A Deeper Insight into the Human Factor in Project Risk Management[1, 2]

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Abstract

A fundamental understanding of risk, risk attitudes, risk ethics etc. is the basis of each risk management approach – not only in project management. Risk management requires human judgement, and this is often influenced and distorted by individual perceptions. After presenting the historic development of the human perception of risk and the individual psychological attempts to handle this matter, we try to work out necessary consequences to project risk management.

This paper can be seen as a continuation of a contribution to a former conference of the same format here in Riga (Tysiak (2013)).

Key words: *project management, risk management, cognitive bias, simulation*

JEL codes: D91, O22, C63

Introduction and Background

In every project there is the need to implement some kind of risk management (cf. PMI (2013), Kerzner (2009), Schelle/Ottmann/Pfeiffer (2006)), which normally contains the following phases:

(1) risk management planning,
(2) risk identification,
(3) qualitative risk analysis,
(4) quantitative risk analysis,
(5) risk response planning, and

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(6) risk monitoring and control.

Since this approach is more or less similar in a lot of disciplines that apply risk management (like financial engineering, software development, supply chain management etc.), let us first broaden our view and look at risk management in general and not only related to projects.

The tasks (2) to (6) have to be seen as a chain/loop that you permanently have to work through simultaneously. But, as always, a chain is as weak as the weakest link: If you are not able to identify the crucial risks, there is nothing to analyze. If you are not able to evaluate the risks and therefore cannot plan how to respond in an adequate way, you cannot handle the risks.

Especially while applying the tasks (2) to (4), we have to be aware that they are of course performed by human beings and therefore by people with different attitudes in risk acceptance, risk handling, risk culture etc. The term "risk" in this context is a little misleading: In everyday language this term is associated with a negative outcome of an uncertain event, whereas a positive outcome is normally denoted by "chance" or "opportunity". In risk management the term "risk" is used as a synonym of "uncertainty" (cf. the definitions in PMI (2013), Schelle/Ottmann/Pfeiffer (2006)) and therefore covers positive and negative aspects. Following, we will identify possible reasons for the disparities in human behavior in the context of uncertainty handling and thus try to provide support to manage it.

We want to start with a short reflection about the historic development of the cultural relation to uncertainty and then look at the individual way how human beings estimate probabilities. The first part is mainly based on the interesting book by Peter L. Bernstein "Against the Gods" (Bernstein (1996)), whereas the second part is based on the findings of Daniel Kahneman and Amos Tversky (Kahneman/Tversky (1974), (1979), (2000)) and originates from several psychological textbooks (cf. Esgate/Groome (2005), Fetchenhauer (2011), McKenna (2000)). Subsequently we want to determine what we can learn from this in general and conclude, which consequences result from this, especially for risk management in projects.

Historic Development of the Relation to Uncertainty

In the book "Against the Gods" by Peter L. Bernstein (1996), the historic development is divided into four phases:

Before 1200

Until ancient times, people believed to be subject to the gods, who could be mildly tempered by sacrifices, and one could foresee the future by means of divination and oracles. With the spread of Christianity, the only change to this belief was that destiny was no longer determined by a variety of gods. From now on everything was planned by the intent of one god. Shortly before the end of this period, the Arabic numerals were introduced in the Western world and thus made numerical calculations much easier and respectively possible for the first time.

1200 – 1700

With the start of the renaissance and the reformation, the mysticism of the middle age was slowly overlaid by logic. For the very first time, mathematicians were concerned with gambling games and by this with risk. Furthermore, Daniel Bernoulli realized that different people may evaluate the result of a decision in a different way, which led to risk and opportunity profiles and subsequently to utility evaluations.

1700 – 1900

In this period of industrialisation, people started to collect data on the numbers of births and deaths. Demography became a subject and supported the development of insurances. Also the growing global trade was a perfect field of application for these insurances. Merchants began the first attempts of managing risks.

After 1900

Up to this time, risk was only related to insurances. The whole economic system was more or less seen as stable and risk-free. But then the first world war and afterwards the world economic crisis occurred. Economists (like John Maynard Keynes and Frank Knight) started to think about the fact that the pattern of the historic data is not necessarily an indicator of what might happen in the future. After the second world war, risk management became very important in the financial markets and a lot of Nobel prizes were awarded to scientists that worked in that subject like Harry Markowitz, Myron Scholes, and Robert Merton.

This very brief summary of the historic development shows that our relation to risk is influenced by a lot of different factors related to religious, social, and economic developments. And, of course, it has to be pointed out, that history is seen here only from a Western perspective. In other parts of the world, people with another cultural background, might see things quite differently. Therefore, the findings of Geert Hofstede, stating that uncertainty avoidance is one of the main cultural dimensions (c.f. Hofstede/Hofstede/Minkov (2010)) are not surprising, but very reasonable.

