

Types of Risk



Risk sits in an interesting space between known facts and the unknowable – for something to be a risk we need to know something about it. If something definitely will, or has actually happened it is a fact and potentially an issue that has to be managed. There is no uncertainty involved in the occurrence, it is a known known.

If something ‘may’ happen that will affect one of the project or program’s objectives, this is a risk. Risks are uncertainties that matter; the effect may be beneficial or detrimental and may affect one or several objectives. Risk Assessment is discussed in WP1015¹ and Risk Management in WP1047². The purpose of this paper is to discuss the types of risk.

Projects are by definition uncertain – you are trying to predict a future outcome and as the failure of economic forecasts routinely demonstrate (and bookmakers have always known), making predictions is easy; getting the prediction correct is very difficult. However, most future outcomes will become a definite fact; only one horse wins a race, an activity will only take one precise duration to complete. What is uncertain is what we know about the ‘winner’ or the duration in advance of the occurrence. The future once it happens will be a precise set of historical facts, until that point there is always a degree of uncertainty.

Risks fall into four broad categories:

- **Known unknowns** – there is no question about the event occurring, the uncertainty is either, or a combination of, when the event will occur and/or the severity of the occurrence. Inclement weather, estimating errors, and software test failures tend to fall into this category (for example; you know there will be a degree of error in every estimate but do not know how great this is until the actual cost or time is recorded). This type of risk is the most easily managed. Typically, there is readily available data and assessments based on past experience can provide a reasonable guide to the probability of the event occurring (some may be 100% certain, other lower), and the range of outcomes likely to occur. From this information, the appropriate levels of contingency needed to insure against the risks occurring can be assessed. The effectiveness of risk mitigation is also relatively easy to assess, the cost and inconvenience of the mitigation activities can be assessed against the reduction in the overall consequence of the risk occurring.

This type of risk is usually included in the risk register and managed inside the project baseline – the other types of risk described below are inherently ‘unknown’ and therefore cannot be included in a risk register. Organisations can work to reduce the degree of ‘unknown’ risks (by collecting the information needed to move them into the ‘known unknown’ category) but some will always remain. Management reserves can be used to protect the organisation from their effect (held outside of the project) but the appropriate amount of reserve needed will always be a subjective assessment based on ‘experience’.

¹ See **WP1015 Risk Assessment**: https://www.mosaicprojects.com.au/WhitePapers/WP1015_Risk_Assessment.pdf

² See **WP1047 Risk Management**: https://www.mosaicprojects.com.au/WhitePapers/WP1047_Risk_Management.pdf

- **Unknown knowns** – these are the things that we know, but are unaware of; typically errors in the project plan. Those that go undiscovered will impact the project when they occur.
- **Knowable unknowns** – these are the most dangerous type of unknown unknown. The risk is inherently knowable but through process failure or the lack of appropriate insight, or a skills failure, they are not considered in the risk management process. These are the possibilities we could foresee if sufficient skill and care is applied to the situation ‘as-is’. The challenge of effective risk management is to turn as many of these knowable unknowns into known unknowns as is practical through creative risk identification, exploration and education. Once the risk is identified (known) we then have the tools for their management. High impact knowable unknowns are also called ‘Black Swans’ after the book by N.N. Taleb. Black Swans are the risks – events or outcomes that you cannot possibly predict or foresee until after they occur³ (see section below), but the events leading up to the risk can be clearly plotted after the event.
- **Unknowable unknowns** – It is not possible to ‘manage’ something you don’t know you don’t know; the only defence is to develop a resilient organisation that can respond effectively after the event occurs.

A similar breakdown is: *‘there are things we know we know, there are things we know we don’t know and there are things we don’t know we don’t know’.*

And there are two basic types of ‘uncertainty’:

- **Reducible uncertainty** – these risks can be reduced by spending money, changing plans, or creating alternatives. This type of uncertainty is called *epistemic* - it is related to the lack of knowledge about the situation. We can obtain more knowledge if we work at it.
- **Irreducible uncertainty** – these risks cannot be reduced with more knowledge. They are dependent on chance and no increase in information can reduce the risk. This type of uncertainty is called *aleatoric* - it is part of the naturally occurring processes

Effective risk management focuses on reducing uncertainty where possible and moving the ‘things’; ie, uncertainties, up the scale from ‘*don’t know we don’t know*’ to ‘*know we know*’, and as a consequence can manage!

Sources of risk

A risk is an *uncertainty that matters*, this include both positive and negative uncertainties from a range of sources.

