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# Lehman Wave shakes the coating industry

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End markets such as Construction in 2009 went down 15% compared to 2007. This article will explain why the sales volume of suppliers to Construction markets first went down 30 – 50%, and then recovered to around original levels, and now may be going down again.

A group of scientists from the Technical University of Eindhoven and DSM NeoResins+ have investigated this effect bearing in mind the hypothesis that de-stocking in the long value chains of the coating industry could be the cause of a significant part of the decline,

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and that de-stocking would have been triggered by the collapse of Lehman Brothers mid September 2008.

## Results of the supply chain investigation of DSM NeoResins+

In January 2009 there was no reliable public information available on inventories and sales, therefore, a series of 50 telephone interviews were conducted under distributors, paint producers, job coaters, part producers, OEM, and retailers in a variety of markets. We asked about actual sales, inventory levels, and changes in inventory policies. The results are shown in *Table 1*.

This picture was later confirmed in various other investigations, including a survey with the newspaper *Brabants Dagblad*. We also found that the supply chain between a Coating resin producer and the end-customer could be as long as “250 days’ sales”, meaning that it takes 250 days for a molecule to travel from DSM’s warehouse to the

final consumer. Finally the survey showed that practically all companies decided to destock, with percentages between 10 and 20%, which was later confirmed by various other sources. And 10–20% reduction of a 250 day value chain means a loss of sale of 25–50 days. So our conclusion at this stage was that indeed our strong decline in sales can have been caused by cumulative de-stocking by the companies downstream from us.

### Building a model to quantify the Lehman Wave

The complex combination of strong stock decisions, a declining end market demand, multiple layers and lead times makes it impossible for a human to accurately predict the development of sales demand. A computer simulation model is needed and DSM and Technical University Eindhoven started in January 2009 to build one.

There are two types of de-stocking, *active de-stocking* and *reactive de-stocking*. Active de-stocking is a conscious management decision to increase efficiency by setting sharper stock targets, for instance reducing the stock target from 30 days sales coverage to 25 days of sales coverage. Reactive de-stocking is the response by supply chain planners to reduce stock levels if sales levels go down. If actual sales decline, most planners will reduce their sales forecast. For instance, if the sales forecast is reduced from 1000 to 900 units, and having 25 days of inventory coverage, inventory targets will decline from 25,000 to 22,500. Both de-stocking actions interact and combine. In the model, active de-stocking constitutes a 10% decrease in the desired inventory coverage (expressed in weeks). In addition, we estimated average inventory coverage and for the lead times in the supply chain.

We have captured this in a system dynamics model, which is a simulation model in which all the interactive decisions can be depicted. The structure for the model is based on the Beer Distribution Game, which was developed in the 70ies by MIT as a demonstration game for supply chain managers. The basic building block of the model is one echelon or one company, which has raw material buying, finished product stock, sales, sales forecasting, desired stock levels and the interrelations between them. Using this single echelon model as a building block, we constructed a complete, simplified supply chain of 5 steps: resin, paint, OEM, construction companies, end market. The first curves (not shown) were already generated in January 2009, proved quite reliable and had the same phasing as the curves shown in Figure 1.

Note that the model accurately forecasts and explains the timing of the trough and the recovery in the sales curve in February resp. November 2009. The position of the trough and peak is actually very robust to many of the parameters in the system, and is primarily a result of the structure of the chain and the de-stocking decision. Furthermore, the depth of the trough and the height of the peak, which are primarily dependent on the amount of de-stocking and the decline in the end market, have also been forecasted quite well. The curve for Paint looks similar, but the amplitude is not as large.

Due to all lead times it takes some time before the actual inventory level reaches the desired lower inventory level. Once this has been reached, orders will start to increase

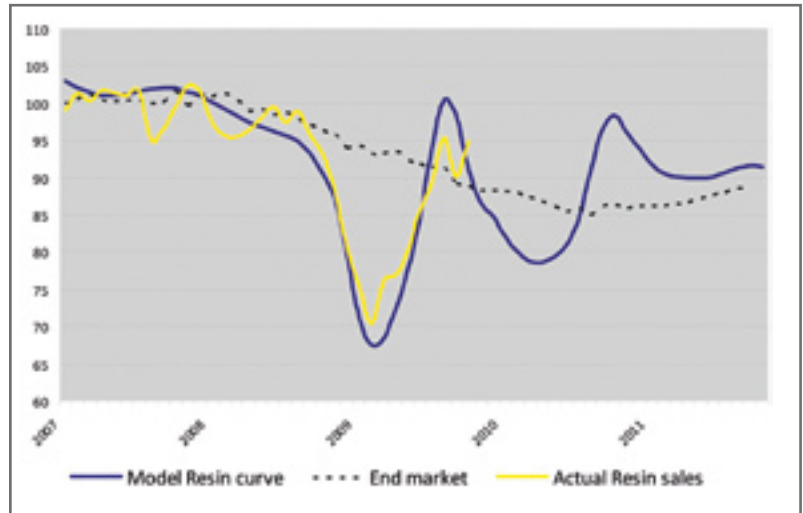


Figure 1: Model forecast (blue) and actual sales curve (yellow) in a segment supplying resin for industrial paint for the construction market (dotted line), based on construction market realizations issued by Eurostat in October 2009 and forecasts issued by Euroconstruct in December 2008, updated in June 2009. In the model all players in the supply chain reduce their desired inventory coverage by 10% per October 1, 2008. The yellow curve shows the actual DSM sales up till November 2009, 3-month moving average, corrected for seasonality.