On the other hand, it becomes obvious that a conscious consideration of risk started relatively late. And if one takes a look at the standard textbooks of psychology, one will recognize that psychologist quite often argue that the origin for many behaviours go back to the time, when men were hunters and gatherers, living in caves. Compared to that, the period of risk awareness is extremely short.

Individual Ways to Deal with Uncertainties

Fundamental in the research about how human individuals handle uncertainties are the works of Daniel Kahneman and Amos Tversky (1974, 1979, 2000), which led to a Nobel prize in economic sciences in 2002 for Daniel Kahneman. These findings are part of the magnitude of ways to describe how human individuals act differently in diverse situations (e.g. too much information; need to act fast; not enough meaning) and are summarized as cognitive bias. To

give an impression related to the scope of the current analysis, let us look at some ways to deal with uncertainties.

Expected Value Approach

Instead of working with probability distributions, people try to use substitutes, like averages, to calculate as if everything is deterministic. But this strategy does not work, especially in risk management, since risk is regularly located in the tails of a distribution and not in the middle: You can easily drown in a lake with an average depth of five inches!

Availability Heuristic

The availability heuristic is based on the notion that something that can be quickly recalled must be important, more important than alternative aspects, which are not as readily remembered. In other words, the easier it is to recall the consequences of something, the greater those consequences are often perceived to be. People often rely on the content of their recall if its implications are not called into question by the difficulty that they experience in bringing the relevant material to mind. For example, days of abnormal stock price downgrades are much easier recalled than those of upgrades.

Anchoring Effect

The anchoring effect describes the common human tendency to rely too heavily on the first piece of information offered (the "anchor") when making decisions. If such an anchor is set, other judgments are made by adjusting away from that anchor, and there is a bias toward interpreting other information around the anchor.

One extreme example of this anchoring effect is given in Strack/Mussweiler (1997): Students were asked to participate in a pre-test for the construction of a questionnaire assessing general knowledge. The questions consisted of 22 pairs of comparative and absolute questions. The first question was intended to set the anchor, whereas the second should quantify the effect. The interesting aspect of this test was that the anchors were obviously implausible. For example, one half of the participants were asked at first if Mahatma Gandhi died before the age of 9. Afterwards, they should guess the real age of death. In the second half of the sample, the anchor was set by asking, if Gandhi died after the age of 140. The averages of the guesses were 50.1 in the first half and 66.7 in the second. By the way: Gandhi died at the age of 79.

The anchoring effect is very important, especially in negotiations, marketing and advertisement, but also in court decisions.

Representativeness Heuristic

Representativeness in the sense of Kahneman and Tversky is seen as the degree to which something is similar in essential characteristics to its parent population, and secondly reflects the prominent features of the process by which it is generated. When people rely on representativeness to make judgments, they are likely to judge wrongly because the fact that something is more representatively does not actually make it more likely.

As an example Kahneman and Tversky described a woman named Linda in much detail and focussed especially on her women's rights and emancipation activities. Following, they asked the test persons if it was more likely that Linda was "a bank clerk" or "a bank clerk and a feminist". The majority chose the latter. But this is of course impossible, because the latter is a subset of "bank clerks".

As already mentioned, these examples shall only give an impression of what is meant by the variety of heuristics that human beings apply, because the amount of information is too large or too complex to handle. The complexity of handling uncertainties, to estimate probabilities or statistical parameters like percentiles, correlations, or the like is widely underestimated. A lot of people are overextended by that.

Additionally, this again reflects the importance of structured creativity techniques (like brainstorming, brain writing, Delphi method) during the risk identification phase.

Consequences for Project Risk Management

Before we start to draw conclusions from the described aspects so far, let us have a look onto the human beings involved in the risk management process. Up to now, most of the mentioned issues are valid for risk management in general and not only for project risk management. Let us first have a brief glimpse on the current situation of risk management in the financial markets, since by this the special requirements in project risk management might become more plausible.

After bankruptcy of some US banks correlated with the rise of interest rates in the late 70's and early 80's, the need of risk management in the financial markets became a vital issue. This led to the first Basel account of the Basel Committee on Banking Supervision (BCBS) in 1988. Since that time banks were obliged to have an elaborated risk management system and these regulations have been permanently extended over the years until today.

