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## Proving the Value of Maintenance

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# Value Driven



by Remco Jonker  
& Mark Haarman

## “What is the actual added value of maintenance?”

**T**hat is a frequently heard question in boardrooms the world over. Even though maintenance is often critically important, few maintenance managers are able to answer the question convincingly. Especially when they are asked to express the benefits in terms of economic value added or shareholder value - the language being spoken in boardrooms.

For this reason Mainnovation developed the Value Driven Maintenance® (VDM) methodology, which is implemented in leading maintenance organizations like DSM, Smurfit Kappa, Sara Lee, GlaxoSmithKline, Akzo Nobel and Volvo Cars.

VDM builds a bridge between traditional maintenance philosophies and managing by shareholder value. Not

only does VDM simplify the boardroom discussion, it also shows that far from being a cost center, maintenance is actually a major economic value within the overall business performance.

### What is Value?

Before you can manage by shareholder value, you have to understand what exactly value is. Reference to financial literature reveals that value is defined as the sum of all future free cash flows, discounted to today.

This sounds impressive, but what does it really mean? Let's start by looking at the first part of the definition. A cash flow is the difference between income and expenditure. This is not the same as the difference between revenues and costs, because that's an item

# Maintenance



that can be greatly influenced by accounting practices. Some companies use highly creative lease, depreciation and reservation techniques to keep their book profits artificially high (or low). Newspapers have been crammed with articles on this subject in the recent past. As we have seen from many of these stories, questionable accounting techniques do not always contribute to shareholder value - and are rarely good for the long-term health of a company.

The second part of the definition stems from the knowledge that the value of a cash flow is related to time. One dollar is worth more today than one dollar next year. This is because you can deposit a dollar at the bank today and use it to generate income over a period of one year. Therefore, you have to adjust future cash flows.

## Value of Maintenance

A maintenance manager is likely to say: "This theoretical approach is all very well and good, but what good is it to me in practice? The value of maintenance comes from delivering maximum availability at minimum cost!" While this is true in theory, it's little help in the day to day operation. This is because you have to prioritize: do you want to reduce costs or increase uptime? Is a 1% increase of uptime just as valuable as a 1% reduction of costs? And how do you determine the value of safety?

VDM provides answers by identifying the value potential of four value drivers in maintenance and enabling you to manage by those drivers.

Figure 1 shows what maintenance is all about. Today's maintenance managers are constantly balancing between higher machine availability (asset utilization) and lower maintenance costs (cost control). In doing so, they must take into account the growing body of laws and regulations covering safety, health and environment. To make everything work, they need to use the right technicians, spare parts, knowledge and contractors (resource allocation).

For all four value drivers, maintenance can and does help to increase a company's economic value. In a market where there is more demand than supply, greater machine availability results in more products, more income and thus higher value.

On the other hand, lower maintenance costs produce higher value by avoiding expenditure. The same applies to resource allocation. One example is a technical storeroom. Smarter inventory management of spare parts can enormously increase value for a company.

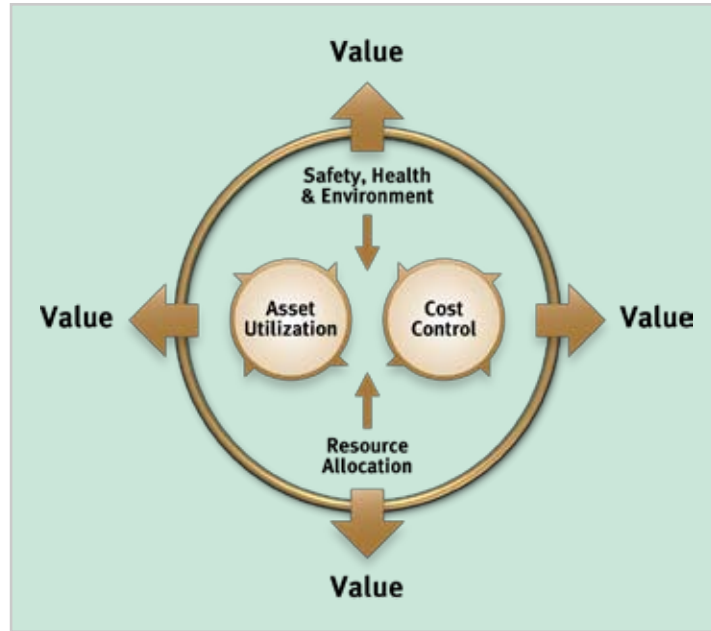


Figure 1: Maintenance Value Drivers

Similarly, the safety, health and environment (SHE) factor affects value. SHE accidents tend to necessitate substantial expenditure, which results in large negative cash flows. Damage caused to personnel, environment and image, for example, will increase expenditure. An

even greater danger is loss of the license to operate because of an inability to comply with SHE legislation. No license to operate means no production and no income.

