SD-Modelling in corporate strategic planning and scenario building

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Abstract
As in many other companies, KPN, the largest Dutch telco operator, has used scenario planning as an aid to strategic planning and business development. We experienced that to give scenarios a full-grown and independent place in the planning cycle of the company, just writing future stories at a highly qualitative level is insufficient. To really get in contact with financial officers, planners and strategists, the scenarios should have a strong quantitative component.

Introduction
This paper will focus on scenarios, quantification and the role of SD-Modelling therein. First, we will give a (rough) definition of a scenario. Secondly, we will explain what can be accomplished by the use of scenarios. Then, the quantification process and the use of SD-Modelling will be explained. Most examples are derived from a project in which both scenarios and SD-Modelling played an important role. A description of this project can be found in the appendix.

A definition of scenarios
A scenario is basically a story about the future. It is not only a description of a possible 'steady state' at a certain point in the future: the scenario also tells us what lies in between the present and some moment in the future. A scenario can thus be seen as a movie, rather than as a photograph. For example, a story about the development of mobile telephony will not only tell us something about the penetration of mobile phones in the year 2005, but also how this state of the world was reached throughout the years 2000-2005, and what happened in the field of mobile telephony during this period.

A scenario never focuses on the outcome of one uncertainty; it always incorporates a whole range of ideas and concepts. In other words: a scenario is never black and white, but always colorful. In the above example, the story about mobile telephony will not be enough to constitute a scenario; something must also be said about, for instance, other telecommunications technology, cultural changes and economic growth.

Scenarios are always used in multiples: the power of a scenario lies not in the purpose of story-telling, but in the fact that multiple scenarios can be compared to each other.
Scenarios never aim to make a prediction, or a forecast about the future; they just tell us what a possible state of the future might be. For this reason, there is no such thing as a 'most likely' or average scenario.
Often, scenarios are created by examining the combination of two important factors or main ideas that might influence the future. For example, one might focus on the factors of economical growth and the concept of individuality. Each factor can have the value 'high' or 'low'. This will yield four different scenarios (see Figure 1).
Each scenario can then be built around the ideas that one has about the future, given a unique combination of the two factors economical growth and individuality.
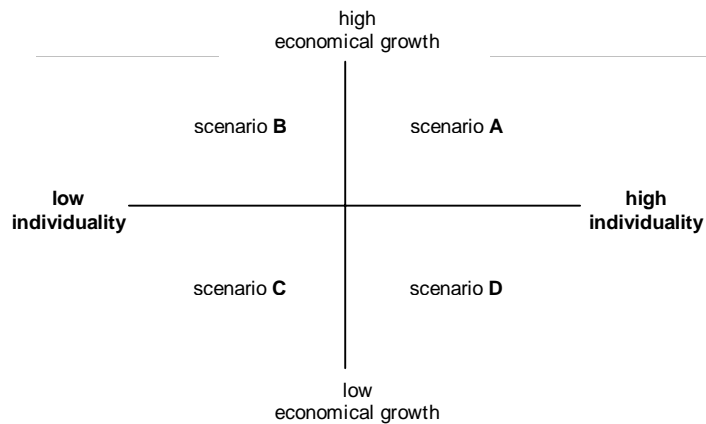
economical growth

scenario **B**   scenario **A**

**low
individuality**   **high
individuality**

scenario **C**   scenario **D**

low
economical growth

Figure 1: the idea of scenario quadrants

The use of scenarios

Scenario builders put in a lot of effort to write stories and as such they play an important role in stretching the minds and spirits of scenario clients. Scenario stories that are well written can give someone the idea that he or she is actually in the future. Scenarios help to think 'out of the box', since most people tend to think along an average flow of ideas, or only consider factors that are immediately obvious to them.

Scenarios are often used in strategic corporate planning. This is because strategy is by definition an attempt to anticipate on possible states of the future, thereby considering all sorts of factors, trends and possible events.

In practice, it has often been seen that, after the scenario stories have been read and used in a workshop, mostly in a nice country-like setting, the users or clients of the scenario builders go back to their offices and continue their work just as if nothing happened. Being involved in the future by means of scenarios is then nothing more that a sweet memory of a forward-looking event. Fortunately, not only scenario builders recognise this, but also employees who are serious about using scenarios in their planning process.