The information in these systems is more or less historic and current data from the financial markets. Therefore, the basis of these systems is numerical data, distributions, correlations (or more detailed: copulas!), and further statistics. To generate these systems into the financial institutions a multitude of specialists were hired. Risk management is a parallel or overarching branch to day-to-day business. The applications of these systems mostly use Monte Carlo simulation, but the focus is not on the risk identification (because of the historical data!), but more on the analyses of possible future scenarios ("stress tests").

The prosperity of project risk management took place in the first decade of the third millennium (c.f. Campbell (2012)), a little later than in the financial markets, and we have to apprehend that there are marked differences in these two areas. Projects are always, by definition, different from each other. Therefore, there is nothing like a "day-to-day" business. A segregation of risk management from the other necessary tasks, is impossible. All the activities are much more interweaved. By this, it becomes clear that it is impossible to deploy specialists for risk management: The core risk management has to be performed by the personnel involved in the project itself. And this is not only argued because of agility, but because the risk is permanently omnipresent in each individual task. You can employ specialists merely temporarily to support special issues.

The majority of team members in real world projects are practitioners, often with an engineering background. They are trained to think in "if-then" conditions instead of correlations and in maximums and minimums instead of percentiles. The only obtainable historic data might be available from partly similar projects, but then you need experience to transfer these similarities.

Let us try to summarize the above mentioned aspects in a few postulations:

- Keep it simple, avoid complex statistical terms!
- Reduce the necessary data to a minimum, no overestimation of distributions!
- Phrase dependencies in terms of "if-then" conditions and not with correlations or the like!

A Monte Carlo Example

As an illustration, we want to present an example by solving a fictitious risk management problem with Monte Carlo simulation. This example is related to time, but of course we could have chosen also examples that refer to costs or quality. In real projects the complexity can also be much higher. But just as an illustration, an example like this seems to be sufficient.

Let us assume that after an intensive risk identification process in which the whole project team, a lot of stakeholders, and additional experts were involved, the time schedule was formulated in the following way:

Activity	Predecessors	OD	MD	PD	remarks
A	-	2	3	4	
B	-	3	6	9	
C	-	2	5	10	
D	-	4	6	9	
E	A, B, C	3	7	10	
F	C, D	2	7	9	if the outside temperature is less than 5°C, the parameters change to 3 / 9 / 11
G	E	2	3	4	
H	E, F	3	6	8	if more than 10 workers can be assigned to this activity, the parameters change to 3 / 4 / 7
I	F	3	5	9	
J	F	2	7	10	if the duration of activity C is longer than 8, the parameters change to 2 / 9 / 12
K	G, H, I	2	6	8	if the start of K is later than 20, the parameters change to 2 / 7 / 10
L	I, J	3	5	8	

source: author's construction

Fig. 1. **A fictitious project plan**

The order of the activities is determined by the given predecessor relations. The durations of the individual activities are assumed to be uncertain and rated by three-point estimates (optimistic (OD), most probable (MD), and pessimistic durations (PD)). The team tried to keep it simple and reduced the necessary data to these three values per activity. In the following Monte Carlo simulation, beta-distributions with the given parameters – like in PERT – are generated.

Let us have a more detailed look at the remarks:

- **Activity F** has an additional condition related to the risk driver "weather". This is quite usual in practice, because e.g. in a construction project it takes longer to dig out a building pit if it is cold. The weather parameters in the simulation model have to be updated over time.

- In **activity H** the risk driver is the "availability of staff". If we manage to deploy more people, we can speed up the whole project. The estimated number of workers has to be updated as well.

