Cognitive Applets

A New Approach to the Management of Strategic Risks

The aim of risk management is to identify risks in good time and to assess and overcome them. Regarding their contents, strategic risks may, for example, be understood as a possible consequence of incorrect business decisions, a poor implementation of decisions or a lack of ability to adapt to changes in a company's environment. Compared to other types of risk, such as operative or financial risks or risks resulting from changes in the market prices, they are characterized at the formal level by a greater degree of complexity and shorter data histories. Additionally, the analysis of strategic risks is rendered more difficult by the fact that over the course of a planning period of several years new, as yet unknown, risk-driving factors may arise. For the purpose of ensuring its long-term success it is important that each company should combine its risk management with the aims of its strategic management.

Strategic risk management concerns itself essentially with two main tasks (cf. ► Fig. 01):

- Identification of the strategic risks and the analysis and evaluation of the essential risk-driving factors;
- Formulation of an adequate risk policy as part of the company strategy for dealing with these risks.

The expression of a company's strategic risk policy is the definition of the core risks that the company is to bear itself and the dispensable side risks that are not to be entered into or to be shifted onto other companies. Such thoughts are indispensable for the shaping of the entrepreneurial business model and may, over the course of time, lead to ever new results due to ever-changing framework conditions. For example the BMW Group, in the year 2004, awarded the production of the model X3 externally to Magna International in Steyr. Following a review of this strategic decision in the year 2010, the production was relocated back to the company's own plant in Spartanburg, South Carolina. A further example is the complete strategic realignment of a company, as was the case with Mannesmann AG. As a result of a management resolution from the year 1999 the core business was transformed from the production of tubular steel to the setting up and operating of the mobile telephone network D2. Strategic risk policy as part of the company planning thus served the purpose of ensuring the company's long-term success.

The formulation of a strategic risk policy can only succeed if the strategic risks have been identified, analyzed and evaluated correctly, and that for the entire period of the company's long-term planning. At the core of this analytical process are the description of the risk-driving factors and their mutual dependences. The degree of fluctuation in the strategic risk portfolio is essentially determined by the interactions (correlations) between those risk drivers. Thus the aggregation of risks at portfolio level may lead to a reduction in the portfolio risk and thus in its turn to a reduction in the amount of risk capital required to cover unexpected losses (VaR approach).

Circulation model of Risk Management **► Fig. 01**

Risk-bearing capacity
Risk monitoring
Risk identification
Risk policy
Risk analysis
Risk evaluation

Nosco® focuses the risk analysis and evaluation

The risk drivers, for example for development projects in the automobile industry, may considered to be, from the "Market Environment", competitors, sales volumes, substitution products and new megatrends (for example alternative drive systems). From the field "Vehicle Characteristics" quality, comfort, cost of ownership and suppliers' structure and from that of "Processes" innovations the awarding of external contracts, production technology make themselves felt. The recognition of the correlations between these factors, the measuring thereof and the estimation of their regenerative effect upon the operative cash-flow of the project represent a challenge to the departments affected within the company [cf. Stenner 2010, p. 13]. Similar interdependences also apply to the counterparty risk in connection with the lending business of a bank. Here the risk drivers might be: developments on the markets for interest rates, bonds and stocks and shares, the development of the Gross Domestic Product and the rate of unemployment. Positive correlations between the driving factors may lead to undesired risk concentrations, so-called cluster risks. With the aid of the scenario analyses the loss rates for the planning periods and the effects upon the risk-bearing capacities of the bank may be estimated [cf. Schlottmann/Vorgrimler].

When evaluating financial risks and the risks of changes in market prices statistical variables such as standard deviations, covariances and correlation coefficients have asserted themselves. They are determined on the basis of the changes in values noted in the past and, with the aid of historical simulation, used as a basis for the forecasting of the price performance over a foreseeable future period of time (as a general rule, 12 months).

The symmetrical and static construction of these variables only permits an extremely limited reflection of reality, however.

- Thus it is that the standard deviation gives equal weight to negative and positive deviations from the expected value. Covariances and correlation coefficients also presume a symmetrical relationship between risks, i.e. the extent and intensity of the dependency between the risks X and Y is, from the point of view of X, identical to the one from the point of view of Y. Asymmetrical or one-way relationships between risks cannot be reflected using these variables.

