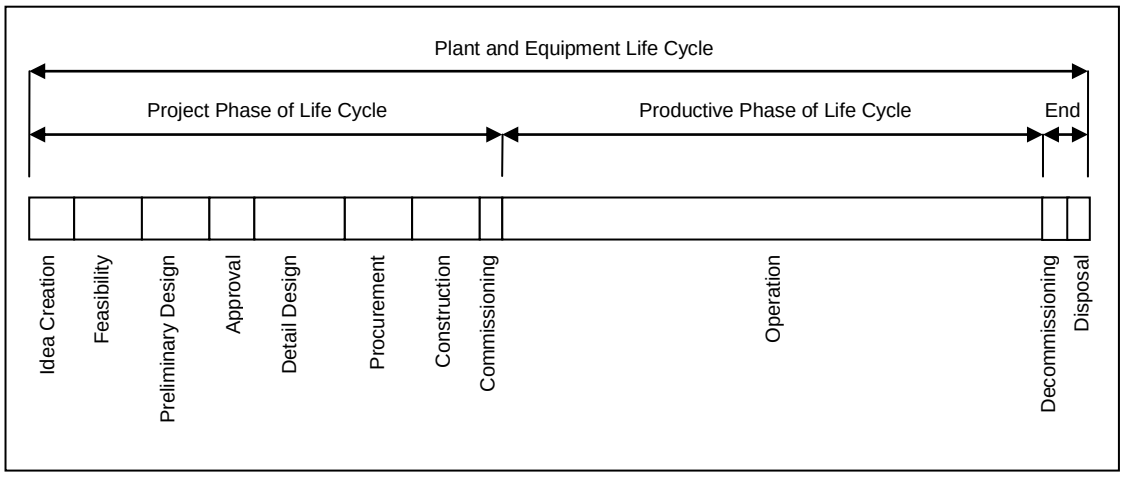

Figure 3 - The Life Cycle of an Industrial Facility involves Multitudes of Series Process

The Board of one of the world's leaders in asset management, du Pont de Nemours[2], has dictated that no capital approval is permitted until the cost estimate is surely within ± 10% of the final cost. They even stipulate that 65% of the final design must be done before asking for capital. du Pont know that if they want ± 10% cost estimate accuracy they must have that level of engineering detail. Their corporate policy is to spend the time and money to make profitable choices.

Operating Costs Design Risk Model

Project groups have the power to build great businesses or just 'also-ran' businesses. When they design a plant, select its equipment, build and install it, the project group are creating a future successful operation, or a painfully drawn-out failure. Project groups need to know the impact of their decisions on the future success of the business they are creating. Blanchard's plot warns us that we need to control the operating risk of project choices.

[2] Hutnich Robert (Bob), *Maximizing Operational Efficiency Seminar*, E. I. du Pont de Nemours and Company, 2004

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Operating risk reduction models like that of Figure 4 allow the project group to make sound, practical choices and lucrative long-term financial judgments on capital equipment selection, project design, and operations and maintenance practices. Once a Board stipulates such an operating risk management model for its capital investments it puts into place the right practices during the project design phase to generate higher operating profits. The Board's capital policy reduces the chance of poor capital equipment acquisition and destructive long-term financial decisions being taken in the project from not knowing their likely operating consequences.

While projects are still on the drawing board project groups need to know that the operation will be a production success.