### Value Potential

Maintenance managers must show where there is potential for value within their maintenance organization. VDM provides calculation models and tools for this purpose (see next page). One of those tools is the VDM Control Centre; an on-line platform that allows maintenance managers to measure and benchmark their maintenance performance against anonymous companies in the same industry. The VDM Control Centre also provides a transparent picture of the contribution a maintenance organization is making to creating value for a company.

Note that the result of the calculation of value will differ markedly depending upon the industry involved. In the bulk chemical

# Value Driven Maintenance - The Inner Workings

The definition that value is equal to the sum of all future cash flows, discounted to today, is translatable into the following formula:

$$PV = \sum \{CF_t / (1+r)^t\}$$

Where: **PV** = value (present value)  
**CF<sub>t</sub>** = future free cash flow in year t (cash flow)  
**r** = discount rate

To calculate the value of maintenance, this formula can be applied in the following way:

$$PV_{\text{maintenance}} = \frac{\sum \{FSHE_{,t} \times (CFAU_{,t} + CFCC_{,t} + CFRA_{,t} + CFSHE_{,t})\}}{(1+r)^t}$$

Where:  
**PV<sub>maintenance</sub>** = value of maintenance  
**FSHE<sub>t</sub>** = SHE factor in year t (% of compliance with SHE regulations)  
**CFAU<sub>t</sub>** = future free cash flow in year t from asset utilization  
**CFCC<sub>t</sub>** = future free cash flow in year t from cost control  
**CFRA<sub>t</sub>** = future free cash flow in year t from resource allocation  
**CFSHE<sub>t</sub>** = future free cash flow in year t from SHE  
**r** = discount rate

To see how this formula works, look at the following example:

Say a paper factory produces 1,000,000 kilograms of high-quality paper each year, with 50% asset utilization. The price of each kilogram of paper is € 10, with a profit margin of 15%. The factory's annual maintenance costs come to € 500,000 and it keeps € 300,000 of spare parts in stock. The annual management costs for the inventory of spare parts (personnel, space, insurance, etc) equals 15% of the value of the stocks. The maintenance concept is of a highly corrective nature, with a SHE factor of 95%.

Based on a thorough reliability study, the reliability engineer has recommended giving the maintenance concept a strongly preventive nature. Each week an extra one-day inspection will be carried out by two technicians (mechanical and electrical). This will increase annual maintenance costs by 52 x 2 x € 500 = € 52,000.

Given the preventive nature of maintenance, the reliability engineer expects to increase asset utilization to 55% and to reduce the inventory of spare parts to € 250,000. The new maintenance concept will not influence the SHE factor.

This makes the value of this improvement proposal:

<b>FSHE<sub>t</sub></b>	= 95%	<b>CFAU<sub>t</sub></b>	= 5% x 1,000,000 x 15% x 10 = € 75,000
<b>CFCC<sub>t</sub></b>	= € - 52,000	<b>CFRA<sub>t</sub></b>	= 15% x 50,000 = € 7,500
<b>CFSHE<sub>t</sub></b>	= 0	<b>r</b>	= 16% (internally determined discount factor)

$$PV_{\text{maintenance}, t=0 \rightarrow 10} = \sum \{ 0.95 \times (75,000 - 52,000 + 7,500) / (1 + 0.16)^t \} = € 140,043$$

PV<sub>maintenance</sub> is greater than zero, so there is an increase in value and the recommendation should be adopted.



Figure 2: Maintenance Core Competences

## Value and Competencies

Once the value potential has been identified, the maintenance function must be organized accordingly. Which competencies are, and are not, important? There will be little point in giving priority to reducing the stock of spare parts if the value potential lies in more uptime. Unfortunately, all too often, we see that

these decisions are not made by the maintenance department. VDM, however, does so and it creates a link between value drivers and core competencies (see Figure 2).

industry, for example, there is currently less demand than supply and worldwide prices are under considerable pressure. The value potential here lies mainly in controlling costs and the smarter deployment of people and resources. In the pharmaceutical industry, the situation is the other way around. Demand for medicines continues to grow but the technical availability of the production process is relatively low. This matter is obviously receiving attention. The SHE factor here is becoming more and more important with the growing role of the regulating authority FDA (Food & Drug Administration).

