DEMAND AMPLIFICATION MAP AND DISTORTIONS IN SUPPLY CHAINS

Mihaela Stet

West University "Vasile Goldiş" of Arad – subsidiary Baia Mare

Key words: demand, amplification, map, shortage, gaming, forecasting

Abstract: In this paper are presented the main causes which determine the amplification and distortions in demand of products realized by the production companies. Regarding these problems, there are analyzed the effects of demand amplification upon the supply chain and in particular, on the inventory management. There are presented, also, some solutions that could be used to prevent the causes and mitigate the effects of demand amplification and distortion.

1. INTRODUCTION

Distortion in demand information can be identified as one of the sources of waste in manufacturing supply chains, being perceived plaguing most business [2]. Any producer need to resort to budgeting and forecasting for sales. But, a series of problems could be identified regarding these forecasts, analyzing the relationship between forecast errors, lead time and delays in the feedback loop from market. This analyzes reveals and underlines the need for rapid responsive systems.

## 2. SALES PLANNING AND SALES FORECAST ERRORS

In forecasting the future demand it is important not only to prepare for product introduction by developing as accurate forecasts is possible, but also to create mechanisms that rapidly synchronize production with end-customer demand. An important factor enabling manufacturer responsiveness when introducing a new product, in this case, a new model of car, is increased demand visibility. In new products forecasting are, also, typically made large errors. A new product will tend to have less predictable demand pattern than the existing product, in this case, the previous model of car produced by car plant. However, the new product should generate an increase in demand over the product it replaces, based on brand loyalty.

The forecast models could be classified in qualitative and quantitative models. Most strategic forecasting models mix quantitative methods with qualitative research, which tend to be useful for medium-to long-term planning.

Regarding the qualitative models, the approach/method that is appropriate depends on a product's life cycle stage. When the new product is in the concept phase, a heavy reliance is usually placed on intentions surveys. Once product is on the market, it is possible to use extrapolation methods. Market size is influenced by environmental factors such as economic conditions. In forecasting aggregate future demand for new passenger cars models are used that include GDP, the age of the fleet (or total pool of passenger cars on the road in a market), the cost of money (interest rates) and levels of disposable income (factoring in cost of living, house prices against wages). Besides income, periods with sharp change in the availability of new-car credits terms can, in conjunction with other factors, influence the change of new-car sales.

1

Between quantitative methods are time series analysis such as rolling average, regression analysis, exponential smoothing and also econometric indicators and models. Judgmental models are expert opinion, Delphi method, market survey, game theory, structured analogies, and decomposition. Based on the assumption that the "forces" that generated the past demand will generate the future demand, i.e., history will tend to repeat itself, analysis of the past demand pattern provides a good basis for forecasting future demand.

