

# Application of System Dynamics in Value Based Management – an approach based on a real-life case

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## Abstract

*Value Based Management is a common management technique to support organisations to get in a good shape to meet competition in the current turbulent economic era. The complete concept of Value Based Management has a very broad scope and is designed to support an organisation in aligning the business strategy, business processes and decisions in order to create maximum value for its stakeholders. In order to get an understanding of the way the business is organized, to identify the most sensitive value drivers and to determine their impact on the creation of value, it is essential to qualitatively or quantitatively model the organization. In this article we describe the application of System Dynamics in the Value Based Management context in order to support strategy development, based on experiences of PwC Consulting in The Netherlands. We identify the areas where System Dynamics adds value to Value Based Management and describe a number of steps we take in client engagements.*

*Key words:* business modelling, business strategy, value based management, client engagements

## 1. Introduction

In the present business environment, changing ever faster, it is of vital importance for companies to acquire and retain a competitive advantage in some way. Without, for example, cutting edge technology or a superior business model it is getting more and more difficult to survive competition in the current global economic structures. One of the possible instruments available to companies to get their business in a streamlined shape is Value Based Management (VBM). However, VBM is not a panacea. The implementation of VBM in an organisation can occur at various levels, both in depth and in breadth and the road towards implementation of VBM principles is fraught with dangers. This is due to the fact that VBM is not just a technical tool but proper implementation of VBM should lead to transitions in the company's culture throughout all ranks of the workforce [1].

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The core concept in VBM is to optimise the value of a company by enhancing value creation for all stakeholders (including, in addition to shareholders, most notably and in general also clients, employees, suppliers, environment and government) by taking the right decisions on both the strategic and the operational level. To be able to maximize the value of a company, management must know what the value drivers are for creating value, what the most crucial ones are and how they can and should be influenced. Both conceptually and quantitatively modelling the value drivers in order to calculate the potential in value creation, and then to find the most important value drivers to actually maximize value creation, is a complex and challenging task. Generally, practitioners from the VBM community build quantitative models of a business by bringing together the value drivers in a value tree, mostly with little or no cross-links or feedback loops present. From a System Dynamics viewpoint, this situation is beyond any doubt susceptible to improvement; real life is not that simple.

However, in the System Dynamics community only a small number of people are focussing their attention on combining the System Dynamics methodology with the VBM methodology [2,3,4,5] or similar methods [6,7]. Therefore, the number of full articles on the subject is still very small [2,3,4] and progress in theory development and conceptual integration of the two methodologies, at least in shared and publicly available sources, is still limited and very much in its infancy. On the other hand, the opportunities for System Dynamics in this field of application are manifold. This paper aims to contribute to filling the gap.

In this paper we will describe how System Dynamics can add value to the VBM-methodology in attaining its goal. Thereby, System Dynamics can make the VBM methodology much stronger and more convincing. Having applied the combination of VBM and System Dynamics in our consulting practice we will elaborate on a number of aspects we encountered in our projects with clients and present an integrated approach for applying System Dynamics in a VBM context.

This paper is structured as follows. In section 2 we will go into some specifics of Value Based Management and the traditional modelling aspects of it. Then, in section 3, we extensively treat the value System Dynamics adds to VBM. Section 4 is concerned with the application of System Dynamics and VBM in practice. We will present some aspects of our integrated approach and will illustrate these with situations encountered in client engagements in SD/VBM projects in the Netherlands. Finally, section 5 will summarize our conclusions.

## **2. The concept of Value Based Management**

Value Based Management [8,9,10,11] is a concept that enables decision makers in a company to prioritise decisions based on the contribution of the outcome of these decisions to the value of the company. To do this successfully implies that all key processes and systems are oriented to support this. This implies amongst others the consideration of the following elements: Resource Allocation, Performance Management, Competence Management, Management Compensation, Business Modelling, and Internal and External Communication. We refer to cited literature for examples.

Covering all aspects of VBM is not the purpose of this article. The focus will be on the aspects of business and strategic modelling relevant to VBM in general and the application of System Dynamics in particular.

The key assumption of VBM - as we apply it in our projects for clients - is that maximising shareholder value is the ultimate goal of a company. The shareholders, as the owners of the company, have delegated decision-making authority to the management of the company. They delegated this authority to the management in the hope they will act in the shareholders' best interest, i.e. creating the value they cannot do themselves. For an individual shareholder this will mean that the earnings per share should be maximised. From the company perspective this means that the company's equity returns should at least be equal to the equity cost (i.e. the return that shareholders demand). A company can only add value when the equity returns exceed the equity cost [11].

Maximising the value for the shareholders does *not* mean ignoring the creation of value for the other stakeholders. Customers will go elsewhere if not satisfied, staff will perform poorly or leave if not being happy or treated well. However, concentrating mainly on only one objective avoids corporate paralysis when choices have to be made between the different stakeholders. In this way, VBM becomes a powerful tool for management to focus its activities on value creation, hence solving conflict in demands like for example cost reductions versus higher quality.