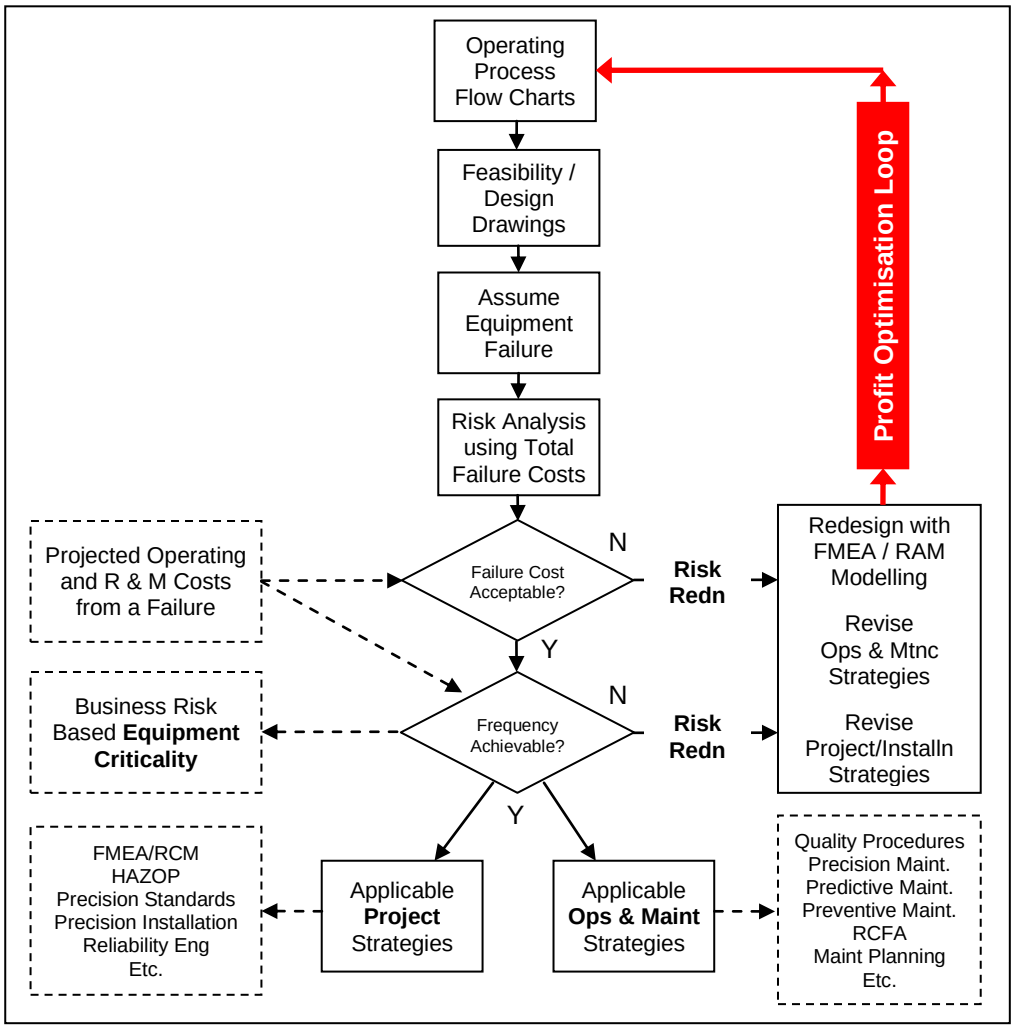

Figure 4 – Optimised Operating Profit Risk Management Model

Equipment Replacement Policies

At a training course I delivered in Malaysia a manager attending from a local electrical utility recounted the story of two engineers he was managing. One engineer worked at a five years old power station. He went to work and left each day with a spring in his step. He was positive in his outlook and a pleasure to manage. The second engineer worked at a similar facility but the plant and equipment was thirty years old. This engineer was continually stressed. His head hung down from the start of the day and even when he went home. His countenance was drawn and tired and

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little that the manager asked for was done by the engineer. The manager wanted to know if I could explain why there was such a difference in demeanour between two comparable engineers.

On the screen in front of the class I showed Figure 5 to the manager and said that was why his engineers behaved so differently. The one that worked in the young plant had machinery and equipment that was strong, robust, with plenty of remaining life. The engineer that worked in the old plant was always dealing with tired equipment that was now past its replacement date. The old plant was full of degraded machinery and equipment worn-out with use. The only way to solve the problem of excessive breakdowns was to install new plant and equipment.