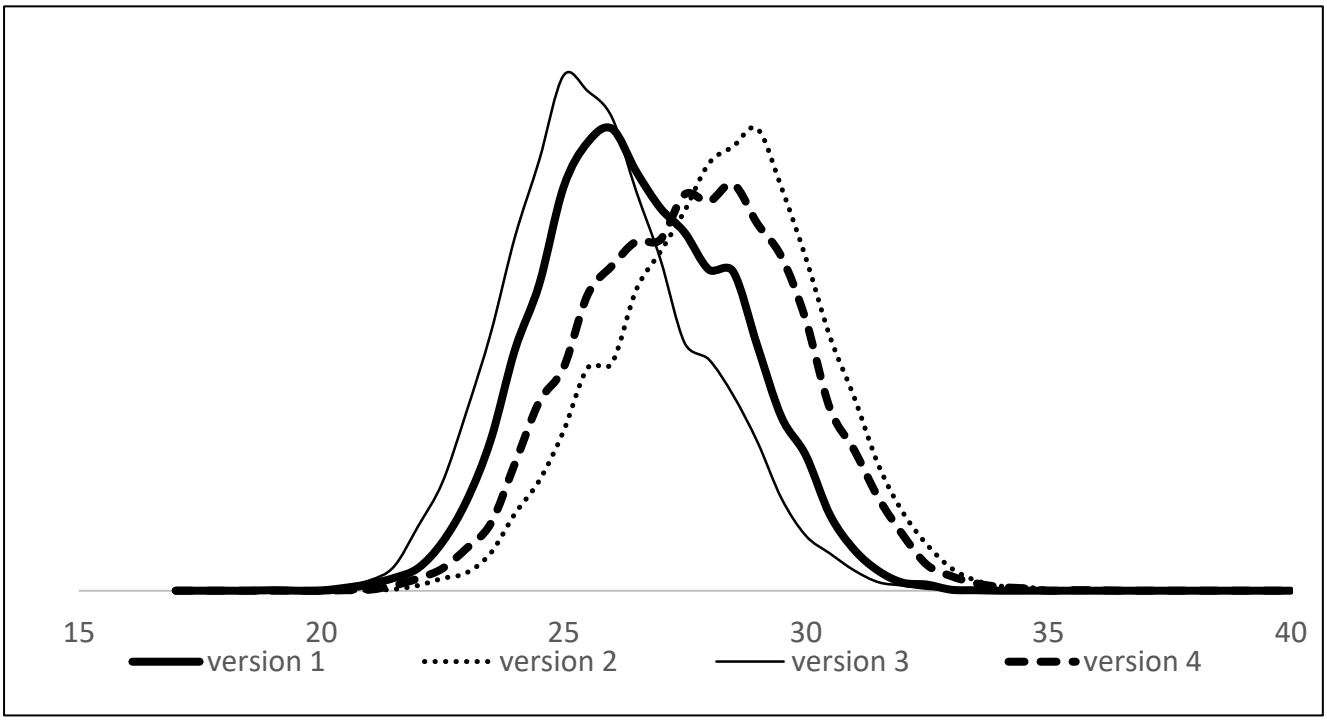
- **Activity J** is in some sense comparable to activity C and experience led to the assumption that if the duration of activity C has been quite long, there is a higher chance that also activity J will last longer.

- The duration of **activity K** depends on the date when the activity can be started. In practice these kinds of conditions might be necessary because we have to regard holiday seasons, weekends or other special periods.

These are only a few examples to illustrate the above mentioned aspects. As you can see, we have conditions that refer to external risk drivers (activities F and H) and others that refer to the project itself (activities J and K). In the passage of time the forecasts of the external risk drivers hopefully become more precise and the durations of the finished activities are known. Therefore, the whole model hopefully becomes more and more precise over time.

Problems like that can be easily modelled by means of Monte Carlo simulation using Excel (c.f. Tysiak/Seresanu (2010)). Fig. 2 shows the densities of the durations of 4 versions:

- version 1: The conditions of activity F and H are both not active.
- version 2: The condition of activity F is active, but not the condition of activity H.
- version 3: The condition of activity H is active, but not the condition of activity F.
- version 4: The conditions of activity F and H are both active.



source: author's construction

Fig. 2. **The densities of the durations of the whole project**

In practice it might be useful to calculate benchmarks to orientate. One popular value is the 95% percentile, which is the duration of the whole project that is kept with a probability of 95%. These values are shown in fig.3. In the Monte Carlo model you have a magnitude of data that offers the opportunity to generate various statistics in order to answer special questions.

	95% percentile
version 1	29.9
version 2	31.4
version 3	29.2
version 4	31.1

source: author's construction

Fig. 3. **The duration of the whole project that is kept with a probability of 95%**

Conclusions and Remarks

Dealing with uncertainties is a quite difficult endeavor. Therefore, everybody who is involved in risk management should be aware of that. If you do not keep in mind that uncertainty is a topic that started to penetrate the human life quite late and by this overstrains the experience of a lot of people, you easily fail in the process of risk management. Especially in projects, the risk management is fully interwoven and pertains to almost everybody involved, not only specialists. Having this in mind, we should follow a few rules to take care that risk management is effective to make the whole project a success.

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In 1995 Wolfgang Tysiak became professor at the University of Applied Sciences and Arts in Dortmund. After studying mathematics, statistics, and business administration at the University Siegen, he received a doctoral degree from the University Wuppertal. After that he worked in the private sector for 12 years, mainly in a consulting firm. During this period most of his work was organized in projects and therefore he gained a lot of experience in applied project management.

At the UAS Dortmund he is a core member of the faculty of business administration. In the EuroMPM (European Master in Project Management) study program, he is mainly responsible for teaching risk management in project.

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