VBM is meant to give the management throughout an organisation (be it commercial or not) a decision framework in order to make value-creating decisions in a well-founded way. VBM or managing for value should not be confused with accounting for value, which is the 'art' of calculating the value of the company in the best way possible. The purpose of VBM is not to determine the value of the company, but to give managers a framework to be able to measure their progress in achieving the desired level of value. A clear measure for value creation is therefore required. Ideally, the measure of performance is not only to be set at a corporate level (like shareholder return), but also on a business unit level.

The measure that best fits the criteria as pointed out above (promoting the creation of shareholder value being suitable to performance evaluation over time and measurable at a divisional level) is Economic Profit. Economic Profit is defined as:

$$\text{Economic Profit} = \text{Net Operating Profit After Tax (NOPAT)} - \text{Capital Charges}, \quad (1)$$

where *Capital Charges* is the product of Invested Capital and Cost of Capital.

By maximising Economic Profit, the company is maximising excess returns, i.e. maximising the spread between the returns a company is generating less the charges for the capital the company is using. The Economic Profit approach says that the value of a company equals the amount of capital invested plus a premium or discount equal to the present value of its projected Economic Profit.

$$\text{Corporate Value} = \text{Invested Capital} + \text{Present Value of future Economic Profits.} \quad (2)$$

By maximising the present value of Economic Profits a company is most likely to maximise its value. When VBM is used as a framework for decision-making, it will give managers insight in where they should set their priority. Setting their priority should then be based on the effect of their decisions on the overall value of the company, i.e. the level of Economic Profit. However, insight only in the financial drivers of Economic Profit (e.g. Revenue, Operating Costs, Invested Capital, Cost of Capital) is not sufficient to understand the effect of operational decisions and the subsequent daily actions on the value of a company. Therefore, a deeper understanding of the operational and strategic drivers of the value is required. The operational drivers are the variables that have an impact on the financial business results. Examples are price, volume and customer satisfaction. The strategic drivers are the variables that have an effect on the operational business results, e.g. level of competitive position or operational effectiveness.

Thus, the critical operational and strategic drivers in an organisation need to be identified. In order to understand their effect on the financial drivers a quantified mathematical model of the organisation needs to be developed. This is one of the challenges for Value Based Management frameworks. To achieve its goal, relations need to be identified and quantified between the operational drivers and the financial drivers, relations need to be identified and quantified among interrelating operational and strategic drivers; time delays between operational decisions and financial consequences need to be taken into account as well as the fact that decisions have complex consequences because of feedback processes that are present in the organisation.

Once a model is created it needs to support prioritising of operational and strategic decisions by giving insight in what value drivers and what combinations of value drivers have the largest impact on the value of the company. Also, target values for operational and strategic drivers and combinations thereof can be determined when a target value for the Economic Profit of the company needs to be achieved within a certain time frame. This information is vital to steer a company on value. It enables one to translate the overall performance metric of shareholder value, i.e. Economic Profit, into underlying operational and strategic performance metrics and it can be used to set the required operational targets to influence the overall shareholder value.

In general, the mathematical value models used in the VBM community are models of cascading type with Economic Profit at the top, cascading down to the operational elements via the financial components underlying Economic Profit. This results in straightforward cause and effect trees or value trees. Figure 1 represents the structure of such a value tree schematically.

Using a value tree as a representation of the way a company works is a strong tool revealing a great number of causal relationships between business variables. However, the value tree also has its limitations due to the neglect of the interrelations between the various operational and strategic drivers and the time effects that exist in real life between decisions and effects. In other words, feedback loops and time delays are absent.

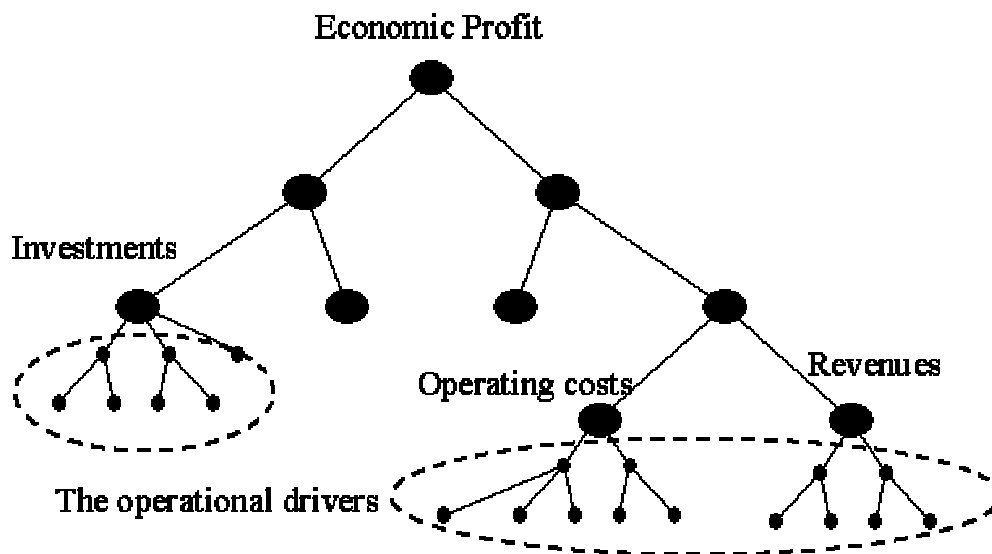


Figure 1. A schematic value tree.

