

Decision Making in a Complex and Uncertain Environment

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Abstract: This paper discusses the issues confronting a management board faced with a decision under uncertainty, and their reactions to this perceived riskiness. One particular kind of human behaviour under uncertainty is the use of heuristics (or mental short cuts). These heuristics are described, and then illustrated by a fictitious narrative of a decision on a Business Case by a management board. This narrative highlights the need for an overall framework for decision making in an uncertain environment. Some characteristics of such a framework are described.

1. Introduction

We make our technology investment decisions on the basis of assumptions about what which technology will prevail, both technologically and commercially. We are sometimes nearly right, sometimes badly wrong. More often, we are partly right, and need to adjust, to greater or lesser degree, the investment cases made.

However, senior management understandably requires accountability from the person presenting the case, and the systems put in place in our companies to manage business cases often will attempt to “fossilise” the investment case and track it as per the parameters presented the day it was authorised.

So how can a management board maintain flexibility when authorising a business case (whose details will inevitably turn out to be incorrect in some measure), whilst maintaining management control of the funds with which they have been entrusted by shareholders? I will be proposing some initial characteristics of a framework which would enable senior management teams to ask key questions at critical stages in the decision process, and through a set of management tools enable them to take the decision path appropriate to their context. Following Stacey [1], I will use both propositional and narrative methods in leading to the proposal for the characteristics of such a framework. I will restrict propositional discussion to that of human behaviour when judging and deciding under uncertainty, of which the most notable authorities are Tversky and Kahneman.

2. Risk and Uncertainty

There is ambiguity in the literature with respect to the distinction between risk and uncertainty. Bazerman (1998) appears to imply that a risky decision is one that is taken under uncertainty. However, Tversky and Fox [2] clearly distinguish between the two, referring back to Knight’s [3] distinction between *measurable uncertainty* or *risk* and *unmeasurable uncertainty*, and refer to risk as uncertainty that can be quantified. But it becomes rapidly evident, as Baron [4] notes, that “numerical probabilities are, however, rarely available in real life”.

For practical purposes, therefore, it does not seem to be useful to distinguish between risk and uncertainty in terms of whether one can calculate it or not. A more useful distinction, it seems to me (and one which corresponds more closely to the meanings attributed to the terms “uncertainty” and “risk” by management boards), is to speak of:

- uncertainty when discussing the decision itself and its possible outcomes.
- riskiness when speaking of a decision maker’s perception of the uncertainty surrounding the decision.

3. Dealing with Perceived Riskiness—the Decision Maker’s Attitude to Uncertainty

Arthur [5] states that *Modern psychologists are in reasonable agreement that in situations that are complicated or ill-defined, humans use characteristic and predictable methods of reasoning. These methods are not deductive, but inductive.* The seminal paper “Judgement under Uncertainty: Heuristics and Biases” by Tversky and Kahneman [6] discusses three such heuristics (mental short-cuts we all use when faced with situations where either we do not have the time, or we do not have the cognitive capacity to think a problem through fully) used by humans to assess probabilities and predict values under uncertainty, and the accompanying biases to which we are subject. They are summarised below.

3.1. Representativeness

Tversky and Kahneman give the example of a fictive character, Steve, described as “shy and withdrawn, invariably helpful, but with little interest in people... a meek and tidy soul, he has a need for structure, and a passion for detail.” When asked whether Steve is a farmer, salesman, airline pilot, librarian or physician, most subjects believed that Steve is a librarian, since the description of Steve resembles a common stereotype of a librarian, in spite of the fact that, by the statistical law of prior probabilities, he is more likely to be a farmer. Tversky and Kahneman say that this approach leads to *serious errors, because similarity, or Representativeness, is not influenced by several factors that should affect judgments of probability.* They go on to demonstrate how

subjects (both naïve subjects and experienced research psychologists) consistently violate rational statistical principles, such as prior probability, or sensitivity to sample size, and they do this in a predictable way.

3.2. Availability

People are likely to judge the probability of an event depending on how easy it is to imagine, or how easily it comes to mind. Since frequently occurring events are easier to recall than rare events, availability is often an appropriate cue. However availability (the ease with which it comes to mind) is affected also by most recent events, as well as the vividness of the impact they had on us. For example people who have recently been in a car accident will estimate the probability of car accidents as far higher than people who have never had a car accident.

3.3. Anchoring and Adjustment

In many situations where the answer is not clear, people make estimates by starting from an initial value, which is then adjusted to yield a final answer. But this adjustment is normally only partial, and as a result, the final answer depends heavily on the initial estimate. In an experiment, when Tversky and Kahneman asked people to estimate the percentage of African countries in the United Nations, the median estimates of the percentage of African countries in the United Nations were 25 for groups who received an initial (random) estimate of 10 as starting point, and 45 for groups who received an initial (random) estimate of 65 as starting point. Payoffs for accuracy (i.e. motivation to get the answer right) did not reduce the anchoring effect.

