DEMAND FORECASTING AS A TOOL FOR PRECISE PRODUCTION PLANNING AND INVENTORY CONTROL

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Abstract: *Forecasting methods represent strong tool for production planning and inventory control system. This paper shows author's experiences in forecasting application arrea and one of possible ways for practical implementing of forecasting methods.*

Key words: *forecasting, production planning, inventory control, forecast error*

1   INTRODUCTION TO FORECASTING

Demand forecasting is a systematic approach to estimation of future customer requirements using statistical and mathematical methods. Forecasting is a base of every parts of business plan, including of distribution and sales plan. In the field of logistics planning (sales-, production- and purchasing-planning) we have to process a detailed data, structured according to items, markets, time behavior, etc.

Forecasting is usable in every production enterprise independend of applied logistics concept. This fact is showed in Figure 1. Forecasting methods are used in each of decoupling point positions except of "purchase and make to order" concept, because in this case exist only order-blocked inventories.
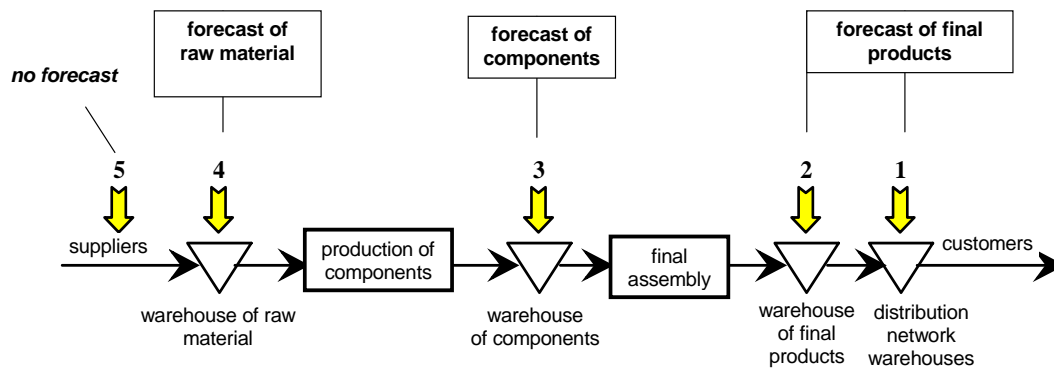
Decoupling point No.	Position of decoupling point	Concept of logistics control
1	distribution network warehouse	make and distribution to stock
2	final products warehouse	make to stock
3	assembly components warehouse	assembly to order
4	raw material warehouse	make to order
5	supplier	purchase and make to order

Fig.1 *Application area of forecasting methods depending on logistics concept.*

2 STEPS OF FORECASTING

To achieve of accurate forecasting results is there necessary to keep following steps:

1. Preparing of data

2. Identification of demand model

3. Selection of an appropriate forecasting method

4. Demand forecasting

5. Evaluation of forecasting accuracy and effects to inventory control

2.1 Preparing of data

The goal of this step is to collect time series of historical demand. Collected time series has to fill 3 base conditions:

- adequate length of time series (depends of demand model and used forecasting method)

- integrity of time series (no missing data)

- elimination of every nonstandard influences from time series data

table 1. Required lengths of time series

Forecasting method	Min. length of time series
Moving average	3 last periods
Regression analysis	1 year
Seasonal models	2 years
Box-Jenkins models	50 – 60 periods

2.2 Identification of demand model

Every practical demand may consist of four base components:

- trend: permanent change (increasing, decreasing) of demand level
- season: periodical change of demand level with length of cycle = 1 year
- cycle: periodical change of demand level with length of cycle > 1 year
- residual component

First three components may be represented using mathematical models, only fourth component is indescribable using models. This component implicates an inaccuracy of every forecast (forecast error).
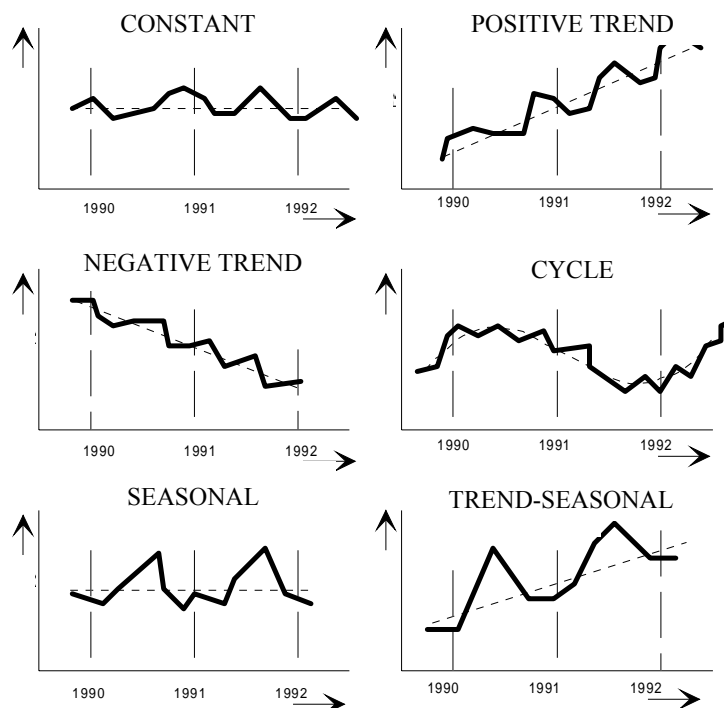