### 3. The added value of System Dynamics in Value Based Management

In the System Dynamics community these final observations are quite trivial. To describe a complex problem as complex as a business, cross-links and feedback loops form the essence of the situation under study. Absence thereof is an evident indication that the model is not complete. In other words, the business dynamics can be modelled much more accurately.

This is where the introduction of System Dynamics in the VBM methodology can greatly help to improve the modelling aspects, thus bringing it a step further in its evolution and success of application. For System Dynamics it can be a wide and important field of application where the opportunities to spread the use and reputation of System Dynamics are immense. System Dynamics is a very natural way of modelling complex problems and it links up with the value tree methodology perfectly. The areas where System Dynamics can aid the value tree methodology in the VBM context to avoid a number of potential risks include the following:-

- a. *Representing interdependencies in the operations comprising a business*  
 The value tree already identifies a great number of relevant variables describing the business. However, there are only single parent-offspring relations present in the chart as can be seen from figure 1. The absence of interrelations and feedback loops causes the model to have no or incorrect dynamic behaviour for most real-life cases. Looking at the situation from a System Dynamics perspective makes it clear that expansions in these areas are the first and most important points of attention. Moreover, they emerge naturally when the connections in the value tree are examined more carefully and, generally, extra variables are added to the model. This principle is depicted in a simple example in figure 2 where the first few steps are taken in the full development of the diagram in order to make the point raised.

Note that the construction of the value tree, although initially strongly financial in nature, resembles the construction of a conceptual diagram in

Systems Thinking. In both cases interaction with the client is sought in workshop settings. However, the techniques used are different from Group Model Building techniques.

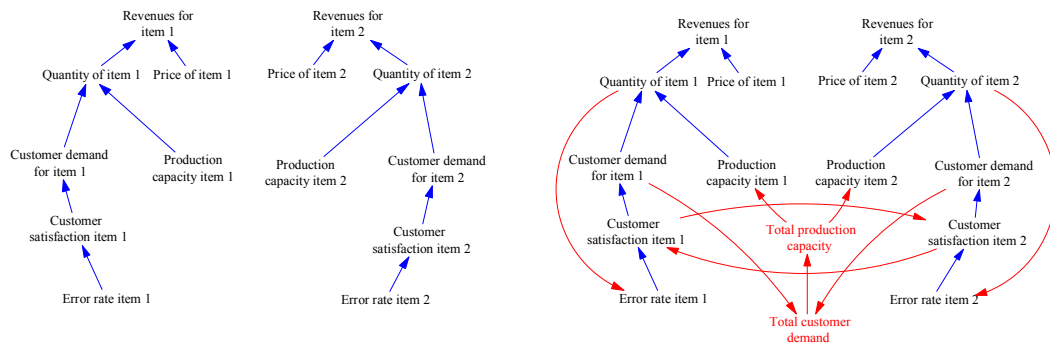


Figure 2. An example of a part of a value tree (left) to illustrate introduction of cross-links and loops (right).

b. *Striking the balance in the model*

When building a value tree in order to model a business and to calculate possible value creation it is important to develop a value tree where there is a good balance between the three foundations of the concept of Economic Profit; investments, operating costs and revenues (see Figure 1). This is often a precarious task. The reason can be that it is natural to focus on the positive side of a situation, the revenues side, or to focus on the aspects with which the modeller or the client participating in the model building process is most familiar, according to his/her mental model. Another reason that often comes into play is poor availability of data.

All this may lead to one part in the value tree having (significantly) more detail than the other parts. Thinking about the situation from a System Dynamics perspective almost automatically restores the balance in the model because the activities that are modelled at the lowest level (almost) always have effects on all three parts. For example, raising production capacity needs extra investments but also incurs extra costs (personnel) and leads to extra revenues when the goods are sold. Therefore, the levels of detail in the three parts of the model have the tendency to become comparable. The model finds its balance by a natural process enforced by the System Dynamics way of working and the picture of the business becomes more complete and close to reality.

c. *Defining consistent scenarios*

When performing simulations of a business using the value tree methodology the scenarios are defined by the value the input variables on the lowest level take. However, as cross-links and feedback loops are ignored altogether in the value tree it is extremely difficult to define *consistent* scenarios. That is, a scenario with no contradictions or unlikely combinations in the input values for the model. When the model is extended and completed using System Dynamics these cross-links and feedback loops are automatically identified and introduced and the operations comprising the business are represented

more exactly. This enormously reduces or even eliminates the chances of defining inconsistent scenarios.