Take the example of bulk chemicals. The market situation means that most value is currently achievable by controlling costs. So the right-hand value circle must be configured from maintenance budgeting to cost analysis. The opposite applies to the pharmaceutical industry. There, the left-hand value circle must be organized from equipment performance planning to loss analysis. Interestingly, both

Using these best practices, a technical department can quickly become a professional maintenance organization that adds value to the overall business performance. In VDM terminology, this is called the Most Valuable Maintenance Organization (MVMO). To ensure that the new way of working is embedded in the day-to-day business, the processes and best practices are described in the VDM process map. This is a complete and interactive description of the processes involved and roles and responsibilities resulting from it. Naturally the people should be trained accordingly. The different steps in the process

value circles include the competencies of reliability engineering, planning & preparation and maintenance execution. These competencies are the link between the four value drivers and thus form the heart of VDM.

## Value and Best Practices

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## Value and Time

The next example shows that value depends not only on the industry concerned, but also on time. In the aviation industry, traditionally the focus was on increasing fleet availability and meeting the regulations of the Aviation Authorities. As a result of the attacks on September 11th, 2001, there has been a (perhaps temporary) reduction of the demand for air travel. This reduces the importance of fleet availability. At present, many airlines are concentrating on controlling costs. This requires an enormous turnaround, one in which the VDM methodology can guide the way.

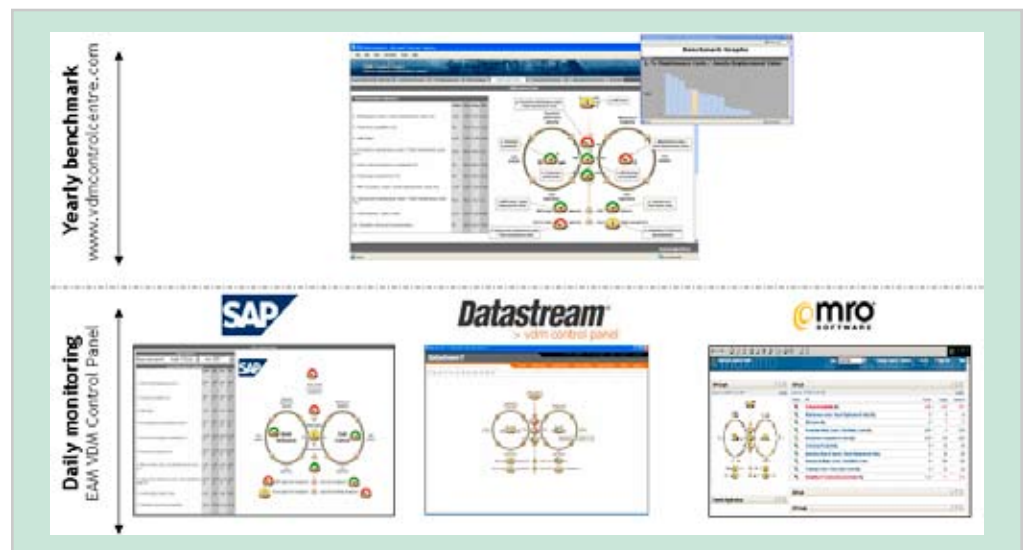


Figure 3 - VDM Controls Panels in leading EAM Vendor Software

# VDM Business Simulation

Just a game or powerful tool to support change?

Value Driven Maintenance® (VDM) is a new maintenance concept that provides a quantitative control model that explains how maintenance can contribute to economic added value through the adoption of World Class principles and practices. Today it is recognized worldwide as an innovative and trendsetting maintenance philosophy. Maintenance organizations from different parts of the world have now adopted the VDM concept with very impressive results.

## Learning by Doing

One of the biggest challenges of implementation is getting the people on board to drive the strategy at an operational level. The VDM Business Simulation encourages people of all levels in the organization to adapt to the upcoming changes and to use the VDM philosophy. They experience the power of the concept by applying it - learning by doing.



The simulation not only shows the value of a certain strategy but also how it impacts the 'day-to-day' way of working. The simulation has been applied at many different companies with great success.

## Fun to Play

The VDM Business Simulation takes place in a competitive environment: teams are faced with true life maintenance problem situations, limited information and conflicting demands. During the simulation all kind of events are introduced. Each team defines its maintenance strategy with variables - number of mechanics, number of critical spares, number of planners, number of optimized preventative maintenance schedules, number of updated drawings and number of performance contracts. A team can also choose to implement best practices (RCM, TPM, Equipment Based Budgeting, Gate-keeping etc.). Implementing these practices, however, requires investments that will not always create value. Due to the limited budget available for investments the teams learn to make choices and trade-offs.

