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The project life cycle: Uncertainty and risk management

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As we know, there are known knowns; there are things we know we know.
We also know there are known unknowns – that is to say,
we know there are some things we do not know.
But there are also unknown unknowns,
the ones we don't know we don't know.

US Defense Secretary Donald Rumsfeld
(On a press conference on 12 February 2002, referring to the Iraq war)

The world is definitely not a deterministic place. As Secretary Donald Rumsfeld said, we face a lot of uncertainties about the future. This is true for the company as a whole and it is also true when we focus on a particular project. Unfortunately, the education received by students in most schools and universities focuses on deterministic knowledge. When asked how long it will take a ball dropped from the tower of Pisa (55.8 meters high) to hit the ground, the honest answer should be either "it depends" (because there are some unknowns, such as the gravity force at that particular location, the air temperature and density, the rugosity of the ball, the air drag it generates, the Coriolis effect at Pisa, etc.) or a time range (considering a suitable set of estimates for the unknowns listed above). However, we all learned to apply Galileo's formula for a falling object,[1] and conclude that it would take the ball 3.37 seconds to hit the ground.

The lack of skills in managing uncertainty by otherwise highly educated professionals is amazing. There are usually two types of answers when asked about something that involves a reasonable level of uncertainty: either one answers "I do not know," meaning that there is absolutely no information about the issue, or one answers with an extremely accurate guess. Try asking your

[1] Galileo's formula states that distance traveled by a falling object, d, can be computed as $d = gt^2/2$, where g stands for gravitational acceleration (about 9.81 m/s^2) and t for time.

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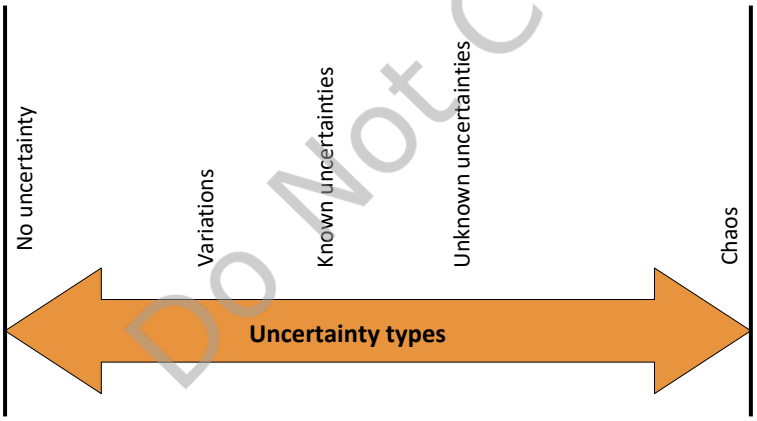
friends about the population of Outer Mongolia, or how many hairs you can find on the head of the average man, and you will get a first-hand experience of these types of answers.

Risk, uncertainty, and crisis are closely related words, which have different meanings to different people. For the purpose of this note, uncertainty will cover all the "unknowns" in a project independently of their type, risk will refer to specific events before they happen, and crisis will be used to describe the events when they occur (and we have not planned for them). It is said that crisis in Chinese consists of two characters:

危機 (or 危机 in its mainland China simplified form). The first character means threat, danger; the second character means possibility, opportunity. When you put them together you get crisis. This is not very different from the original definition of crisis in English, from the Greek *krisis*, the turning point of a disease, when it becomes clear whether the patient will recover or not. We like to bring this to the reader's attention to stress that we should understand both risk and crisis as an event that can affect the outcome of a project, i.e., something that can have a positive or negative impact on the project, even though the word "crisis" usually only denotes negative issues when. Remember that we defined the outcomes of a project along three main dimensions: cost, time, and specifications (scope and quality). Risk (and crisis) will therefore be events in the life of a project that can have an impact on cost, time, and/or specifications.

Following de Meyer et al.[2] we will consider a typology of uncertainty in a project as described in the Figure 1.

Figure 1



In the project planning technical note we assumed that there was no uncertainty in the project. Thus, in that note we covered the aspects of project planning without uncertainty. This note will complement that one by reviewing how to deal with the different types of uncertainty that you will likely encounter in a real-life project.

Let us start by describing the uncertainty typology proposed above.

- Certainty. "We know what will happen" (within a very good degree of accuracy). This is the case of the ball dropped from the top of the tower of Pisa. Galileo's model provides us with enough accuracy to figure out how long it will take to hit the ground.

[2] De Meyer, A., Loch, C. H., Pich, M. T., From Variation to Chaos, *MIT Sloan Management Review*, Winter 2002.

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- Variations. "We know approximately what will happen." The variations come from many unidentified events, each of them with a small influence on the project. Consider the activity of going to the airport by taxi. The duration of this activity is influenced by (among many other things): (a) how long it takes for the taxi company to pick up the phone, (b) the skills of the operator in collecting the necessary information to send the taxi, (c) the quick response of the taxi to the radio request, (d) the location of the taxi when answering the call, (e) traffic on the way to picking me up, (f) the number of people I meet on the way from my office to the taxi, etc. It will not be practical to identify and analyze each of these events in detail. They are usually treated as an aggregate and we say that it takes between 5 and 10 minutes for the taxi to arrive to my office, and between 20 and 35 more minutes to arrive to the airport.

- Foreseen Uncertainty. "We know what can happen." These correspond to identifiable and understood influences that the team cannot be sure will occur. Let us revisit the trip by taxi to the airport. The following events could easily be classified in this category: getting a flat tire, encountering a traffic accident, running out of gas, etc. The importance of each of these events will be significant, and therefore, we will want to analyze them in detail and probably implement possible contingency plans.

- Unforeseen Uncertainty. "We do not know what can happen." As implied by the name, these events cannot be identified during project planning (or maybe they can but we don't because we're not paying enough attention). Maybe after they occur once we can include them in the Foreseen Uncertainty category in the future. When taking a taxi to the airport, we cannot imagine that the taxi will be hijacked and forced to drive 1,200 km before being released.

- Chaos. "We have no idea what will happen." According to the Britannica, the modern meaning of the word chaos is derived from *Ovid*, who saw Chaos as the original disordered and formless mass, from which the maker of the Cosmos produced the ordered universe. That is, everything can come out of chaos, as opposed to some well-defined line of action that can be influenced by some out-of-the-blue events. In a chaotic situation, even the basic structure of the project is uncertain, and the project ends up with final results that are completely different from the project's original intent.

In the rest of this note we will put most of the emphasis on the Variations and Foreseen and Unforeseen uncertainty types, as this is where there is more possibility for proactive intervention.

Variations

The fist step in dealing with variation uncertainty as we encounter it in the project activities is to estimate it. When we ask the project team members to provide an estimate of the cost and duration of an activity, it is very likely that they give us a point estimate, a value which turns out to not be representative of what we can expect will happen. The reason is that the probability distribution of both time and cost is not symmetrical. The reason for this is obvious. Think of an estimate of the time it takes to go from your office to the airport. Assume you believe the average to be 20 minutes. Now, think about something that can happen to make the trip 20 minutes longer than the average. It is not difficult to imagine such an event: an accident on the highway, a problem with the car, a police control causing a traffic jam, etc. Notice that it is impossible to imagine anything (other than a direct miracle) that can reduce the estimated time by the same amount. There are many more possibilities of increasing the cost and the time than there are of reducing them. The probability distribution usually looks like the following chart.

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