d. *Designing formulas reflecting the operations of the business*

This issue is evident from a System Dynamics perspective. As the business is represented according to the actual workings thereof, the structure of formulas should be logical and therefore the design a natural process. Of course, it may still be a very difficult process indeed. In the value tree methodology the actual mechanisms are short-circuited as ‘unnatural’ or incomplete causal relations are used to represent the business. As a consequence the mathematical relations then have to be construed in such a way as to correctly represent these indirect relations. A tedious task to say the least.

e. *More complete view on the organisation and the impact of decisions*

Finally, once the model is constructed and scenarios are being studied, there is another advantage in using System Dynamics. With the value tree there exists the real danger of focusing on value creation for shareholders only as it has a narrow and mostly financial scope. A System Dynamics model creates a much broader context for evaluating the impact of measures taken. Such a model deals with a great number of aspects that play a role on a day-to-day basis. For example, taking a certain decision may create value but may also negatively affect the satisfaction of the work force, which in the long run may even negatively impact value creation. The System Dynamics model reveals this insight leading to reconsideration of the original decision. The strength of System Dynamics is that one can determine the measures that are good for the sustainability of the value creating system as a whole. This greatly supports one of the important concepts in VBM as mentioned in section 2, and that is *not* to ignore value creation for other stakeholders while trying to maximise value for shareholders.

To summarize, a number of potential shortcomings in the value tree methodology can be resolved using System Dynamics. The consequences are enormous and combining VBM with System Dynamics significantly enhances the reliability of Performance Indicator identification and prioritisation<sup>2</sup>.

#### **4. An integrated approach and its application in practice**

Based on our experiences we will now turn to some of the main practical aspects we encountered in our work with our clients. Our integrated approach has already been used successfully on several occasions.

The main goal of the integrated approach is to model Economic Profit as a measure of value (creation) using System Dynamics, so management is able to steer on value. Generally, every manager is struggling with a great number of issues and is in general not able to objectively and clearly define and prioritise the

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<sup>2</sup> In this article we concentrate on quantified causal loop diagrams only. In fact, it is also possible to proceed, based on a causal loop diagram, with identification and prioritisation of value drivers in a purely qualitative fashion [12]. Nevertheless, the conclusion remains that System Dynamics is the key underlying methodology and extremely valuable in attaining the goal.

actions he/she should take to steer the company on value. Therefore, we have two sub-goals connected with the main goal. Our approach will deliver 1) a lot of new insights gained during the process about how to create value in the business, and 2) a useful tool (the System Dynamics model) to support future decisions with respect to managing for value.

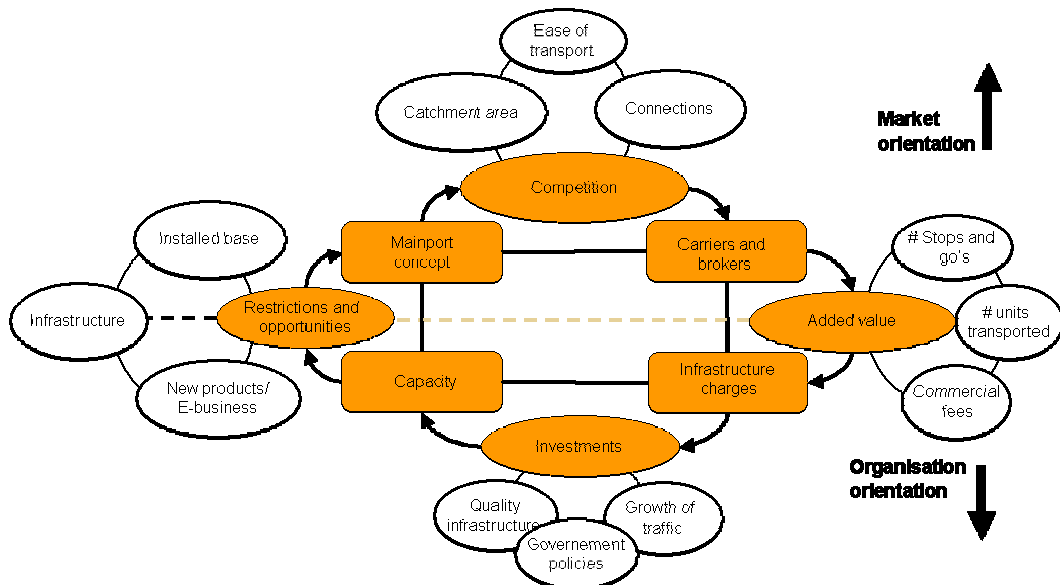
*Steps toward the goal*

The goal and sub-goals as defined above are pursued by breaking down the road towards them in a number of smaller steps. These steps can be taken with more or less depth, depending on the knowledge and level of experience with VBM and System Dynamics with the client. The most important steps we distinguish in our integrated approach are as follows:

1. Building a value mind map.
2. Developing a causal loop diagram.
3. Turning the conceptual diagram into a System Dynamics model.
4. Validating the model using scenarios.
5. Performing sensitivity analysis on the value drivers.
6. Integration in the management process.