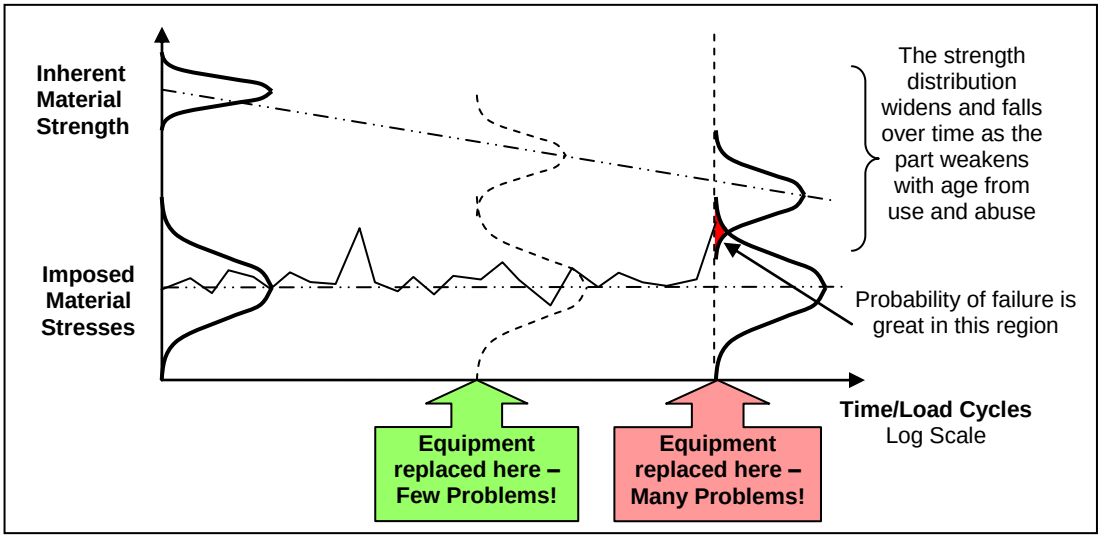

Figure 5 – Time Dependent Load and Strength Variation as Stress Damage Accumulates

Many materials in machines degrade with time, either from suffering overload conditions, or from the accumulated fatigue of fluctuating stresses. Figure 5 shows what happens to material strength through usage and abuse over time. The parts' material-of-construction weaken and are no longer able to carry the original loads and stresses. As they fatigue the chance that some parts will encounter stresses above their remaining capacity to sustain them increases. Some of those parts eventually fail because a fateful overload occurs that they cannot take.

I am reminded of a discussion with a CEO who would not proactively replace degraded equipment. His plant was suffering regular breakdowns and when the CEO was advised the equipment was fatigued and at the end of its life he decreed that there was no reason that the equipment could not be repaired and maintained indefinitely. Parts can be replaced and machines can be rebuilt was his mindset. If he lived his life by his own words he would have been driving around in a 1908 T-model Ford. Yet he replaced his company car when it became clear to him that the risk of failure was too great and the maintenance costs were getting too high. Wisely he took few risks of failure with his own car, but inextricably he willingly put his business at risk of sure failure by not making the same choices for his operating plant and equipment. Not long after that conversation the Board dismissed him for mismanagement.

Because machines and their parts age Boards and CEOs have to put money put aside to replace them before they get too tired to keep working. A Physics of Failure savvy Board will plan 25 years, and even 50 years, ahead by including necessary replacement of aged facilities in their long-term business strategy. Planning ahead makes everyone aware that the Board understands their

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responsibility to future success and warns of the capital commitments to come which will need to be funded at that point of time. This planning does not obligate the company to spend that capital, rather it makes sure all are aware that aged asset replacement commitments exist and cannot be forgotten about. It also encourages the Board to actively look for how to extend the operating life of their plant, and there are many ways to do that.