- These variables are not subject to any temporal changes. It is presumed that the dependences that were measured yesterday will also still apply tomorrow. In reality, the interactions between risks are of a dynamic nature; they change over the course of time. Their intensity may increase or decrease and they may take effect at a later or at an earlier date.

- The “Neue Züricher Zeitung” (in its issue of 24.5.2012), with a view to the practical application of the known correlation approach, rightly notes: “By splitting assets among a few correlating investment forms an investor could eliminate the so-called unsystematic risk to a large extent and thus reduce the overall risk, according to the theory. This theory, at a simple level, does have a grave error, however. It does not explain that correlations – a measure of the synchronization of prices and courses – are not constant, but indeed endogenous to the system. [...] Evaluation and risk management models in which correlations play a part must (*therefore*) be treated with the necessary caution. Only in the past few days was JP Morgan forced to experience how incorrect correlation assumptions expensive can be. They cost the bank one thousand million dollars."

The problem has thus been recognized, but how is it to be dealt with?

The aim, first and foremost, must be to reflect the complex interplay between time-sensitive interdependences between risk drivers. This modeling approach, for example in the solution offered by Nosco, exploits the principles of neuroanatomy and neurophysiology and replaces mathematical correlations by biological impulses or effects. This alternative model approach concerns itself with information processing in the sense of the functional principles of human perception. Such **cog**nitive app**lets** grant new insights into the dynamics of complex systems and help to understand and comprehend changes in content and causal relations in their respective temporal expressions holistically. At the heart of Coglet-technology, therefore, we do not merely find connections between statistics or rather stochastics, such as probability distributions and chance processes, but also natural linguistic communication. Human beings think in their own languages and the written word facilitates the holistic cognitive process. This happens in two ways: on the one hand by way of the shaping of the software architecture of the application of the software in itself and on the other in the interaction with the user.

- Software architecture: Nosco's impulse-guided manner of working is shaped by analogy to the example of the human brain. By taking the interaction between the causal relationships of the factors to one another into account new and, in part, unexpected causal profiles become apparent which can, in the long run, contribute towards the finding of an innovative solution.

- Interaction between user and application: the presentation of the results and information should strengthen and optimize the user's systemic understanding. The user should interactively search for creative paths to a solution. The often contradictory solutions offered by the software require from the user a precise interpretation that broadens his perceptual horizon.

These aspects of the cognitive applets confirm why this methodological approach is particularly well-suited to the analysis of strategic risks, not so much by way of quantifying the risk parameters as by way of supporting the time-sensitive shaping of a scenario. The tool offers the possibility of recognition when which risk factors make themselves felt or rather the effects that disappearing or altered risk factors may have upon the system as a whole. Beyond that, the program also allows one to identify collateral effects and to differentiate between side effects and main sources of risk.

The Interaction Model

Generally speaking this methodological approach makes the description and integration of any number of risk factors in the most widely differing manners possible. The interdependences, by way of analogy with neurobiology are defined as impulses and described from five causal perspectives. The **Impulse Type** is divided into:

- Stimulating impulses: they describe positive causal dependences (algebraic sign +)

- Restrictive impulses: they describe negative causal dependences (algebraic sign –)

The **Impulse Strength** stands for the intensity of the effect thereof on the target factor and differentiates between five degrees of strength (1, 2, 3, 4, 5).

By way of the **Impulse Profile** the user may allow the intensity of the effect of the factor to either remain constant, increase or decrease (constant, rising, declining) throughout.

The **Impulse Latency** reflects the temporal dimension of the dependency. It determines the point in time at which the influence of one factor upon the other factor is revealed. The model provides for five time frames (0, 1, 2, 3, 4), for example, six-month periods. By way of setting the latency values the user is able to incorporate leading and lagging effects in the program run.

The **Impulse Duration** is a measurement of time revealing the duration of the effect of an impulse. It encompasses 1 to 4 temporal units.

With the aid of this toolbox containing a five-dimensional description (type, strength, profile, latency, duration) of the radii of impulses the user of the program is able, of course, to capture the dependences in the real world far more precisely in his model than the static correlation coefficient (k) on the linear scale *–1 < k > + 1* permits (cf. ► Fig. 02).