Tversky and Kahneman's conclusion is that: *These heuristics are highly economical and usually effective, but they lead to systematic and predictable errors.*

3.4. A Complementary Approach from Complexity Theory

Kahneman, Slovic and Tversky overtly adopt a cognitivist position in the preface to their collection of papers on judgement under uncertainty [7] in which the above paper is published. This cognitivist approach is strongly challenged by Stacey in the context of human interaction, and other Complexity Science theorists concerned with management suggest that experienced managers instinctively recognize patterns, or "fractals" in situations, and can take important decisions quickly without working through each step of the decision "rationally". Brown and Eisenhardt [8], as well as Stacey suggest that human processes of relating and managing are essentially fractal, like other processes in nature. Koch [9] asserts that: *The fact that business is fractal is the best justification for the case-study method in business schools, although this would be much more useful if we could map the different fractal patterns for different types of businesses.* This "case study" approach closely resembles the "narrative" method for communicating knowledge advocated by Stacey. I will now use this method.

4. Narrative—Imagine yourself in this Position

I am the chair of a senior management board for the authorisation of Business Cases. We are presented with a case for investment in a new feature of MPLS¹ that will give our company significant competitive differentiation for at least six months, if I and my colleagues authorise the Business Case in today's meeting. If we delay development, we may pass over this competitive advantage. The case meets all the company's financial requirements for return on investment, but the investment is significant, and would require us to divert funds off other products. However, the revenue upside is large enough to enable us to exceed our bonussable revenue targets significantly. Current revenue trends suggest that without this case we could miss our targets for this year.

Some of us remember a similar case for a feature in Frame Relay a few years ago. Everyone had believed in the revenue upside, and targets had been changed to reflect the new "reality". But just as the feature was being launched, there was an economic downturn, and companies pulled back on their communications spend. As a result, the case never delivered on its promise, and the top team at the time missed their bonussable P&L target. My Sales Director, who was in post at the time of the Frame Relay case, feels he was "taken for a ride". What is more, he had missed a chance of promotion because he had missed his sales target that year, which he felt was extremely unfair.

My Finance Director is positive about the case, and states that her finance team had reviewed the case thoroughly and reduced initial incremental revenue projections from €300m to €200m over the three years in the case. But my Business Development director responds that he had heard through the grapevine that realistic estimates for incremental revenue were around €100m, so €200m seems ambitious to him. My Marketing Director thinks this is a great case, but she is a close friend of the person presenting the case, so I am not sure to what extent emotional ties are affecting her judgment.

¹ Multi-Protocol Label Switching. A recent Telecoms networking service that enables firms to set up Virtual Private Networks over the Internet, with guaranteed levels of service.

Half way through the presentation, the Sales Director picks up on a flawed assumption, and aggressively attacks the person presenting the case. The presentation (which had been confident and clear up till now), loses pace and conviction, as the presenter loses her composure. The Sales Director goes on to point out that:

- ❑ The sales and volumes forecasts are estimates based on assumptions. If, one assumption is flawed there is a good chance that others underlying the revenue projections are too. If the Group Finance Director gets wind of the revenue upside, our targets for this year may be changed, and we will end up in a “no-win” situation—like Frame Relay.
- ❑ The cost estimates have been made by people who want to be sure that they will obtain the money. He is sure that there is a significant “comfort factor” in the investment figures.

The Networks and Systems Director, who has recently been recruited from another company, chips in: “I remember auditing the budget process a few years ago in my old company. The budget submitted for approval was 50% above the real requirements, after passing through only three levels of management. I also remember my previous company discussing user functionality of the type being proposed here, but with very different technical specifications, though we had not got to the business case stage when I left.”

The presenter responds: “I believe the technical alternative you mentioned was taken into account, I need to confirm this with my technology experts. But if we don’t commit financially to our supplier for this development in the next week or so, we may lose 2 months (because of the summer break) and up to €25m of revenue.”

It is the end of a long day. The Sales Director (who is my deputy) is not willing to approve the case as it stands; most other team members are neutral or positive about the case, but unwilling to overrule the Sales Director. Two of us have flights we need to take, and have to leave in 15 minutes at the latest. Working through the details of the case, as well as addressing the personal issues that are surfacing, will require significant time spent together. Due to summer holidays, the next time we are due to meet is in one month’s time.

Significant uncertainty remains about the decision. Making the decision to commit at least provisionally to the project could mean shareholders’ money down the drain, as well as alienating my deputy. Deciding not to decide could mean that we lose up to €25m incremental revenue.