Power Law Implications for CEOs and Boards

The simple risk equation (Risk = Chance x Consequence) that CEOs' and Board Members' business success depends on is a power law. Power laws take the general form $x = z \cdot y^n$. For the standard risk equation the exponent 'n' is assumed to be 1. Equations of the risk type are special. Physicist Philip Ball in his book, 'Critical Mass', points out that that power laws have particular properties[3]. For example, they are 'scale-free'. In the case of risk, it means the risk equation applies to every size of risk. It means that failure costs are not linear, and while one incident may lose a few dollars, another can total immense sums. They are "typically a signature of some process governed by strong interaction between the 'decision-making' agents in the system". This implies that risk does not arise randomly; rather it is affected by the 'decision-makers' present 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. With risk, this means there are a few key factors that influence the likelihood of catastrophe. Control these and you increase the chance of success.

Perhaps the most important insight for CEOs and Boards from the risk equation being a power law is the presence of 'decision-making agents'. Philip Ball says, "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." Our simple risk equation now take on far greater and menacing implications—everyone in an organisation is a 'decision-making agent'.

Why a Company Really Needs a Vision and Shared Goals

Philip Ball's advice that risk arises from the effects of 'independent agents' at work in a system needs to be addressed by CEOs and Boards.

If it is the decisions and actions of random and uncoordinated agents throughout an organisation that cause the risks that eventually lead to disaster, then to reduce and eliminate risk in an organisation it becomes necessary to reduce randomness and lack of coordination between the people and departments across the organisation. The alignment of peoples' actions and the use of shared goals across an organization is a critical part of risk management strategy.

To help coordinate the behaviour of 'random agents' in asset management and maintenance the CEO and Board need to set guidelines for decision-making and action-taking by establishing universal asset management policy and maintenance policy. These two policies then cascade throughout the organisation and act to coordinate and focus decisions and actions. The policies drive randomness and lack of coordination out of operational, engineering, finance and maintenance

[3] Ball, P., *Critical Mass – how one thing leads to another*, Arrow Books, 2005

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group behaviours, and both business and operational risk reduction results. Providing a guiding vision of the future and a mission statement of how the organisation will get there is not only smart quality policy it is very smart business risk control. Ensuring the right business systems and processes are put into place across the business to control future risk is an absolutely vital task for the Corporate Leadership to do well.

Figure 6 lists some of the current methods available to address operational risk. The various methods are classified by the Author into chance reduction and consequence reduction strategies depending on whether they prevent failure starting. Methods that come into play after failure starts are in the consequence reduction category and those that proactively prevent failure initiating are chance reduction techniques. Several observations are possible when viewing the two risk management philosophies.

The consequence reduction strategies tolerate failure and loss as normal. They accept that it is only a matter of time before problems severely affect the operation. They come into play late in the life of a failure when only rectification options are left. In comparison, the chance reduction strategies focus on identification of problems and on proactively making business system changes to prevent opportunity for failure Chance reduction strategies view failure as avoidable and preventable and improve business processes rather than improve failure response methods. They expend money and effort early in the life cycle to identify and remove problems so the chance of failure is minimised.