Impulses describe causal dependences **► Fig. 02**

Impulse Type
Impulse Strength
Impulse Latency
Impulse Duration
Impulse Profile

Source: Nosco Collaborative Cognitive Computing

The creative potential for the model-like reflection of causal relationships may be illustrated using the following simple example: if one examines, in the context of a planning scenario, the impacts of economic developments in the USA and in Europe the correlation coefficient for the growth rates in both economic areas for the coming ca. 12 months is determined on the basis of the selected historical data and the scenario analysis based thereupon. The interdependencies for these two half-years will thus be described, for example, as being + 0.5. The growth rates for both economies correlate positively at medium strength.

This approach offers far greater scope for the description of these causal relationships. Approximately thus: the growth of the Gross Domestic Product in the EU furthers growth in the USA (Impulse Type +), this effect is assigned medium strength (Impulse Strength 3), the effect commences in the second half-year period (Impulse Latency 2) and continues over two time frames (Impulse Duration: 2). Within these two time frames the effect of the impulse will increase (Impulse Profile: rising). This causal relationship is assigned the description (+, 3, 2, 2, rising) and completes a field in the causal matrix that is to be completed by further causal relationships. In contrast to the standard correlation tables in which two parameters are dependent upon one another symmetrically, the direction of the link plays an important role in this. Should Factor A influence Factor B, this does not necessarily apply vice versa – if and how Factor A depends upon Factor B must be defined separately. This principle of one-way directionality opens up additional creative leeway. In our chosen example, therefore, the causal relationship EU → USA could be defined as (+, 3, 2, 2, rising) whilst the causal relationship USA → EU could be described as (+, 3, 3, 1, constant), i.e. Impulse Type: positive effect, Impulse Strength: Grade 3, Impulse Latency: Effect commences in the third half-year period, Impulse Duration: the effect continues for a period of six months and remains constant during this time (Impulse Profile).

The possibility of deploying five characteristics to describe a causal dependency makes it clear that an exactly symmetrical causal relationship between two factors can only be an exceptional case.

It is a peculiar feature of this neurobiological approach that the transfer of the impulse does not progress in a linear manner but is dependent upon a threshold value. Only if the sum total of the incoming impulse should exceed a certain absolute minimum value is the impulse passed on. Should this value not be reached, no impulse is passed on in accordance with the All-or-Nothing Principle. The newly transmitted impulse is restricted by a maximum value that cannot be exceeded.

The calibration of the threshold value is decisive for the definition of the causal dependences. This defines the minimum value of a causal dependency in order that an effect may unfold itself in the first place. This value is to be defined in accordance with the particular application situation. The general rule applies that the lower the threshold value, the stronger the data torrent and, vice versa, the higher the threshold value, the weaker the data torrent. The correct calibration is to be tested by the user according to the “trial and error” principle.

The Impulse Maximum is a further important control lever for the relevance of an impulse. The capping of an impulse by way of the Impulse Maximum describes in the program the natural phenomenon not to allow impulses to increase without hindrance. The role which is performed by a muscle in a human organism could be played by liquidity in a business enterprise. Should a dangerous scarcity of liquid funds be recognized in good time and automatically prevented, this development leads to an easing of the strain on the ability to pay. By way of the capping of the Impulse Maximum a short-term inhibitive mechanism is integrated that will not take effect until after the liquidity calculation within the respective timeframe has been completed and will not necessarily require a total recalculation of the liquidity planning. One thus takes the rapid subsequent correction of entrepreneurial liquidity planning into account, as is also done in reality.

Summary

The modeling of causal relationships based upon cognitive applets is characterized by a high degree of flexibility and enables a precise reproduction of the manifold causal dependences from the real company environment. The strength of the impulse to be passed on is – derived – thereby heeding the respective algebraic sign - from the multiplication of all incoming impulses with their degrees of strength. The program supplies the required quantitative information for the determination of the desired amount of risk covering assets with the aid of the VaR-approach, such as the probability distributions of relevant values within a defined timeframe. It furthermore also produces text descriptions of future developments dependent upon the given initial situation. The model approach is thus eminently suitable for deployment during the analysis and evaluation phases of the risk management process. The methodological approach feeds off expert opinions that, when linked to one another in a meaningful manner, reveal one (of many) possible developments. One target is the relinquishing of subjective, intuitive expectations. It supports, simply and comfortably, a process, triggered by the user, of adaptation of the risk drivers to new environmental conditions. The principle is based upon the close interaction between the user and the program. In the context of risk management the stable and therefore relevant risk parameters for strategic company planning are determined. They form the foundation for the controlling the strategic risks.

Bibliography and recommendations for further reading:

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Author:
Prof. Dr. Frank Stenner, Pullach.