For a new car model is appropriate a medium-range planning horizon. This kind of tactical plan is used to estimate aggregated demand. I've chosen a medium-range forecast for two years, taking in consideration the data of problem. The car plant requires planning to undertake launch of production of new model. The forecast needs to prove that the enterprise has the adequate working capital to fund the inventory and additional resources to service the designed throughput model. There are, also, necessary to take in account the needful capacity and the equipment to meet the new production plan. More, the producer has to analyze that the suppliers and customer channels have the required capacity, working capital, people and other resources to commit to the new plan. This will include inventory and storage of materials, from raw materials to point of sale stocks. This will involve early stages of detailed materials resource planning, critical for products and supply chain complex bill of materials.
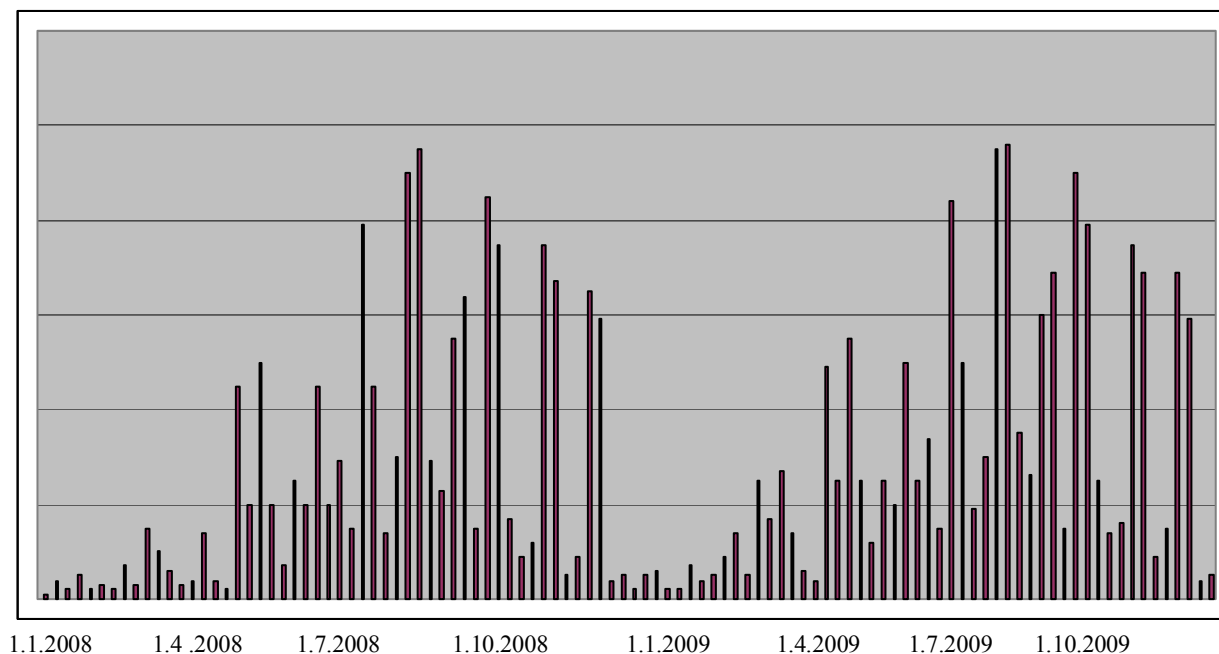
Figure 1. Forecasts for a new car model

Sales lifecycle forecasting is important when a new model of car is launched because the inventory of finished stocks of the model that has been replaced can be costly in the form of discounts and the demand for new products should exceed the demand for the previous product which has been in the market for several years and, therefore, less desirable. A successful new car launch is typified by long lead times, full order books, healthy retained margins and good residual values for recent buyers. Therefore, it is important to know at what

2

point a product is within its lifecycle, when it is due to replaced and how the transition of production and supply from one model and the next is to be managed. There is necessary, also, to make an assessment of overall market and segment volumes [1].

Regarding the car sales, by combining seasonal indices and cyclical factors with other explanatory variables, forecasting models acquire increased accuracy. The inclusion of time series components in least square models offers a new approach to forecasting.

In what it concerns the automobile demand there have been developed new models which combine the statistical method and the system dynamic method.

3. DEMAND AMPLIFICATION AND DISTORTIONS IN DEMAND INFORMATION

The difference between the production that is allocated to a market and how the market performs in term of real sales will have a great bearing on future allocation as well as current holding costs [4].

To understand the true demand and the forecast errors it is useful to use a demand amplification map. In consequence, it is presented a set of demand amplification maps for different kinds of food products, and based on these, an analysis of the causes of demand amplification and the means which can be used to address these problems.
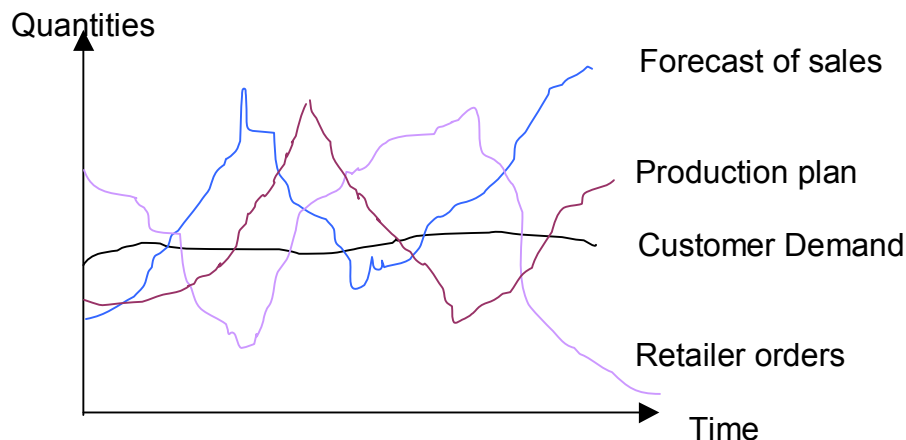