The effects of the team's decisions are measured against the 10 VDM KPI's and benchmarked every playing round. The overall result, the maintenance performance of a team, will be translated into the added value for the fictitious company. The team that creates the most economic value after a number of playing rounds wins the prestigious VDM award.

## Focus and Setting Priorities

In real life, the maintenance manager faces three stakeholders with conflicting interests. The production manager is interested in higher equipment availability and reliability, while the financial manager scrutinizes every penny in the maintenance budget, especially in economic downturns. At the same time the main-

tenance manager is experiencing mounting pressure from laws and regulations introduced by government and the company.

Making quality choices is paramount in an environment with conflicting interests. The VDM Business Simulation is a very powerful tool to support decision making based on the economic added value of maintenance. It is an excellent tool for getting everyone in an organization - operators, maintenance, accountants, managers, executives - to understand the effects their decisions have on the company as a whole.

## Experience the Simulation

The VDM Business Simulation is not only a game that can be played by companies that are familiar with VDM, but by anyone who wants to know and learn about how maintenance can be a driver adding value to the overall company result. You can play the game at the International Maintenance Conference, IMC-2007 - on December 8th in Daytona FL. The simulation is being offered as a Post Conference workshop. During the day several teams will play against each other in break out sessions for the prestigious VDM award. For more information, please visit [www.maintenanceconference.com](http://www.maintenanceconference.com)



Volvo Cars produces more than 460,000 cars per year. Their production site in Gent, Belgium alone builds 260,000 cars. 5000 people are in service and 300 of them are active in the maintenance organization. About 725 industrial robots are commissioned at the 10-mile long production line. In 2004 management received the challenging task to streamline the maintenance processes. This was mainly instigated by macro economic trends - increasing costs of raw materials, a weak dollar against the euro and little growth in the major markets - that led to considerable pressure of the profit margins.



To standardize maintenance processes the site managers in Belgium and Sweden decided to set up uniform and transparent work processes in line with Value Driven Maintenance. The processes are based on internal best practices across the sites and enriched with external best practices. They are all translated into a standardized common Maximo system. Of course this whole exercise affected the jobs of many people. "As a consequence the cultural change is probably our greatest challenge in order to deliver results at the end of the day", says Marc Begijn, Maintenance Manager at Volvo Cars Gent. "We decided to use the VDM Business Simulation to familiarize the key players in the maintenance organizations with the new or adjusted roles and the new way of working. The main objective is to get the right mind set - so people understand the reasons why change is necessary and how it affects the way they work. The first results are very promising. We are even considering playing the simulation at board level".

map are also linked to the different steps in the EAM-system.

### Monitoring via the EAM System

If these processes and practices are supported well by the EAM-system, that is definitely a solid basis for continuous improvement. However that is only the beginning. To enable

the organization to focus on value adequately, it is necessary to visualize the management information properly. That is recognized by the leading EAM-vendors. Therefore, VDM Control Panels are developed in Maximo, Datastream 7i and SAP EAM (Figure 3). This is a graphical overview with drill down functionality, showing the performance of the maintenance organization at a glance. It also allows-

for the detection of deviations, defects and their causes in just a matter of a few mouse clicks. It shows answers to questions like "Why didn't we perform according to the Service Level Agreements we made with Production?" or "Why do the actual costs deviate from the originally budgeted costs?" etc.

### Valuable?

Is VDM valuable? We and a growing number of multinationals on all continents think it is. Or, as Bengt Svensson (maintenance manager of Volvo Cars Manufacturing) explains: "If you want to improve your maintenance process, you need an operating control system. VDM is such a system, while it shows us where and how to improve."

Managing by value is not just a must; it is the only way to discover the true significance of maintenance. VDM makes maintenance more than a cost center because it contributes in various ways to a company's economic prosperity. In fact, VDM confirms what we in the maintenance and reliability world already thought, but now we have the proof!

*Mark Haarman MSc MBA is Managing Partner in Mainnovation, the company he founded in 2000. Today the company is one of the leading maintenance consultancies in Europe and the inventor of Value Driven Maintenance®. In the course of his career, Mr. Haarman has become a maintenance expert with a wide array of expertise, helping customers develop "World Class" maintenance and reliability policies and practices. He is a former chairman of the Dutch Maintenance Association (NVDO) and the author of the book entitled "Value Driven Maintenance, New Faith in Maintenance".*

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### References

1. Mark Haarman and Guy Delahay, "Value Driven Maintenance – New Faith in Maintenance", Mainnovation, Dordrecht, the Netherlands, 2004.

The book is available exclusively in the US through RELIABILITY Magazine. For more information, visit [www.reliability-magazine.com](http://www.reliability-magazine.com)

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