MORAL HAZARD IN STRATEGY IMPLEMENTATION: SIMULATION AND ANALYSIS

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Abstract
Implementing strategic initiatives is likely one of the most challenging management tasks in today's corporate world. Usually, required changes are so significant in scope and nature that the owner of a strategy cannot succeed in implementation without delegating much of the responsibilities to a lower level manager. One key question for the strategy owner then becomes to determine how to incentivize the manager to act in line with organizational goals. The manager, because of his knowledge of the organization and operational details, frequently possesses more information than the strategy owner regarding enabling factors, potential obstacles of the implementation and overall chances of success. This asymmetric distribution of information carries the risk that the manager "cheats" on the strategy owner. This article deals with issues of moral hazard in the context of strategy implementation. Building upon Porter and Lawler's model of managerial motivation, potential behaviour of the manager is mathematically modelled, simulated, graphically presented and discussed. Simulation results suggest that cheating indeed pays off for the manager. The article closes with recommendations on further research in the context presented in this study.

Keywords:
Strategy, strategy implementation, motivation, behaviour, simulation.

JEL Classification:
L2, D23, D90, C6.

Introduction
On a regular basis, strategies do not develop their full potential (Mankins and Steele, 2005). This may be due to a poorly defined strategy in the first place, however several studies have identified obstacles which hinder successful implementation of what may have otherwise been a sound strategic initiative (Alexander, 1985; Al-Ghamdi, 1998; Johnson, 2004; Hrebiniak, 2005; Brenes, Mena and Molina, 2008). Yet, this part of Strategic Management receives only marginal recognition in the academic community. Based on a Google Scholar search, less than 3% of all publications in the field of strategy between 2005 and 2014 were related to strategy implementation or strategy execution. This by far doesn't take justice to the importance of the topic.
Since the early days of strategic management, when Chandler and Ansoff introduced their ideas on strategy (Chandler, 1962; Ansoff, 1965) the field has developed much further. Most noticeable is Michel Porter's work on sources and drivers for competitive advantages

(Porter, 1985). Researchers approach strategic issues from a variety of perspectives. Broadly speaking, two main streams can be distinguished. One being the normative wing which views strategy as something that can be actively designed and managed. The other wing is descriptive in nature and aims at understanding how strategies develop in corporate settings. Mintzberg and Waters have introduced the term of emergent strategies which evolve out of collective behavior of an organization as opposed to deliberately designed strategic plans (Mintzberg and Waters, 1985). For this study, the authors take on a normative view with strategy formation and implementation being distinctive phases of the strategic management process (Kolks, 1990). Of course, this does not mean that aspects of implementation would not be considered and addressed during the phase of strategy formation or that there wouldn't be interaction between the two phases. But formation and implementation are separately managed and individually addressed.

From a timing perspective, strategic change can take place incrementally or as a "big-bang" while the extent of change can be transformational or a mere re-alignment (Hailey and Balogun, 2002). This study assumes that a significant change has to be executed within a relative short period of time (Kolks, 1990). Both scope and content of such a significant change will require the owner of the strategy to delegate all or part of the implementation to a subordinated manager. Such delegations always bear problems of control. Absent other feasible solutions, the strategy owner will try to align the goals of the manager with his own by setting corresponding incentives. While incentive systems have not proven to increase efficiency over longer periods of time they are very useful to focus and bundle effort for short to medium term projects (Sprenger, 2014). Incentives can take different forms (monetary vs. non-monetary; linear schemes vs. non-linear schemes; long-term incentives vs. short term, and many more). The present study focusses on a monetary scheme with a fixed base pay and variable pay which is linked to the achievement of agreed, measurable goals.

Theoretical context

As outlined in (Kiehne *et al.*, 2017; Kiehne, Arp and Schüler, 2017), by making a few additional assumptions, Lyman Porter and Edward Lawler' model of managerial motivation can be transformed into a principal-agent-model. In this study, the authors use a LEN-model (see for example (Laux, 1990)) to model, simulate and analyze how the manager, who has been tasked with implementing the strategic initiative, behaves and what the consequences of his choices are on his own well-being and how they impact the owner of the strategy.

Situations of delegation are frequently characterized by asymmetric information. Either because the delegating party doesn't have enough resources or enough knowledge, the manager frequently develops more and better information about the tasks to be fulfilled, about relevant process and system parameters, and the likelihood of success. Holmström has first analyzed this behavior of moral hazard (Holmstrom, 1979). The manager may use his additional information to act in a way not anticipated and appreciated by the owner of the strategy (hidden action).