- **Risk events** (stochastic uncertainty) an occurrence that may or may not occur and if the event occurs, may have a range of consequences. We can estimate a probability of occurrence for each of these possibilities (which is less than 100% because the future event is uncertain) and determine its impact should it occur.
- **Variability** (aleatoric / statistical uncertainty), where there is uncertainty about some key characteristics of a planned event or activity or decision. A range of outcomes are possible but we’re not sure which

³ Taleb asserts: We don’t understand the world as well as we think we do and tend to be fooled by false patterns, mistake luck for skills (the fooled by randomness effect), overestimate knowledge about rare events (**Black Swans – see below**), as well as human understanding, something that has been getting worse with the increase in complexity. Taleb is interested in a systematic program of how to live in that opaque world, be less fragile to a certain class of errors (*robustification program*). In other words, while most human thought (particularly since the enlightenment) has focused us on how to turn knowledge into decisions, I focus on how to turn lack of information, lack of understanding, and lack of “knowledge” into decisions. The Black Swan (2nd ed.) drew a map of what we don’t understand (an attempt to set a clear and systematic limit to what is both unknown and consequential); ongoing work *Antifragility* focuses on how to domesticate and exploit the unknown -with simple heuristics and rules of thumb, something ancient Mediterranean cultures --as conveyed by the ancient classical authors -- knew rather well.
<http://www.fooledbyrandomness.com/>



one might actually happen. For example, we plan to solve a problem, but have no way of determining the time needed to develop the solution – this applies to every duration and cost estimate and is managed by processes such as Monte Carlo to calculate appropriate contingencies. There is a 100% certainty variability will occur, but the degree of variability is uncertain.

- **Ambiguity** (epistemic uncertainty), arises from imperfect knowledge creating uncertainty about what might happen, if anything. For example, we intend to launch a new product into a competitive marketplace - how will competitors and potential customers react? This is minimised by taking the time to properly research a problem and to consult and communicate with subject matter experts and stakeholders. There is a 100% certainty that some degree of uncertainty will remain, but the amount of ambiguity and its effect is uncertain.
- **The unknowable-unknowns** (ontological uncertainty). These arise from limitations in our conceptual frameworks or world-view discussed in ‘Black Swans’ below. We can be certain that such risks exist even though we cannot describe them, so their probability is 100%. The uncertainty lies in the effect that these risks might have if they occur.

Variability and know-ability interact; the risk management challenge is understanding how much you can reasonably expect to know about the future:

- Some future outcomes such as the roll of a ‘true dice’ has a defined range (1 to 6) but previous rolls have absolutely no influence on subsequent rolls, any number can occur on any roll.
- Some future outcomes can be understood better if you invest in appropriate research, the uncertainty cannot be removed, but both the ‘range’ and the ‘probability’ can be refined.

This ‘know-ability’ interacts with the type of uncertainty. Some future events (risks) simply will or won’t happen (eg, when you drop your china coffee mug onto the floor it will either break or not break – if it’s broken you bin the rubbish, if it’s not broken you wash the mug and in both situations you clean up the mess). Other uncertainties have a range of potential outcomes and the range may be capable of being influenced if you take appropriate measures.

Aleatoric (not knowable)	Single point failures 'will the mug break'	Typical accidents 'variable outcomes'
	Environmental uncertainties 'the weather'	Most project estimates 'cost & time'
Epistemic (can learn more)	Incident (will / won't)	Variable (range)

The interaction of these two factors is demonstrated in the chart above, although it is important to recognise there are not absolute values most uncertainties tend towards one option or the other but apart from artificial events such as the roll of a dice, most natural uncertainties occur within the overall continuum.

The challenge is to recognise the type of uncertainty you are dealing with based on the matrix above and then to focus your efforts to reduce uncertainty on the factors where you can learn more and/or where you can



have a beneficial effect on future outcomes. The options for managing the four quadrants above are quite different:

- **Aleatoric Incidents** have to be avoided (ie, don't drop the mug!)
- **Epistemic Incidents** need allowances in your planning – you cannot control the weather but you can make appropriate allowances – determining what's appropriate needs research.
- **Aleatoric Variables** are best avoided but the cost of avoidance needs to be balanced against the cost of the event, the range of outcomes and your ability to vary the severity. You can avoid a car accident by not driving; most people accept the risk and buy insurance.
- **Epistemic Variables** are usually the best options for understanding and improvement. Tools such as Monte Carlo analysis can help focus your efforts on the items within the overall project where you can get the best returns on your investments in improvement.

Effective risk management should include techniques to identify, assess and respond to all of these types of *uncertainties that matter*; not just defined risk events.