*Step 1: building a value mind map*

A Value Mind Map is a representation of the business on an aggregate level. We build the Value Mind Map connected to value creation together with the client in a workshop. The management team of the company or business unit is invited to identify the most important areas in which they think critical success factors and critical value drivers are located. This is supplemented with the areas that are in any way of strategic importance to the company. These areas are allocated to a number of different main subjects, e.g. the mission, customers, products & services and resources. Figure 3 contains an example of such a Value Mind Map.



*Figure 3. An example of a Value Mind Map as a result of a workshop in the transportation infrastructure sector.*



The Value Mind Map now holds the issues on an aggregate level that are the key to creating value for the company, based on the mental model of the management team. Thus, in the first instance, the Value Mind Map captures the scope of the ‘business value model’ that has to be developed in the VBM context and the issues that have to be addressed in that model. However, in the modelling phase, extensions to the original scope may come up due to advancing insights into the workings of the business. Nevertheless, the Value Mind Map is a good starting point for the development of the causal loop diagram.

*Step 2: developing a causal loop diagram*

In this next step we develop a causal loop diagram by detailing the Value Mind Map and identifying links and loops between all variables in order to set down causes and effects. Before going into this process, some issues with respect to the scope and potential future use (and users) of the value model must be addressed. We will turn to these issues in step 6.

The value model usually contains several distinct parts. To start with, there is the part of the model essential from the VBM perspective. This part holds the financial value drivers, split up in the categories operating costs, revenues and investments. In the lower parts of the tree the financial value drivers are linked with the operational and strategic drivers. They describe the way the business works and they lead to the financials. These operational and strategic drivers include for example market competition, daily operations, employment dynamics, market regulation, etcetera. It is in these parts of the model that in general numerous levels, feedback loops and time delays can be found that generate the dynamics. What the complete value model schematically looks like, is shown in figure 4.

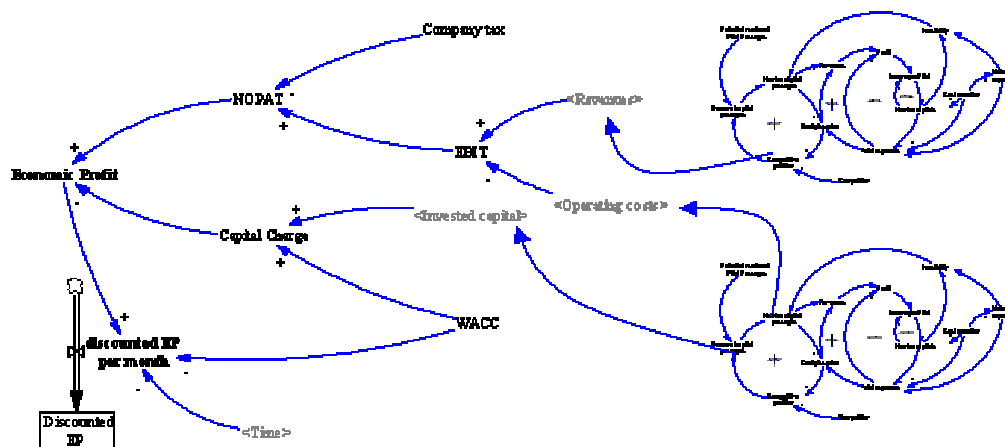
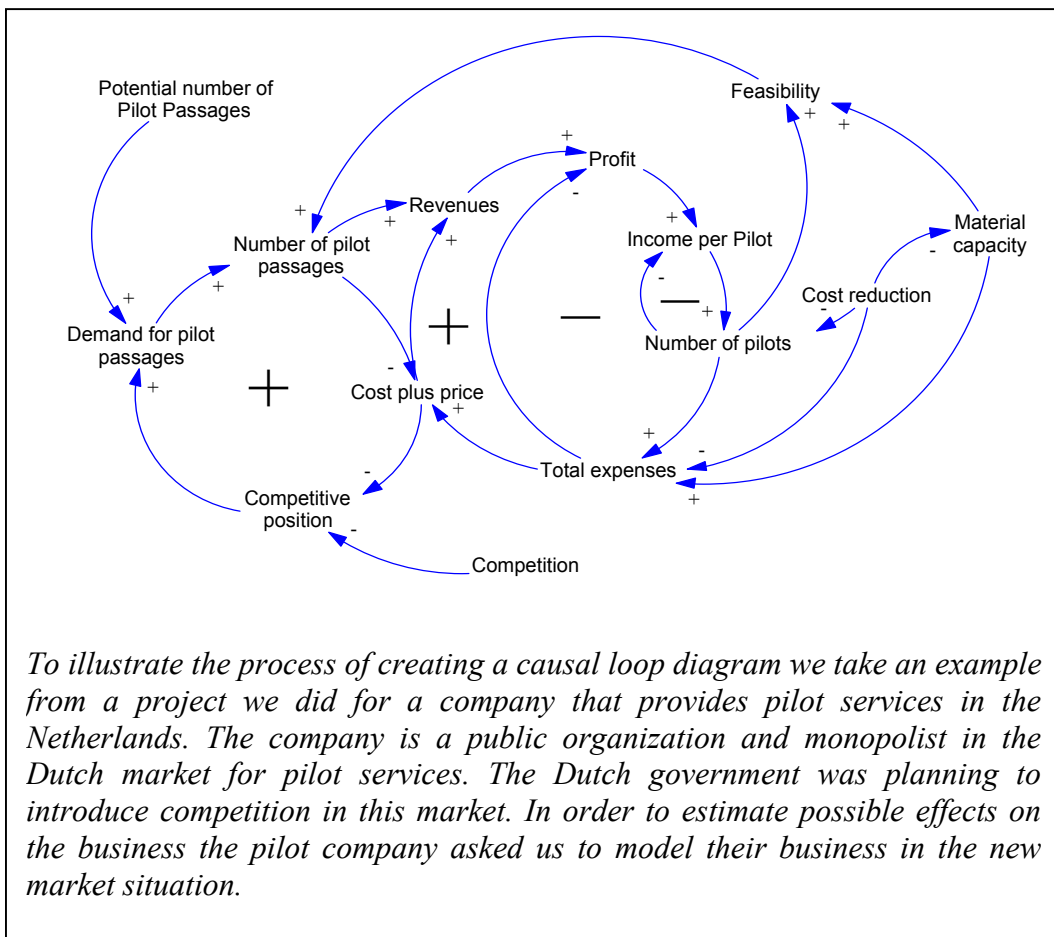