The answer to this problem is not straightforward. In our experience, a qualitative description of the future has proven to be insufficient in certain cases. Therefore, as explained in the next chapter, a quantification of the scenarios is needed. In the above example, the value 'high' of economic growth will have to be replaced by '5% per year', for instance. We will elaborate on this in the next chapter.

The quantification of scenarios

We at KPN discovered that to give scenarios a full-grown and independent place in the planning cycle of a company, just writing future stories with a strong qualitative character is insufficient since a lot of potential scenario users speak a different language. To really get in contact with financial officers, planners and strategists, the scenarios should have a strong quantitative component too. Only then will they be used in writing and testing marketing and strategic plans.

How do we obtain a good quantification of a scenario? The answer lies in the scenario writing process. This process should be tailored to the purpose of quantification from the beginning. This involves - amongst other things - two elements in the process.

The first element is to give the scenarios a certain level of abstraction. The second element is to make use of SD-Modelling. Both elements will be discussed below.

In our experience, a team of scenario writers worked closely with a team of SD-Modellers throughout the whole project. The combined skills of the team ensured that both elements were present in the scenario building process.

Element 1: Abstraction

To give scenarios a certain level of abstraction, one has to ensure that the scenario stories are based upon a certain *set of variables*. Each scenario should be based on the same variables.

Each scenario will probably emphasize certain variables, but every scenario should tell the reader at least something about each variable. These variables can later be given a different value for each scenario. Each unique combination of variable values thus defines a scenario. How to pick the set of variables that will form the basis for each scenario? The answer to this lies in the co-operation of the scenario writers and the modelling team. Both teams impose certain requirements on the variables. These are as follows:

The scenario writers will want to make sure that every scenario can incorporate the variable in its story. The variable 'level of competition in the videophone market' is only of importance in the scenario where there is actually a market for videophones.
Secondly, the scenario writers will have to take care that the variables vary enough between the scenarios. The variable 'death rate of teenagers' is not likely to change much in the near future, even though it may have a certain effect on the market for videophones.
Certainly, the story writers will not want to base their scenarios around this variable.

The modelling team will need to be able to find appropriate values for each variable.
The variable 'influence of the telecom regulator', though very important in modelling the telecommunications industry, is not easily quantifyable since it lacks unit or dimension. In this case, using the variable 'maximum price for a mobile phone' is probably a better idea. Furthermore, the modelling team will have to ensure that the variables all have a certain effect within the SD structure of the model. A variable that tells us something about the influence of the greenhouse effect will be pretty useless when modelling the market for highspeed access, although it may be used in adding flavor to the different scenarios.

Element 2: System Dynamics

System Dynamics (SD) is a powerful tool that can help to quantify scenarios.
To begin with, the causal relations between variables are not yet identified in the qualitative description of the scenario. With the aid of qualitative SD, one can make a mental model or a causal loop diagram of the scenario. The question remains whether such a causal loop diagram will be the same in every scenario. In other words: is it just the *values* of the variables that are different between the scenarios?
In our experience, we concluded that the answer to this question should be 'yes'. Based on just one causal loop diagram, we were able to construct a model in which for each scenario different values for a set of variables were assigned. In our case, this proved to yield enough interesting (different, but relevant) results to use as input for the strategic discussion.

System Dynamics can do more. During the process in which variables get values assigned to them, the team has to think about which values are appropriate. Some variables may prove to be easily quantifyable. An example is the market penetration of mobile phones, which can relatively easily be measured. Other variables, like the rate of individualization, are harder to assign a value to. The scenario writers may feel that this variable has a significant effect on things when ranged between 'low' and 'high'. But which values correspond to these rather qualitative values? To determine this, one has to look at the variables that will be influenced by the rate of individualization, for example the average household size. This variable will vary as the rate of individualization is varied. By building a SD model, one can 'test' which values for the rate of individualization will be needed to obtain the corresponding values for the household size.