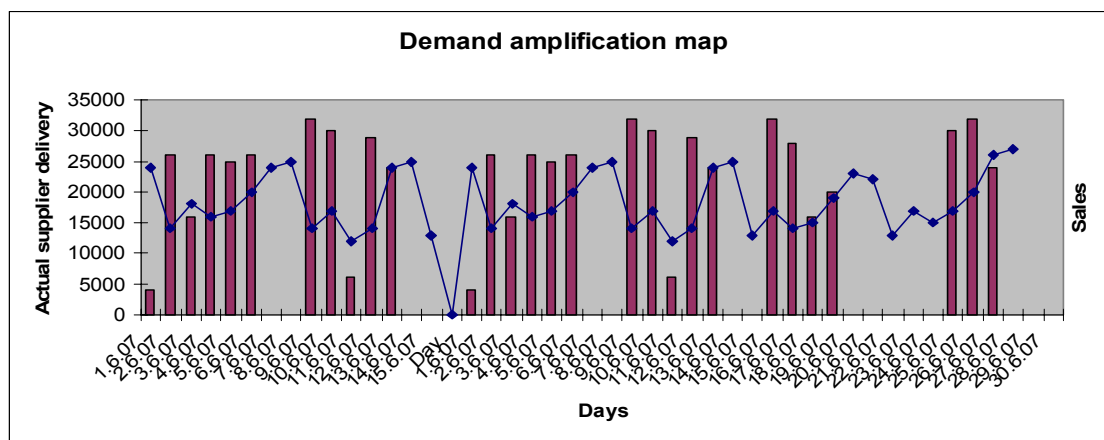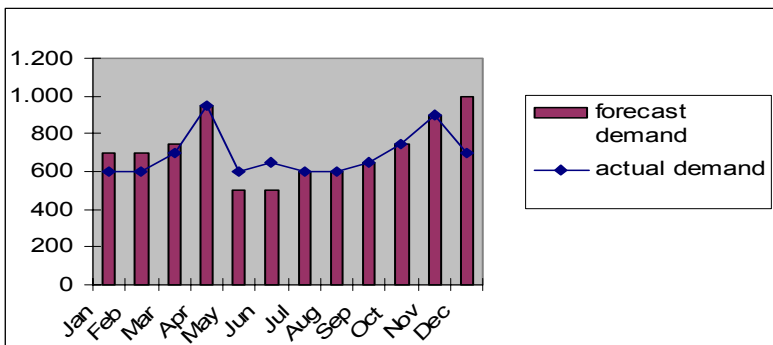*Figure 2. Demand amplification map – Biscuits*

Figure 3. Demand amplification map – vegetables

3

Figure 4. Demand amplification map – pressed cheese

The pressed cheese has some peculiarities:
- ✓ its production strongly depends on farmers' milk production, which grows in spring months;
- ✓ milk's quantities are smaller in autumn and winter periods;
- ✓ the product need to be preserved a determined period in the special storage spaces at producer, as procedure in obtaining the finished product;
- ✓ demand for pressed cheese in spring is reduced, when appear the first fresh products made with ewe's milk on the market, at smaller prices;
- ✓ the demand grows in winter season, which matches with the growing offer of finished products by the producer. For this reason the fluctuation in actual materials requirement are not so important in this case, because the producer knows well these tendencies.

