

By Lorien Pratt and Mark Zangari

## The new science of decision engineering

By bringing engineering discipline to the boardroom telcos can leverage underutilized data sources to support decisions more rigorously and achieve better alignment during decision implementation throughout an organization

**T**he global telecommunications network is arguably the largest, most complex and most reliable technology artifact ever created.

The reason for our success: we excel at coordinating the effort of large numbers of experts to solve difficult, complicated problems.

Over the past two decades, operators' strategic challenges have shifted from the network to the back office. Just as the network benefited from significant innovations in network engineering, new concepts in software engineering have been applied to streamline OSS and BSS.

In most telcos today the source of strategic risk and, therefore, opportunity, has again shifted. It now resides in the ability to make effective decisions quickly, as telcos navigate a turbulent, rapidly evolving competitive environment (see chart on page 26). Although network engineering and software engineering for OSS/BSS are still critical, telcos have become like a ship that can move quickly but lacks a navigational system. Those at the helm are now those most in need of innovation. Steering very high stakes at high speed through enormous complexity has exceeded the limit of what is

manageable by today's ad hoc approaches. Consequently, an opportunity exists for the industry to extend traditional engineering principles into the realm of decision making.

By following decision engineering principles, operators can leverage previously underutilized data sources during decision making, combine the best of both worlds of data and expert judgment, and can achieve better alignment during decision implementation throughout the organization.

These decisions may be at many levels, from the strategic choice for a new geographic market, down to a tactical decision regarding how much to charge for a new product.

### Lost in complexity

As with network and software engineering, the need for a decision engineering discipline arises from complexities that cannot be effectively managed using informal approaches. Complexity may arise from many sources. First, the sheer number of factors that must be considered in making the decision, and their inter-relationships, can overwhelm the capabilities of a decision maker who relies on informal methods. Consider setting the parameters for a typical

### Elements of Decision Engineering

#### Planning

■ Specification

■ Design

■ Alignment

■ Quality Assurance

#### Implementation

■ Monitoring

■ Replanning

product – a process that must take into account features, pricing, QoS, marketing, competitors, etc. Not only are there many such factors, but they also affect one another. Changing pricing, for example, changes the demographics that are attracted to the product, the level of QoS that is possible, and the response of competitors. These relationships are highly non-linear, rendering simple reasoning about them dangerously ineffective.

Time adds additional complexity. Factors affecting a decision rarely remain static. In addition, the criteria used to make the decision, the constraints it

must satisfy, and even the outputs of the decision itself will all typically evolve. So a change control process that can handle both the rate and extent of change, and be able to quickly assess its impact, is essential.

Another source of complexity arises from the data that populates the quantitative elements in the decision model. Data may be obtained from sources such as an organization's operations, an external vendor or from a study commissioned to guide a decision. Each data source adds complexity. The first, in particular, is often problematic for at least two reasons. Operations data repositories are often both very large and extremely hard to access without significant IT expenditure. External and empirical data present their own challenges, principally ensuring that the data provided aligns with that needed to inform the decision.

Finally, there is the matter of uncertainty. Data is often not available, is vague or imprecise, or is of questionable accuracy or reliability. Clearly understanding the effect of unreliable data as it propagates through the decision process adds yet further complexity.

Considering all this, combined with what is at stake when significant decisions are made in any large organization, it is not surprising that there is a limit, which we refer to as the complexity ceiling, beyond which effective decisions can no longer reliably be made using unstructured, ad hoc methods (see table). It is analogous to a limit on the size of building that could safely be built without architectural blueprints and the discipline of construction engineering. Perhaps a small cottage might be safely erected this way, but certainly not a skyscraper.

## Decision engineering

Fortunately, other disciplines have faced similar limitations of informal methods, which they have overcome through what may be considered engineering practices. Many of these practices are being adapted to decision making

and execution. Together, they constitute a discipline we call "decision engineering".

Decision engineering (unlike "decision support") covers a lifecycle from initial specification through implementation and then through a replanning / new decision loop.

On the planning side, decision specification captures and documents what the decision is required to achieve, the choices available to decision makers, and

the restrictions that constrain choices. For example, we may request a decision for the right product to launch to raise revenues under the restriction that the risk of making a net loss is kept under a certain value.

Decision design is the heart of the decision engineering process, and includes methodologies, tools and processes for creating the decision itself. As with an architect's blueprint or software UML diagram, a shared visual language

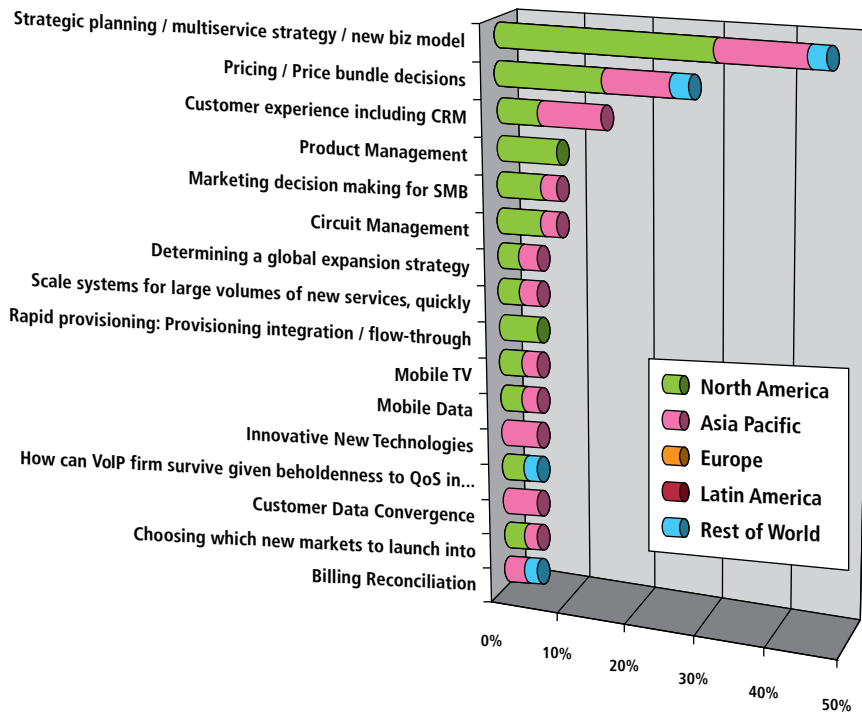
## Signs of the decision complexity ceiling