In the next section the LEN-model which was used as the basis for the analysis will be introduced in more detail and it will be briefly explained how the optimal factors for a linear compensation scheme can be determined. Following this, the authors will simulate which hidden actions the manager may make if he developed additional information regarding some key parameters which the strategy owner had assumed when offering a certain incentive scheme to him. The results will be illustrated by multiple graphs and interpreted and discussed at the end of the paper.

The Base Model

The strategy owner delegates all or parts of a strategy implementation task to a manager. He cannot directly observe the manager's behavior but he can measure the output, i.e. the degree to which the strategy has been implemented. The strategy owner knows that higher effort by the manager increases expected implementation results. Highest and lowest possible outcomes remain the same in all possible scenarios. All outcomes are possible with any level of effort by the manager, just with different probabilities.

The input-output-relation is assumed as: $E(O) = x * I$, with $I \triangleq$ the manager's effort level, $E(O) \triangleq$ the expected output, $x \triangleq$ the "productivity" factor of the manager. Output is normally distributed with variance σ^2.

The basic assumption is that strategy owner and manager share symmetric information. The strategy owner is risk neutral. The manager is risk averse with 'a' being his Arrow-Pratt-Risk measure. The manager's utility function is $U_M(B,I) = - e^{-a*B} - y*I^2$, i.e. additively separable regarding compensation B and penalty of work. The manager's penalty of work factor is 'y'. The manager has a risk free alternative income of C. The manager receives a total compensation of $B = F + f * O_r$ with O_r being the realized outcome, f the variable factor and F a fixed compensation.

Both strategy owner and manager aim at maximizing their expected utility. Assuming rational decisions in line with the Bernoulli principles this means the manager strives to maximize his security equivalent and the strategy owner wants to maximize expected net return from the project.

Calculating optimal model parameters

As said, the strategy owner aims at maximizing his expected net gain:

$$E(NG) = x * I - E(B) = (1 - f) * x * I - F \qquad \text{(equation 1).}$$

The manager's certainty equivalent can be expressed as:

$$CE_M(B, I) \qquad \text{(equation 2).}$$

Setting the first derivate with respect to effort equal to zero and rearranging for I the optimal effort level I^* for the manager can be calculated as:

$$I^* = f * \frac{x}{2y} \qquad \text{(equation 3)}$$

The manager will ask for a security equivalent at least as high as his risk free alternative income C (cooperation condition). The strategy owner on the other hand will set the fixed compensation F as low as possible, i.e. such that the cooperation condition is just being met:

$$F + f * x * I - \frac{a}{2} * f^2 * \sigma^2 - y * I^2 = C \qquad \text{(equation 4a)}$$

Equation 4a can be rearranged to

$$F = C - f * x * I + \frac{a}{2} * f^2 * \sigma^2 + y * I^2 \qquad \text{(equation 4b)}$$

Inserting equations 3 and 4b into equation 1 and setting the first derivate with respect to f equal to zero gives (after some rearranging) the optimal variable compensation factor

$$f_{opt} = \frac{1}{1 + a * \frac{2 * y * \sigma^2}{x^2}} \qquad \text{(equation 6).}$$

Inserting equations 3 and 6 into equation 4b provides as the optimal fixed compensation

$$F_{opt} = C - f_{opt}^2 * \left[\frac{x^2}{4 * y} - \frac{a * \sigma^2}{2}\right] \qquad \text{(equation 7)}$$

Simulation

For the simulation the assumption of the base model that strategy owner and manager have the same information about project parameters is being relaxed. Instead, the authors look at what happens if the strategy owner sets compensation factors f and F in line with what was

described in the previous section, but the manager acquires additional (private) information and choses his activity level based on different values for productivity factor x, risk averseness factor a, penalty of work factor y, the project risk σ, and alternative level of risk free income C..
Starting with a base case:

Parameter	x	a	y	σ	C
Base Value	1,5	1	0,01	5	30

expected utility levels (i.e. expected security equivalents) which the manager would realize if two of the parameters were different from the base case are being calculated. The range the parameters are being modified in is between 50% and 150% of the base value. For better readability and comparability the data is being normalized with 100 being the value of the base case.
The first simulation covers the parameters for risk aversion (a) and project risk (σ). Ceteris paribus, i.e. if x, y, and C remain at their levels of the base case, the sensitivities on the manager's expected utilities are illustrated in (fig. no. 1).