Probability of the risk occurring

Many risks are 'certain to occur' – they have a 100% probability of occurring what is uncertain is the affect or impact of the occurrence and if it can be modified. Other risks may or may not occur and can have probabilistic statements and impact assessments. The four basic options are:

- **Future possible events** (*stochastic uncertainty*) – a risk that has not yet happened and it may, or may not occur, but if it does occur then it will have an impact on one or more objectives. These are the most common type of risk in the risk register and have a probability less than 1.
- **Variability** (*aleatoric uncertainty*) - where some aspect of a planned task or situation is uncertain. This applies to virtually every estimate in the project planning and can be reduced by 'hard work' but not eliminated. There is a 100% certainty of variability in every estimate and process (probability = 1)!
- **Ambiguity** (*epistemic uncertainty*) – uncertainties associated with a lack of knowledge or understanding about future activities. Ambiguity can be reduced but rarely eliminated entirely through effective communication and stakeholder engagement⁴; therefore for all practical purposes here is a 100% certainty of some degree of ambiguity.
- **Unknown Unknowns** (*ontological uncertainty or emergent risks*) – we can be certain that there are things we don't know and even though we cannot describe what they are they exist. The uncertainty lies in the effect that these risks might have if they occur. There is a 100% probability that some of these risks exist, what remains unknown is what they are and the probability of them occurring. Low probability – high impact emergent risks are sometimes called *Black Swans*. However, apart from some general allowances and developing 'resilience', you cannot include this class of uncertainty in the 'risk register'.

Black Swans

Originally conceptualized by philosopher Karl Popper and refined by N. N. Taleb, a 'black swan' is a risk event that has never occurred before, if it did occur would have an extreme impact and is easy to explain after the event. In his book of the same name, N.N. Taleb defines **Black Swans** as having three distinct characteristics: they are unexpected and unpredictable outliers, they have extreme impacts, and they appear obvious after they have happened. The title of the book is derived from the belief in 17th century Europe that

⁴ For more on **communication** see:
https://www.mosaicprojects.com.au/WhitePapers/WP1066_Communication_Theory.pdf



‘all swans were white’. It was only after ‘black swans’ were seen in Australia did Europeans have a reason for changing this perspective⁵.

Context is important in this regard, in exactly the same way Europeans had no concept of a ‘black swan’ prior to their discovery in the 17th century; prior to the introduction of European swans in the 18th century, Australian Aborigines would have had no concept of the possibility of ‘White Swans’

The term ‘*As rare as a black swan*’ originated in a Latin expression and was popularised in 16th Century England, the term was used to describe the non-existent (the modern equivalent would be ‘*As rare as hen’s teeth*’). From Roman times through to 1697 the Western world believed that all swans were white. This was a known fact and any similar bird of a different colour could not by definition be a swan! Then Dutch explorers travelled to Australia and discovered true swans that were black, and the known fact had to be modified in the light of new evidence.

However, not every unforeseen, high impact event is a ‘black swan’ – foreseeable events or circumstances with extremely low probability and extremely high impact are just risks and they can and should be managed through the normal risk process. It is too easy to classify manageable ‘**knowable** unknowns’ as ‘Black Swans’, and then suggest they were unforeseeable, simply because insufficient work was done to understand the actual situation. Black Swans should not be used as an excuse for ineffective risk management.

This does not mean ‘black swans’ should be ignored. The idea of Black Swans is a valuable concept that warns us to expect the unexpected even after we have implemented effective risk management! The only certainty is uncertainty, and we need to remember that we will continue to be surprised even if we have implemented the most effective risk management strategies.

If we mistakenly think that identified risks with very low probability and very high impact are Black Swans, then we are likely to remain blind to the existence of true Black Swans. That in turn will leave us unaware of how vulnerable we are to genuinely unknowable unknowns.

Because by definition ‘black swans’ are unforeseeable normal risk management cannot help. The defence is a resilient organisation with adequate capacity and well thought through contingency plans to deal with any emergency. This is the space where risk management and disaster recovery overlap. Whilst it is impossible to prepare for the specific ‘disaster’ – you don’t know you don’t know you need to plan for it – it is sensible and practical to have a well rehearsed generic disaster recovery process in place with clear roles and responsibilities in place to minimise the damage and re-start operations as soon as practical. Typically this type of recovery operation would/should involve the overall organisation, not just the project team.

Jim Collins’ new book, *Great by Choice* introduces the concept of *Productive Paranoia*. Productive paranoia is being aware that the worst can happen. We cannot predict the future, so be constantly alert to the big shift that comes out of leftfield. Leave some options open and don’t bet the business on the success of a single outcome.

⁵ For more on **Black Swans** see: <https://mosaicprojects.wordpress.com/2011/02/11/black-swan-risks/>



Risk White Papers

Mosaic's risk White Papers are:

- Risk Management: https://www.mosaicprojects.com.au/WhitePapers/WP1047_Risk_Management.pdf
- Types of Risk: https://www.mosaicprojects.com.au/WhitePapers/WP1057_Types_of_Risk.pdf
- Risk Assessment: https://www.mosaicprojects.com.au/WhitePapers/WP1015_Risk_Assessment.pdf
- Probability: https://www.mosaicprojects.com.au/WhitePapers/WP1037_Probability.pdf
- Our blog posts on risk are at: <https://mosaicprojects.wordpress.com/category/project-controls/risk/>

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