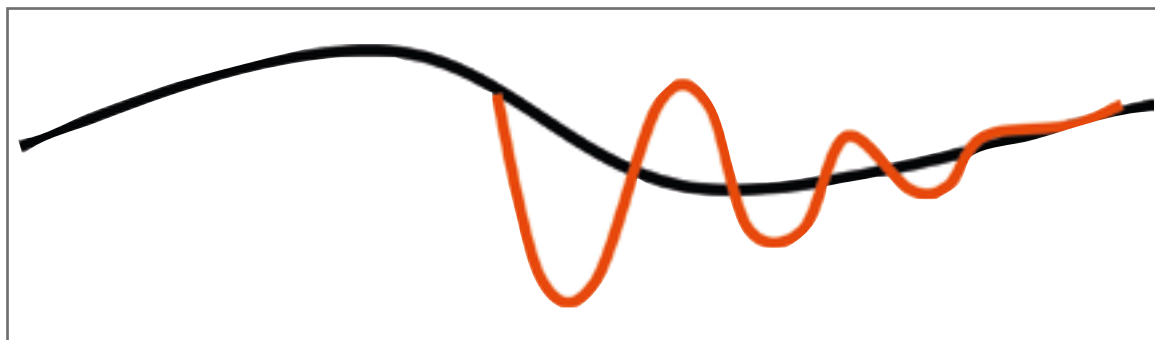
again. This pattern interacts with patterns in end market sales. As a consequence, forecasts will be updated upward and as a result restocking will take place. In line with the terminology used above, we will denote this as reactive restocking and this will lead to increased inventories, and thus will cause an upward peak.

Figure 2 summarizes the insight of this article. The model is able to predict reality to a certain extent because the economy as a whole is riding on a strong secondary wave on top of the normal economic cycle. This secondary wave is caused by the bankruptcy of Lehman Brothers, therefore we have named it the Lehman wave. It is a wave because the value chain system is elastic: all companies constantly strive to reach their equilibrium, but due to delay factors are always overshooting. The Lehman wave is dampened, because all companies take time to respond to changes in demand. Like any other wave, the Lehman wave has a wavelength, which is determined by the medium in which it oscillates, thus by the parameters of the supply chain. The amplitude of the Lehman wave is determined by the force of the pulse that caused it. So immediately after the Lehman wave had been triggered, its course was determined. The system dynamics model acts as an algorithm that accurately describes and predicts the Lehman wave.

Level in supply chain		Percentage decline
Upstream	Resin production	30%
	Paint production	20%
	Parts production	15%
	OEM	8%
Downstream	Retailer	Fairly stable

Table 1: The sales decrease at companies upstream was higher than the sales decrease at companies downstream

Figure 2: Lehman wave (red) with a wavelength between 12 and 16 months on top of the longer term economic wave (black), with a wavelength of 5 to 10 years



### What did DSM NeoResins+ do with these insights?

For DSM NeoResins+ these insights were the basis for our approach of the crisis in three Alarm Phases. In each Phase the amount of cost reductions would become more severe, but only in Alarm Phase 3 would the cost cutting endanger our long term strategy, and based on the knowledge about the Lehman wave this Phase 3 should be delayed as long as possible.

In October 2008, after the decline started, we entered Alarm Phase 1 and started re-organizing our non-core business, while leaving our core segments intact and ensuring that all key personnel were kept on board. Being a business unit of Netherlands-based Life Sciences and Materials Sciences company Royal DSM N.V., our Innovation program as well as our investment programs were approved by the board, in line with the company's approach of 'Staying the Course' during the economic downturn. We opened two new factories during the crisis, which gave us extra capacity of which we would benefit greatly when demand picked up later. The insight from the Lehman wave was included in the Sales & Operations Planning (S&OP) process as a second source of info next to the currently rather unreliable sales forecasts.

In January 2009 it was decided to partially implement Alarm Phase 2, with closures of a plant and reduction of some product lines. The rest of Alarm Phase 2 was postponed in the hope that business would recover as predicted. In April 2009 we started in advance of market

pick-up to partially rebuild the stocks which had been reduced the previous 6 months.

When we found in July-September 2009 that sales indeed recovered completely as forecasted by the model, the implementation of the rest of Alarm Phase 2 and 3 was put further on hold. Now, in January 2010, we are preparing ourselves for the possibility that a "second dip" occurs as forecasted. According to the model it will not be as deep as last year, but still profound. We see this crisis as a once-in-a-life time opportunity to improve market position. In line with the overall strategy of Royal DSM, we believe that companies with long term vision and cash reserves, companies that stay the course, are in the best position to emerge from the crisis stronger. Further, we believe it is essential for companies to really know their end markets and to have an understanding of the general stockpiling in the industry. Finally, a relatively simple system dynamics tool seems to help to fairly accurately predict sales cycles.

### Conclusion

Most companies will expect their sales to change in line with their end market, but we have shown that due to the Lehman wave a company can sell alternating much less and much more than its end market. Since eventually sales will go to the end market level again, it could be that Resin and Paint producers supplying to the European construction industry in 2010 will be selling less again in 2010 than in 2007. If this becomes reality, the Lehman wave could be pushing the Coating industry into a W-shaped recession. ◀



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