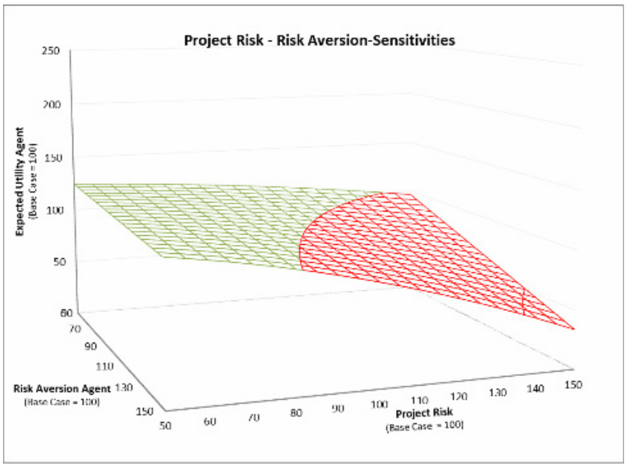

Fig. no. 1. '3D-Graph' Project Risk – Risk Aversion Sensitivities
Source: authors' contribution

The graph shows that the manager's utility increases with project risk and/or his risk aversion decreasing. The red area of the graph represents parameter combinations which yield a utility level for the manager which is below what he could have expected to realize under the base scenario. The green area represents parameter combinations where he can expect to be better off than in the base case.

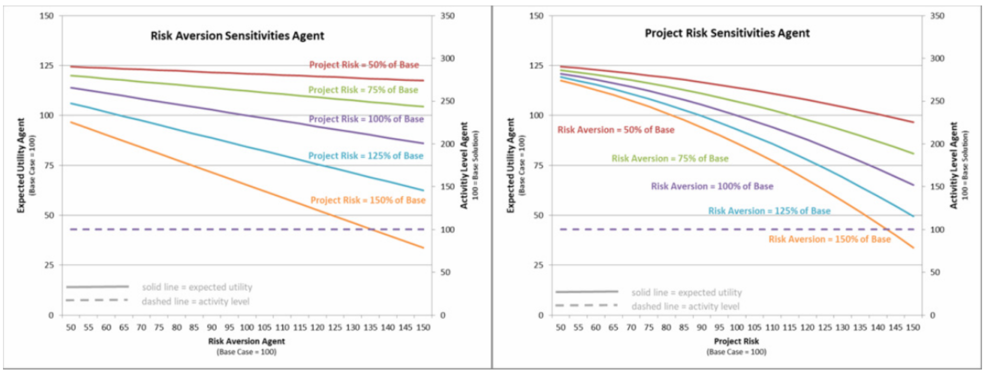

Fig. no. 2. '2D-Graph' Risk Aversion / Project Risk Sensitivities
Source: authors' contribution

In order to better demonstrate the individual contribution of each parameter the authors have plotted how expected utility changes if one parameter is being modified over the whole range while the other is held constant at 50% / 75% / 100% / 125% / 150% of the base value. Additionally, the activity level of the manager was added.

In (fig. no. 2) it can be seen that the manager's expected utility level decreases linearly with an increase in his risk aversion. This can also be directly read out of equation 2. The activity level he would be choosing remains at 100% of the base case. This follows directly from the fact that equation 3 is independent of both risk aversion as well as project risk. It can further be seen that the negative impact of an increase in project risk on the manager's expected utility increases the higher the project risk becomes. The lines are continuously decreasing with increasing steepness. This is because project risk reduces the manager's expected security equivalent by the power of 2. The chosen activity level remains at 100% of the base case.

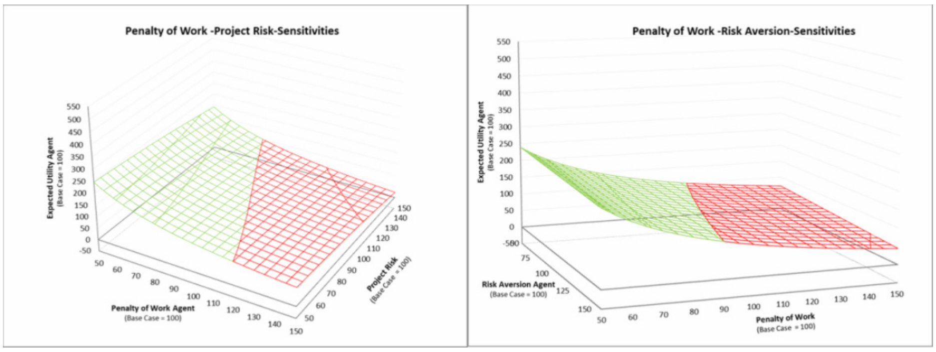

Fig. no. 3. '3D-Graph' Penalty of Work Sensitivities

Source: authors' contribution

(Fig. no. 3) shows the impact that the penalty of work factor has on the expected utility of the manager. The left graph in combination with changes in project risk, the right graph in combination with risk aversion. Expected utility increases with a decreasing penalty of work factor. However, the absolute impact on the manager's expected utility is significantly higher than for the combination of project risk and risk aversion. This is because the penalty of work factor not only decreases the level of disutility experienced at a certain activity level, it also lead to the manager choosing a higher activity level thus increasing expected project outcome and expected variable compensation. A similar or even slightly higher impact can be observed if the productivity factor is being modified: increases in productivity lead to higher expected utility for the manager (see fig. no. 4).