I try to stand back from the financials and think “what is the *right* thing to do. Our company has decided strategically to focus on MPLS as our flagship product. With respect to the company, I feel there is less risk in committing to limited spend on a project that does not deliver its promises than us passing over competitive advantage in our flagship product (with me being blamed too).

I cut to the chase and suggest we take the decision to commit to the first portion of the development only (it will be up to the presenter to negotiate this with the supplier). I commit to my Sales Director that acceptance of the case will not change this year’s sales targets. He grudgingly accepts. I know he will not be a supporter when we get to implementation stage, but between now and then I have time to bring him round.

5. Commentary

In the scene above, it appears that (apart from rumours) only the Finance Director had been involved in the earlier stages of the decision process that led to the framing and presentation of the choice. Had the presenter perceived the decision she was asking for as a process rather than a single “moment of choice”, she might have spent more time with each team member so as to familiarise them with the situation, give her view on the possible choices, and—most importantly—listen to their judgements and perceptions so that the way the decision was taken would reflect the identity and concerns of the management team.

Since the case is new to the minds of the top team, and there is no time to think things through in dialogue round the table, team members are pushed into use of heuristics. The behaviour of the Sales Director displays characteristics of the Representativeness heuristic (where he applies the “lessons” of the Frame Relay case to the current one), and the Availability heuristic (missing his targets due to the Frame Relay case was extremely painful, and the perceived similarities the MPLS case brings to this pain to the fore again in a forceful and unwelcome way). One can see the phenomenon of anchoring and adjustment in that the Finance Director believes the case to be cautious because her initial anchoring point was €300m, whilst the Business Development Director thinks it is ambitious, because his anchoring point was €100m.

One can see several concurrent “layers” of decision-making in operation. The company strategy is “go for MPLS”, and this decision forms the context of the current decision. The decision on this specific business case also takes place within the context of an annual budget, with the fear that a decision at the level of this Business Case will cause annual targets, which are the result of the annual budgeting process, to be changed. To allay the fears of the Sales Director, the Chair commits to make sure that the company does not confuse the choice on a specific business case with the choices of budgets and targets made on an annual basis. At the same time, the decision taken in this meeting will form the context of, and influence other decisions, not only within the direct line of command of the management team, but also in other parts of the organisation. What we have seen in the

narrative is just a glimpse in a moment of time of a complex system of decisions influencing, and being influenced by, each other.

At the moment of choice, what makes the Sales Director and the Chair nervous is the perceived riskiness of an irrevocable choice. The Chair wisely chooses to break this choice into stages, and commit only as much as he is obliged to. The staged decision above in fact makes intuitive use of notions of Real Options theory [10], [11], and could be improved by formal use of Real Options.

What would really help the management team here is a systemic decision framework that enables them to make sense of, and chart a decision path through, this complex and often confusing environment. Many excellent prescriptive decision processes exist, such as that of Peter Drucker [12]. They are helpful in enabling us to see decisions as processes, rather than as moments in time. However, they often assume a certain predictability in events, as well as rationality (or bounded rationality) on the part of the decision maker. Neither of these assumptions necessarily hold in an uncertain and complex environment.

6. Next Steps

Based on thinking around decision frameworks proposed by other writers, I will propose and test a decision framework that will take into account both the uncertainty of the environment and the behaviour of humans in the face of perceived risk. At each stage of the decision process, I will propose a set of context-dependent management tools. For example, some tools that could be used in the implementation stage of a decision are:

- ❑ Communication tools—clearly a critical part in getting people to “buy in” to the decision, and thus participate in an effective way in its implementation. These will differ according to different contexts.
- ❑ Tools to correct biases stemming from the heuristic of anchoring and adjustment. A universal bias documented by Tversky and Kahneman is that people tend to overestimate the probability of conjunctive events (similar events which follow one another—such as picking seven red marbles in a row from a bag containing 90 red marbles and 10 white marbles). This is why even the most carefully crafted project plan (which is a series of conjunctive events) is almost always too optimistic, since the “base plan” is generally created from (or “anchored” by) the most optimistic scenario, and then adjusted by inserting slack.
- ❑ Tools to combat the well-documented phenomenon of overconfidence in one’s own judgement (4 chapters in [7]), and hence the participants’ overconfidence in achievement of plan.
- ❑ Tools informed by Kauffman’s [13] notion of Robust Constructability in the face of endemic uncertainty. If there are 100 ways to build the house in twenty-two steps, but only three to build it in 20 steps, a more robust plan is to build the house in twenty-two steps. This is a very different approach to creating the most efficient project plan, then building in slack.
- ❑ Tools for tracking implementation of a choice in an uncertain environment that address the need for flexibility, whilst addressing the concern of senior management about accountability and control.

The framework to be developed and tested has the ambition of being a reference point to which a decision maker can turn at any stage of the decision process, see where he or she is, and be able to identify the most appropriate tools and approaches in a particular context.

7. References

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