- Decisions are made based on ego and power politics  
The loudest person in a room, or the best story teller, wins
- Alternatively, decisions are made only "by the numbers", without expert judgment
- Some claim they are "drowning in spreadsheets"
- Valuable data sources are ignored
- Different departments have different understandings – down to basic vocabulary – of strategic direction
- Decision corner-cutting is pervasive

## How cutting corners leads to poor decisions

- We use one measure, such as ARPU, when there are multiple objectives (such as, in addition, shareholder value and market share)
- We focus on measurable factors at the extent of important intangibles (like morale and reputation)
- We don't consider opportunity cost (i.e. the cost of expending all resources on one product at the expense of another)
- We make decisions that assume an unchanging future
- We focus on only the short term
- We are unable to reason about cause-and-effect chains, like the impact that our QoS improvements have on our competitors' costs as they attempt to match our standard
- Quantitative short cuts:
  - We ignore important statistical information (such as base rates)
  - We spend too much effort acquiring data that is irrelevant to a decision
  - There is insufficient monitoring of relevant factors
  - We abstract to general cases from an insufficiently diverse sample (e.g. assuming all customers are the same)
  - We plan for only a single future scenario
  - We aggregate data prematurely (e.g. into average usage), losing important nuances (such as usage by teens)

## Telecom executive answers to "What are the most important issues you face today?"



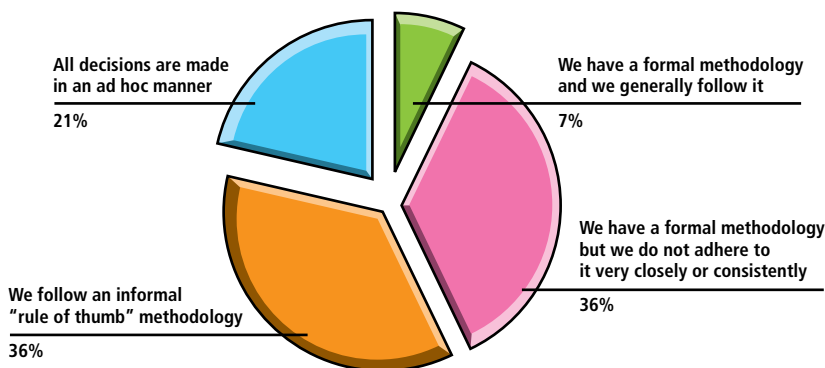
for expressing decision elements, their properties and the relationships between them is critical. Such diagrams unambiguously both record and communicate assumptions, data sources, conclusions and flow of reasoning.

Core to effective collaborative decision design is an iterative refinement

process, where detail is gradually added. For instance, an initial, rough approximation for a product's demand curve may be made more accurate as data is acquired.

An important best practice during decision design is to plan for a number of future scenarios, to be triggered based

## Telecom executive answers to "How are decisions generally made in your company?"



Quantellia 2008 State of the Telecom Industry Study  
Number of respondents to this question = 14

on currently uncertain information. For instance, many telcos are creating different plans for future recession and non-recession scenarios.

Many situations call for planning a sequence of decisions each of which affects the others, and which may need to be made over time.

Decision quality assurance comprises processes that detect potential errors in a decision. We can evaluate a decision for incorrect assumptions, flawed reasoning, statistical bias and other errors.

As a decision is implemented, it is particularly important that we monitor key factors (i.e. those that have a high impact) against expectations. Note that dashboards and revenue assurance techniques fit here: instead of monitoring arbitrarily, we do so in the context of planning expectations.

Finally, if during monitoring, new information arises indicating the original decision should be adjusted, then replanning begins. Throughout the decision-making process, alignment throughout the organization is critical. Visual decision design greatly facilitates this, especially in assisting alignment when decisions change.

The need for decision engineering has emerged gradually over the history of telecommunications. Today, it is clear that we have reached a watershed, where offering superior technology alone is not enough to compete effectively. Technology is but one of many factors about which telecom leaders must make rapid, high-value decisions. To create the kinds of organizations that will succeed in the current and future environments, we must augment our own skills and experience with a rational, structured, scalable decision making paradigm.

Decision engineering is critical for managing the complexities we face as we steer telecommunications companies into the 21st century. **TA**

*Lorien Pratt and Mark Zangari are founding a new software and consulting company called Quantellia ([www.quantellia.com](http://www.quantellia.com)), providing decision engineering software and services*