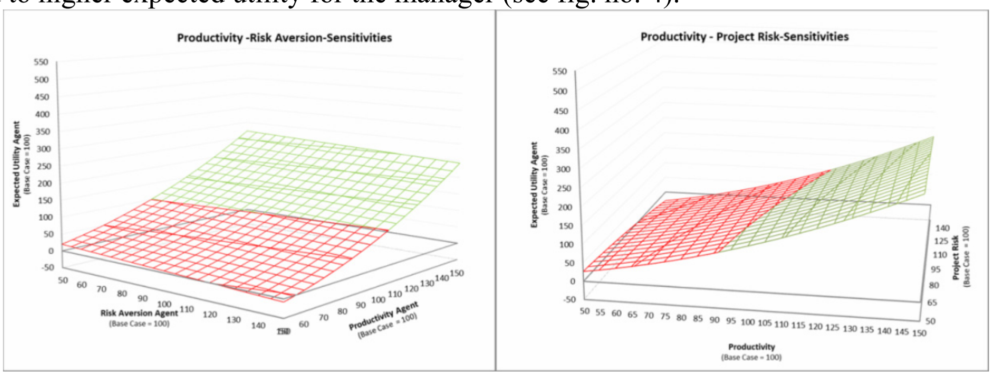

Fig. no. 4. '3D-Graph' Productivity Sensitivities

Source: authors' contribution

The highest sensitivities can be observed if both productivity and penalty of work factor are being modified (see fig. no. 5). If productivity is being set at 150% and penalty of work at 50% of the base level, the manager can expect to realize a utility level of 539% of the base case. For reasons of available space only a selection of the graphs prepared are being presented here. (Tab. no. 1) provides the range of expected utility for all factor combinations looked at. Please note that the manager's alternative level of risk free income C has not been included. As can be seen from equation 3b any change in C results in a corresponding change in expected utility for the agent, on top of any other potential effect.

Table no. 1. Sensitivity Ranges Expected Utility Agent (Max/Min)

	Risk Aversion		Project Risk		Pen. of Work		Productivity	
Risk Aversion			124	34	239	44	271	-8
Project Risk	124	34			246	23	278	-29
Pen. of Work	239	44	246	23			539	-5
Productivity	271	-8	278	-29	539	-5		

Max | Min

Source: authors' contribution

(Tab. no. 1) lists the maximum and minimum level of utility (100 = base case) which the manager can realize if two parameters are modified to 50% resp. 150% of base case. For example, the manager's maximum expected utility level is 124 if both project risk and risk aversion turn out to be only 50% of base case values. If both parameters increase to 150% of base case the expected utility level drops from 100 to its minimum of 34.

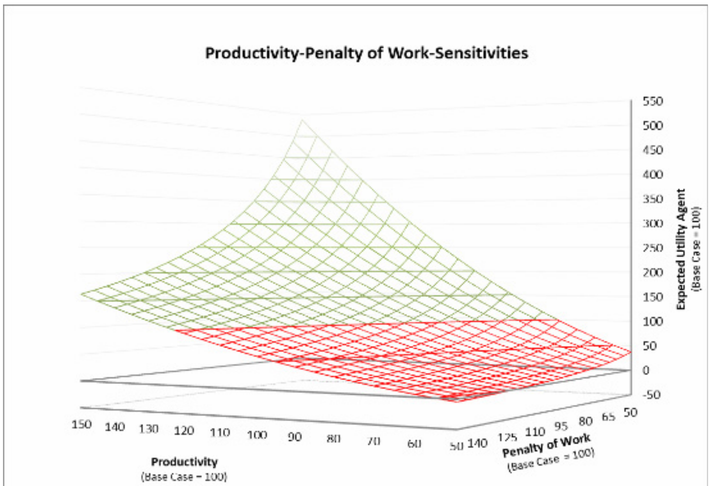

Fig. no. 5. '3D-Graph' Productivity – Penalty of Work Sensitivities
Source: authors' contribution