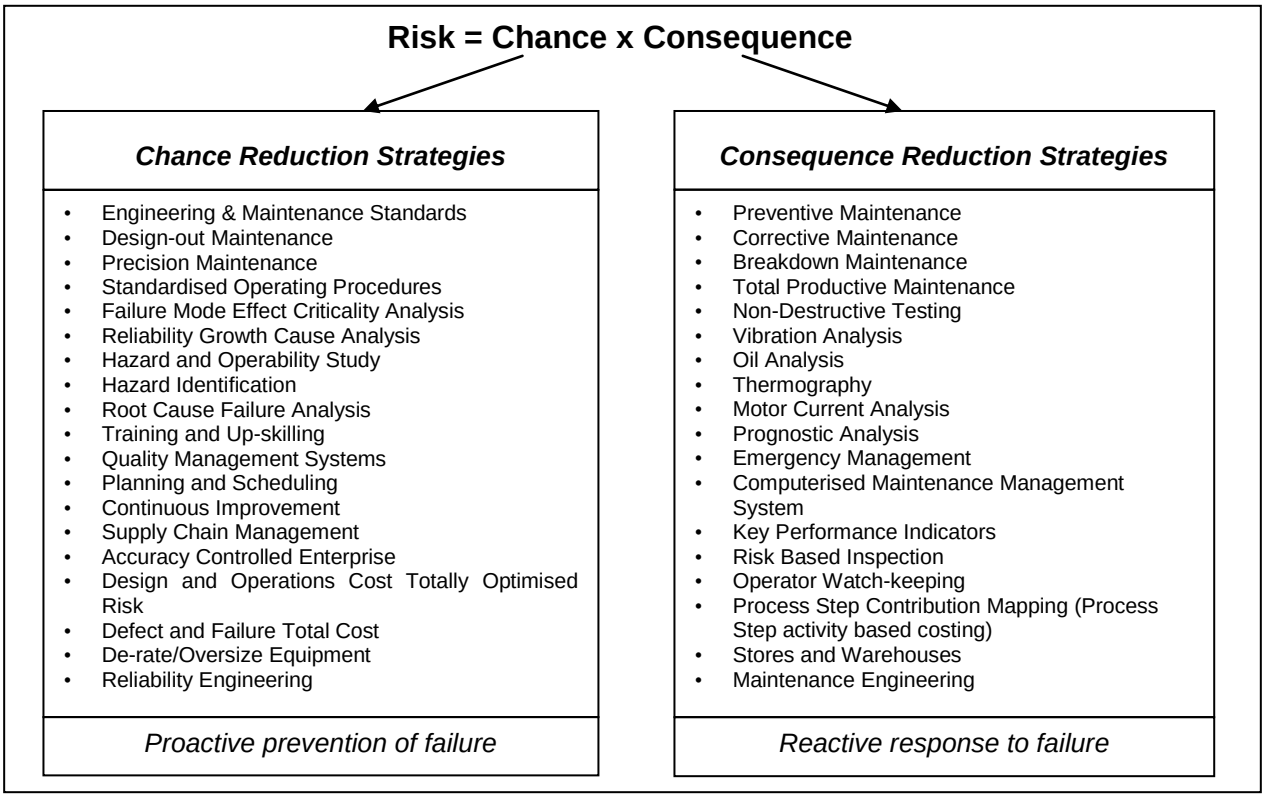

Figure 6 - Various Risk Management Processes and Methods

Chance reduction strategies work by aligning and coordinate masses of people and information, thereby removing the randomness of 'independent agent' influence which unwittingly act to increase the causes of failure and loss. Gradually and continually the chance reduction strategies act to align and organize the efforts of the mysterious 'independent agents' playing unscripted parts

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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 by removing uncertainty and unplanned interactions from business systems.

Both risk reduction philosophies are necessary for optimal protection. A complete risk management strategy is to use both chance reduction and consequence reduction together to maximise profit. But it is in the CEO and Board'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 will not take an organisation to world-class success and profit because they expends resources. Only chance reduction strategies reduce the need for resources because they proactively eliminate failure incidents through defect elimination and failure prevention.

How CEOs and Boards Produce Asset Maintenance Excellence

This is how CEOs and Boards take the lead in creating asset maintenance excellence—they set life cycle asset, maintenance and reliability policies to be adopted across the company, they set performance quality standards to be achieved by the business processes, they develop plans of how to allocate the money and resources needed to keep plant productive, they build shared focus and co-ordinated processes across the organisation, and they 'stick at it' until the policies and quality goals become 'the way we do things around here'.

If CEOs and Boards want world class results from their business they must first create world class performance in their business. If no life cycle asset, maintenance and reliability policies are established, nor work quality standards set, they unintentionally ensure innumerable variations will happen. This randomness leads to a sure rise in risks, some of which eventually produce catastrophe. Without good operational asset and maintenance life cycle governance from the CEO and Board they deliver control for reaching the operating results that they want over to luck and hope.

My best regards to you,

Mike Sondalini
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