Last but not least, a SD model can serve to include decisions involving the company's strategy.
Since scenarios are often used in strategic planning sessions, one will be interested in the effect of the combination of a scenario and a certain corporate strategy on the company's business or

environment. In other words: what will happen when scenario X occurs, while the company has chosen to implement strategy Y? A qualitative story will not be able to provide a good prediction of the outcome. A SD model will do just that. Also, a collection of (quantitative) graphs derived from the outcomes of a SD model can tell much more than a (qualitative) story within a scenario.

Appendix: the project
The case study that we carried out developed the scenarios for KPN Carrier Services, a business unit involved in giving competitors access to the KPN networks. Its activities can be characterized as very busy and complex, due to the increased competition in the Dutch telecommunications market and the dominant role of the regulator. Still, they have managed to get their organization right and to devote less of their time to short-term problems. Because KPN Carrier Services wanted to use the scenarios not only for thinking out of the box but also for preparing its business plan, it was clear that the scenarios had to include a quantitative component as well.

We started by conducting three expert interviews to get to know the main variables and uncertainties. On the basis of this knowledge, we organized a group session in which we explored these variables and uncertainties, giving both the SD-Modelling and scenario story writing group enough information to proceed. The next step was to start writing the scenarios and building the model Figure 2).
During this process there was regular contact with the most important stakeholders of the scenarios, i.e. the three interviewees.
The scenarios were presented in a closing group session with the same people as before. The session also helped the group in figuring out what the consequences were for KPN's corporate strategy, its business units' strategies and the technologies to be used. All the decisions made concerning the values of the strategic scenario parameters were calculated in the model. This enabled users to obtain a more comprehensive view on what their futures could be like and what their actions would imply for their business.
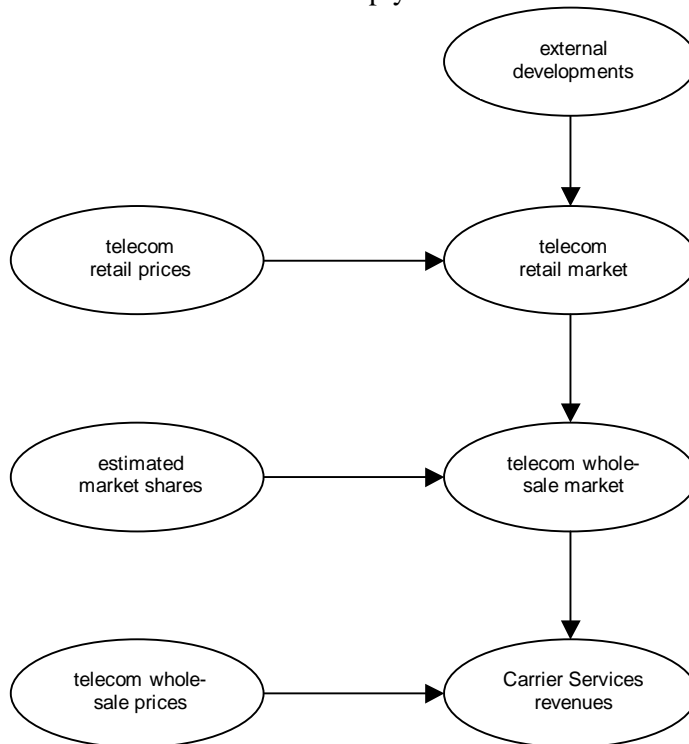

Figure 2: the business model

The business model starts with a model of the external developments of a demographic (e.g. the number of inhabitants), social (e.g. free time spending) and economic (e.g. household income) nature. These external variables, together with retail prices influence the total demand for telecommunications. The estimated retail demand for telecommunications services were then distributed (by using estimated market shares) over the different telecommunications operators in order to estimate wholesale demand. The wholesale demand for Carrier Services multiplied by the wholesale price was an estimation of the revenues of Carrier Services. In this model, costs are not taken into account.

Concluding remarks

System Dynamics (SD) is a powerful tool that can help to quantify scenarios. Each scenario writing team that wants to add a quantitative component to their stories should have SD Modellers in their team.

Literature

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