Figure 4. The value model with a financial part (left) and a strategic and operational part (right).

In order to detail the Value Mind Map and to obtain a true conceptual diagram in the System Dynamics sense we organize interviews with the managers and employees responsible for the areas that are to be incorporated in the model. The interviews are followed by Group Model Building sessions in which all insights and disciplines are brought together to evaluate a first draft version of the causal

loop diagram and to build a more detailed and improved version of the model. The Group Model Building sessions are essential for changing the various, often distinct mental models that exist in the minds of the various managers. The advantages of Group Model Building sessions are described in a number of articles and books [13,14,15] but the most important ones we want to mention here are 1) a faster and more efficient modelling process and 2) a better and a less biased conceptual model as the various mental models are brought together to form a more complete and agreed upon picture of the whole. The process of interviews and Group Model Building sessions continues during a period of 4 to 8 weeks in order to reach consensus about the model that is going to be used as the value model and which should hold a common language describing the way the business works. In the end, commitment of all managers is claimed for this conceptual model. At this stage it is also preferable to name the future owners of the model within the client organisation in order to further enhance sense of ownership of the model.



*After exploring the key issues and mental models in a Value Mind Map session, the management team was brought together in a Group Model Building session. The goal of this session was to create the first draft of a causal loop diagram. One of the elements discussed in detail was the relationship between material capacity and demand for pilot services. The mental model of the management team led to the conclusion that material capacity always follows the demand for pilot services. After a short discussion we got the client to conclude that their mental model at this point was 'traditional' and did not anticipate the forthcoming situation. In the 'new world' the pilot company is not obligated to serve all clients but is able to choose a level of material capacity that can meet for example only 50% of the demand in the market, containing the most profitable pilot services. As shown in the causal loop diagram depicted above, the term feasibility came into play.*

*From this example we can draw the conclusion that the mental model of the management team changed and that it gave them new insights in what their business will look like in the future. It even led the president of the company saying at some point in the process 'this is already worth the consultancy fee!'.*

### *Step 3: turning the conceptual diagram into a System Dynamics model*

In the causal loop diagram all relevant variables are present at the conceptual level. However, in order to determine the quantitative effects of possible measures in the VBM context, we have to quantify the conceptual diagram obtained in step 2. The goal of this step is to obtain a model with which simulations for analysis purposes can be run. Before this goal is reached a lot of effort must be put into data collection and quantifying causal relationships between variables. In order to generate and collect the required data we must proceed in various ways. Historical data is preferred, but is often not available. Therefore, collecting benchmark data and constructing data based on (day to day) experience of employees in the organisation are necessary and valuable means to complete the quantification of the model.

Quantification of relationships is done in many different ways, depending on the type of causal relationship. Some relationships between variables are based on economic or 'physical' laws. For example, profit equals revenues minus costs. Other relationships can be estimated based on regression analysis of historical or constructed data. When data is absent we must take refuge to making assumptions. However, these assumptions in particular will be subject to sensitivity analysis in the following steps in order to estimate the magnitude of the impact on the model results. For very important parts of the model for which there is no data available, it is preferable to start collecting data at the earliest stage possible, for example by sending out a questionnaire.