Interpretation of Results

The simulations provide indications how the strategy owner and the manager may behave before and after they entered into the project. As conventional wisdom would suggest, the strategy owner would be looking for a manager who is prepared to work hard (with no or only small extra compensation), i.e. someone who has a low penalty of work factor. He would further be looking for a highly capable and efficient manager and would try to present the project as not being too complex (both would directly or indirectly increase the productivity factor in the model). The risk the strategy owner runs, though, is that if the manager realizes after entering into the contract that project parameters are less favorable for him than assumed, his expected utility may fall below that of his alternative risk free income and he may seek for ways to get out of the contract. The same could happen if project risk turns out to be higher than anticipated or risk aversion of the manager higher than thought. Both could lead to a situation where the risk premium, which the strategy owner included in his total assessment of required compensation, is not high enough to ensure a utility level for the manager above his alternative source of income. Again, the manager may seek to get out of the contract.

On the other side, the manager could increase his expected utility if he misled the owner of the strategy regarding his (the manager's) personal characteristics (i.e. penalty of work factor, risk aversion, the level of alternative source of income, and/or his own productivity) or the parameters describing the implementation project (i.e. project risk, and/or project complexity). While sensitivities on risk aversion and project risk are relatively moderate, the other parameters can have quite a significant impact. As said before, any exaggeration on the alternative risk free income C will directly increase the manager's fixed pay and hence his expected utility.

The manager will have to decide if he wants to position hisself as a "hard" worker or a "smart" worker. The lines shown in (fig. no. 6) represent different penalty of work-productivity-combinations which yield the same expected utility for the manager. For example, a manager with a penalty of work factor of 0,005 and a productivity of 1,125 realizes the same expected utility as a manager with a penalty of work factor of 0,015 and a productivity of 1,875. In other words, an increase in disutility of work of 200% can be compensated by an increase in productivity (or reduced project complexity) of "only" 67%. In essence this means that hard work can make up for lack of productivity. The manager would likely try to make the owner of the strategy believe that the task at hand is more complex than it actually is (the manager would probably not argue that his efficiency is lower than what the strategy owner believes or that he wouldn't be willing to work hard).

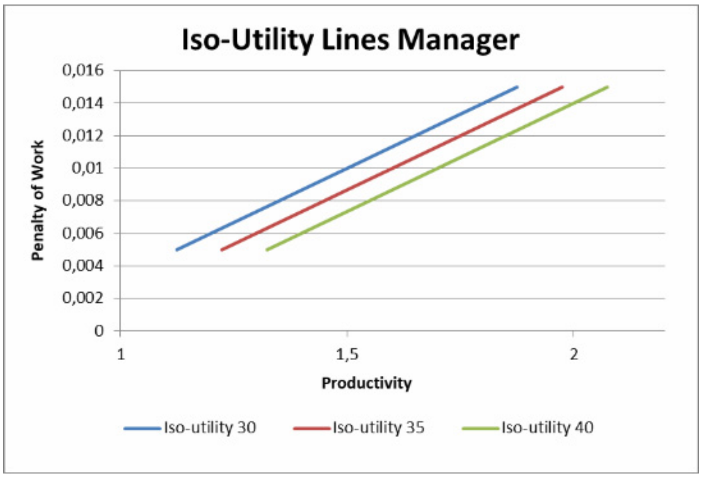

Fig. no. 6. Iso-Utility Combinations Manager
Source: authors' contribution

A very important and fundamental result of the simulation is that potential upsides of hidden actions for the manager are significantly higher than potential downsides. In other words, cheating is likely to pay off for the manager. This is particularly true for moral hazard behavior in connection with project complexity resp. manager's productivity and his perceived disutility of work. If productivity increases to 150% and the penalty of work factor decreases to 50% of base value, expected utility of the manager increases from 100 to 539. If, on the other hand, productivity decreases to 50% and penalty of work increases to 150% of the base case, expected utility of the manager drops to "only" -5. So the upside potential is approximately four times as high as the downside risk.

Conclusions and Outlook

The simulation shows how sensitive a linear compensation scheme is with respect to asymmetric information. If the owner of the strategy makes wrong assumptions regarding personal characteristics of the manager or regarding parameters defining the implementation project when establishing the compensation scheme, he may give up a significant share of his potential return because of sub-optimal compensation factors and hidden action by the manager. The flip side of this coin is that cheating by the manager is likely to pay off for him. However, it has to be noted that the sensitivities to a great extent depend on the values assumed for the parameters of the base model as well as on the model as such.

Future research could use a simulation model with other (nonlinear) transformational input-output-rules. Further, the analysis could be modified to consider other than exponential utility functions. It would be interesting to see if results for other types of simulation models confirmed those of this study.

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