Table 1 - Forecasts materials requirement and actual materials requirement for pressed cheese

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Forecast milk requirement	6000	6000	7000	9500	10000	9000	8000	8000	7500	7500	6700	5800
Actual milk requirement	6000	5500	6500	9000	9500	9000	7500	8000	7500	7000	7000	6000

Table 2 - Forecast demand, actual demand, for pressed cheese

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Forecast demand	700	700	750	950	500	500	600	600	650	750	900	1.000
Actual demand	600	600	700	950	600	650	600	600	650	750	900	700

Generally speaking, in this field, of food products, it can be identified a series of causes for demand amplification:

4

- Demand signaling process;
- Delays in information passing and, in the same time, incomplete data;
- Forecasting errors, multiple tiers of forecasting;
- Rationing (supply shortages), overreaction to backlog, placing orders beyond the proportional response to the inventory shortages.
- Poor order batching;
- Price variations.

In other fields, for example in clothing sector, an order fluctuation from customers to high street retailer determines an increasing of order fluctuation between retailer and garment maker at +/- 10%, between garment maker and fabric maker around +/- 20% and from fabric maker to yarn maker at +/- 40 %.

In the different types of supply chain it can be identified a series of other causes for demand amplification:

- Poor IT systems integration;
- Poor inventory management (bad records);
- Lack of necessary buffers;
- Misunderstanding underlying demand uncertainty;
- Inflexible MRP systems;
- Purchasing strategies;
- Inappropriate sales incentives and revenue management inconsistent with supply chain strategy;
- Functional silos;
- Erratic supply.

Manufacturers and retailers periodically organize special promotion campaigns such as price discounts, quantity discounts, special package deals, coupons, incentives and bonuses. The incentives and bonuses encourage the sales system to cyclical sales periods, which results in what is termed hockey stick demand.

One way to reduce the influence of price fluctuations is to reduce both the frequency and the level of promotion campaigns. In retail environments, this channel alignment measure is known as Every Day Low Pricing.

Lack of information or distorted information passed from one end of a supply chain can create significant problems like excessive inventory investment, lost revenues, poor customer service, misguided capacity plans, ineffective transportation and missed production schedules.

First of all, to prevent the causes of demand amplification it is necessary to understand the demand, to determine the underlying demand. Creating more stable demand where possible is the real causal problem and should the primary focus. It is important, also, to know, if the demand data is shared and whether is the volatility subject to uncoordinated pricing changes, such as promotional demand.

There are, also, many ways to reduce or to eliminate the effects of demand amplification:

- In the presence of order lead times a simple forecasting rule could lead to demand amplification. A countermeasure against demand signaling is to share point-of-sales and inventory data among parties in the supply chain. Other potentially countermeasures are direct selling to customer and lead-time reduction, speed the flow of products through the supply chain;
- Understanding the demand, the type of underlying demand and what are the main factors which influence it;

- Smaller batch sizes would decrease the end-product inventory and increase flexibility. The companies can develop a simple production schedule system which helps to define production runs daily on the shop-floor level [3];

- When, for a manufacturer, the major part of demand is originated from wholesalers, the cooperation between factory and wholesalers is the first compulsory step towards better logistics performance;

- An effective countermeasure to shortage gamming is to apply different rules for allocating scarce capacity across customers in genuine shortage situations, like the introduction of allocation mechanisms based on past sales records rather than on actual orders eliminates the incentive for customers to exaggerate their order sizes.

- Share accurate and timely information;

- Product line rationalization to reduce complexity alongside modularity for postponement;

- Questioning where to keep inventory and ways that inventory can be tactically used for buffering stability;

- Creating more level schedules that can be achieved with reduction of changeover time and production of smaller batches and the effective use of bottlenecks and islands of pull-based flows;

- System design and collaborative management.

The most important of all can be considered the system design and collaborative management.

3. CONCLUSIONS

Changes in end-user demand are amplified upstream along the supply chain, generating different negative effects. Use of demand amplification map as a collaborative planning tool, assisting suppliers and customers, represents an important mean to tackle these problems.

REFERENCES

[1] Kleinbaum, R. – Multivariate Time Series Forecasts of Market Share, General Motors Research Laboratories Marketing Science Institute, Cambridge, MA (1988)

[2] Stalk and Hout – Competing Against Time: How Time Based Competition is Reshaping Global Markets, Free Press, New York, (1988)

[3] Taylor, D.H. – Amplification Across the Supply Chain, Cardiff University, IJOLM (2001)

[4] Waller, B. – Inventory Management and Demand, Cardiff Business School, UK,(2007)