After all the data is collected and the relationships have been quantified, getting the model to run properly is the next challenge. In practice this is not an easy job and a lot of trial and error and tracking and tracing is needed to get the model running without error. Running the model is just a technical achievement and if

we would stop here it would not be of any value. The next phase in this step is then to carry out verification and validation tests to be sure the System Dynamics model makes sense.

The actions as described above within the scope of step 3 are ideally done in collaboration with one or two employees working in the client organisation. Generally, System Dynamics modelling is an expert task, because of the complexity, but client involvement is essential to ensure prolonged success. The confidence carefully built up in the conceptual modelling phase is going to be lost if the efforts at this stage are undertaken without involving the client.

*Step 4: validating the model using scenarios*

The potential risk mentioned in step 3 of losing commitment of the client's management must be taken seriously. The confidence that management acquired in the conceptual model can be destroyed by strange and unreliable results obtained from simulations. At this point, a possible way to proceed is to use reference modes to validate the *quantified* model. Reproducing historic behaviour as illustrated in reference modes can increase the confidence in the model.

Checking the model results in a session with all managers present in earlier stages of the process is necessary to build up confidence in the model. Up front we have to emphasize that evaluating the results must be aimed at exploring system behavior and not at pointing out the (in)accuracy of the numeric outcomes.

A useful, understandable and pleasant way of validating the model with a group of managers is to guide them through a number of scenarios they constructed themselves. These scenarios involve measures the company or business unit can take as well as different situational settings that are not controllable by the company itself.

*In one particular case for a specific business unit of one of our clients we defined several scenarios for illustration purposes. These scenarios covered several main issues that management was dealing with, varying from cost reduction to human resource measures and from client segmentation to quality improvement. For example, a possible scenario for cost reduction was the investment in a workflow system to make a certain part of the work process more efficient. The scenario implies changes in values for processing times and ICT investments. The effects of these investments on (discounted) economic profit were then evaluated with the model. With the scenario's we succeeded in building commitment and confidence in the behavior of the model as well as in the quantitative results the model produced.*

So in the first instance we define, together with the client, several scenarios that preferably include variables from all parts of the model. Then, evaluation in a workshop session with the client takes place. In the case of trustworthy model outcomes relating to system behavior, the confidence in the model grows. Evaluation of these scenarios usually leads to some final adjustments to the model.

*Step 5: performing sensitivity analysis on the value drivers*

When the modeling part of the project as described in the previous steps is finished, model analysis is the next step. Referring to the goal of the project, the idea is to identify the most important value drivers in the value model. Sensitivity analysis on the value drivers leads to the desired insight at this point. An analysis can be done ‘quick and dirty’ by varying the input variables with some not too large fixed percentage. However, in order to do this properly, prior analysis is necessary in order to determine the range in which a variable still has a realistic value. For example, a ten percent reduction of processing time is generally more unlikely than a ten percent change in employee absenteeism. This analysis helps to evaluate the impact of value drivers on value creation under the condition of still being in a realistic business situation.

Next, the sensitivity analysis is performed with respect to the so-called discounted economic profit. The value drivers are prioritized according to their impact on the discounted economic profit. Moreover, this model analysis also shows side effects on other important business aspects, so the impact on value creation can be evaluated in perspective. Value creation at the cost of everything else will not be acceptable most of the time.

Determining the impact on value creation is only one part of the value driver analysis. The second part in this step is what we call the ‘influence assessment’. Influence assessment rates the value drivers according to the extent the company or business unit is able to influence the value of these parameters. This part must be done in a qualitative way, for example by gathering the expert opinions of the managers in the client organization. With this input, the value drivers are classified into various groups on a scale of 1 (‘outside span of control’) to 5 (highly controllable on company or business unit level’).

We get a very powerful instrument to assess the relevance of the various value drivers with respect to the possibility of pro-actively creating value for stakeholders when both the impact and the influence of a value driver are put together in a matrix. This matrix, presented in figure 5, helps a company or business unit manager to prioritize his or her actions and leads to a better understanding of the business. Value drivers that have great impact on value creation of a company must be closely monitored, but the focus of a company must mainly be on the value drivers that in addition can be influenced to a large extent. This is illustrated by the terminology used in figure 5.

At the end of these analyses it is very interesting to look back at the value mind map created in the first step. Ideally, the variables marked as ‘focus & priority’ in figure 5 correspond closely to the most important areas that were identified in this step. If this is not the case, one or both of the following two things is at hand:

- (1) The mental model of the managers is not correct, which is proven by developing and using the business value model.
- (2) In the process of building the model we lost sight of some relevant aspects of the business.

This check is confrontational but often shows the value added in the project. Ideally, the outcome of the analysis results partly in confirmation and foundation

of certain ideas already existing and partly and most importantly in surprising new results that lead to reconsidering measures and focus areas.

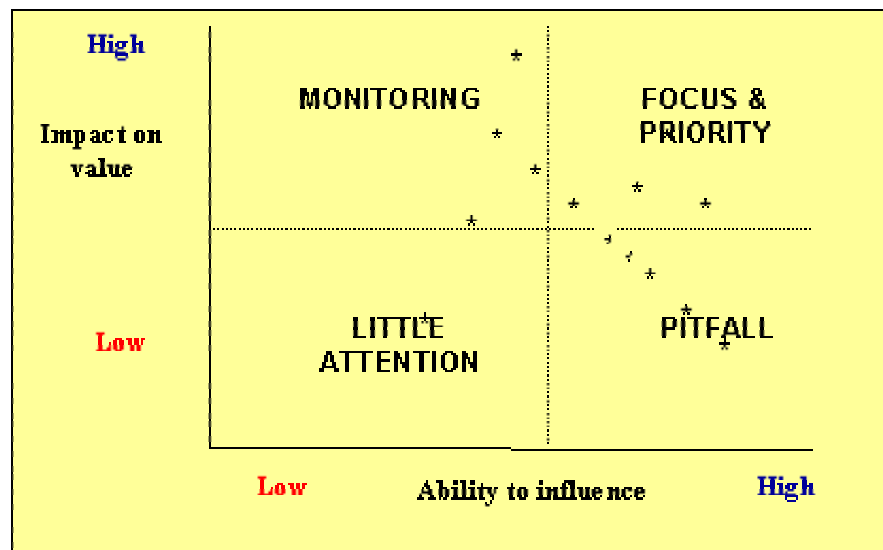


Figure 5. The value impact and influence matrix for value drivers.

*For a call center, the analysis using the value impact and influence matrix identified the 'focus & priority' value drivers to be amongst others processing time, productivity, number of client contacts and percentage of temporary labor. As 'pitfall' value drivers we identified for example training budget and leave percentage of employees. The performance of other business units and the part-time working percentage were marked as 'monitoring' value drivers.*

#### Step 6: Integration in the management process

The value drivers in the 'focus and priority' and the 'monitoring' quadrants of the value impact & influence matrix should be integrated in the company's performance measurement frameworks. Given the impact these drivers have on the value of the company they become by definition the Key Performance Indicators for value. They will be made part of some kind of management dashboard or (Balanced) Score Card.

The targets for the Key Performance Indicators need to be set at the beginning of the planning period in the company. The value model could play a very important role in this target setting process. Given a desired level of Economic Profit we can use the model to calculate the required target for each of the Key Performance Indicators present in the value model. Subsequently, the management information systems need to be set up so as to be able to report on the Key Performance Indicators on a timely (e.g. monthly or quarterly) basis in order to inform management whether they are on track in creating the value they set out to create. If not, appropriate actions could be devised by management, using the value model in order to ensure targets are met and the aspired level of value is achieved. By integrating the value drivers in this way in the performance measurement

framework it is ensured that daily actions are aligned with the overall value targets and focused on value creation.

Furthermore, the value model could be used very well for budgeting and business planning purposes. The impact of a change in strategic directions on the value of the company could be determined by running specific scenarios. Also, when the model has incorporated the appropriate Profit and Loss, Balance Sheet and Cash Flow items, the model could easily produce the projected financial statements given a desired level of Economic Profit. In this way, the value model will be a very powerful tool in both strategic and operational planning and budgeting.

## **5. Conclusions and opportunities**

Our conclusions are based on our experience in applying the combination of System Dynamics and the ideas of the Value Based Management methodology. The results of our integrated approach which we tested in client engagements confirm our prior expectations of the great opportunities for System Dynamics in this field.

The first issue we want to point out explicitly is that the application of Value Based Management becomes more realistic, powerful and convincing if System Dynamics is used in the modeling stage. As we mentioned before, some of the drawbacks and limitations of a value tree in the 'traditional' modeling approach in Value Based Management can be 'solved' by introducing System Dynamics. System Dynamics adds value to the process of determining the most important drivers for value creation due to the introduction of cross-links and feedback loops. Furthermore, with the aid of System Dynamics, possible measures can be assessed in perspective.

Secondly, from a System Dynamics point of view, the field of Value Based Management is an interesting field of application. It offers a lot of opportunities both in a technical but also in a PR sense because the development of the *combination* of both methodologies is still in an early stage.

Thirdly, based on our experience we conclude that Value Based Management is a very promising field of application for System Dynamics because of the clear link with management processes. Great opportunities come up for actually integrating a System Dynamics application in a day-to-day management situation, instead of carrying out a temporary, once-only and stand-alone model building exercise. Translation into a performance management framework like the Balanced Score Card is key in this perspective.

Finally, the companies that are determined to steer their business on value can profit from the integrated approach we present in this article. The value driver analysis and the evaluation of possible measures, based on a model that includes dynamic aspects, should lead to better and sustainable decisions of management. In this way, managers are given specific levers to control the value creation process in their daily work.

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