Fig.2 *Various demand models*

2.3 Selection of an appropriate forecasting method

Applicability of forecasting method depends of:

- demand model (simple demand model requires simple forecasting method)
- required forecast accuracy (used forecasting model has to generate minimal forecast error)

One of applicable approaches to find the best forecast model is so-called backforecasting. In this technique is builded the forecast model, which is used to demand forecast in historical periods. For each of historical periods we get two values: actual demand and forecast demand. Difference between these two values is called forecast error:

forecast error = actual demand - forecast demand

On the basis of forecast errors is chosen the best forecast model.

2.4 Demand forecasting

Chosen forecast model is used to demand forecast in future periods.

2.5 Evaluation of forecasting accuracy and effects to inventory control

Every forecast is only probabilistic expression of future demand progress. Every forecast contains some error rate. Forecasting error must be compensated through safety stock holding. The forecasting error is higher, the safety stock must be higher too. One of possible approaches to safety stock determination is safety stock calculation on the basis of MAD (Mean Absolute Deviation):

$$MAD = \frac{1}{n} * \sum_{i=1}^{n} |e_t| \qquad (1)$$

$$s_s = 1{,}25 * R * MAD \qquad (2)$$

where:

MAD – Mean Absolute Deviation

e_t - forecasting error in period t

n - number of analyzed values

s_s - safety stock

R - safety coefficient (determined from normal distribution)

3 PRACTICAL APPLICATION OF FORECASTING METHODS

On of possible way of practical forecasting application is usage of Microsoft Excel background. This way presents the cheapest solution of this problem. Simultaneously it is appropriate way of forecasting application in the small and middle enterprises.

Basic tool of forecasting application in Microsoft Excel background is programming language Visual Basic for Application (VBA). This tool allows to make individual-like computer program with personal interface.

Some example of practical forecasting application in Microsoft Excel background shows figures 3 and 4. Figure 3 shows sheet with basic input and output data for selected forecasting method (include future forecast, forecast errors and graphs). Figure 4 shows summary of forecasting.
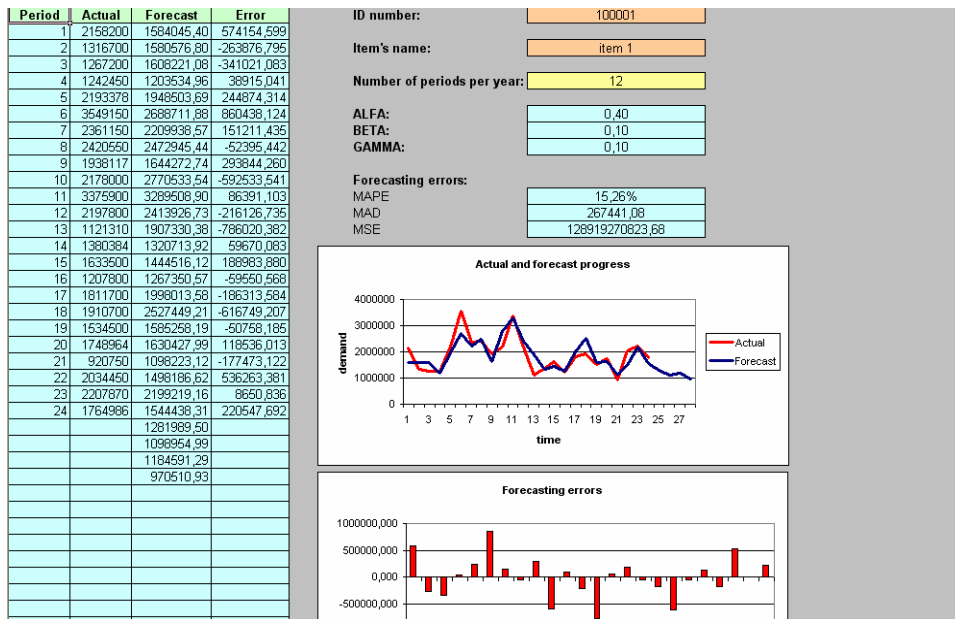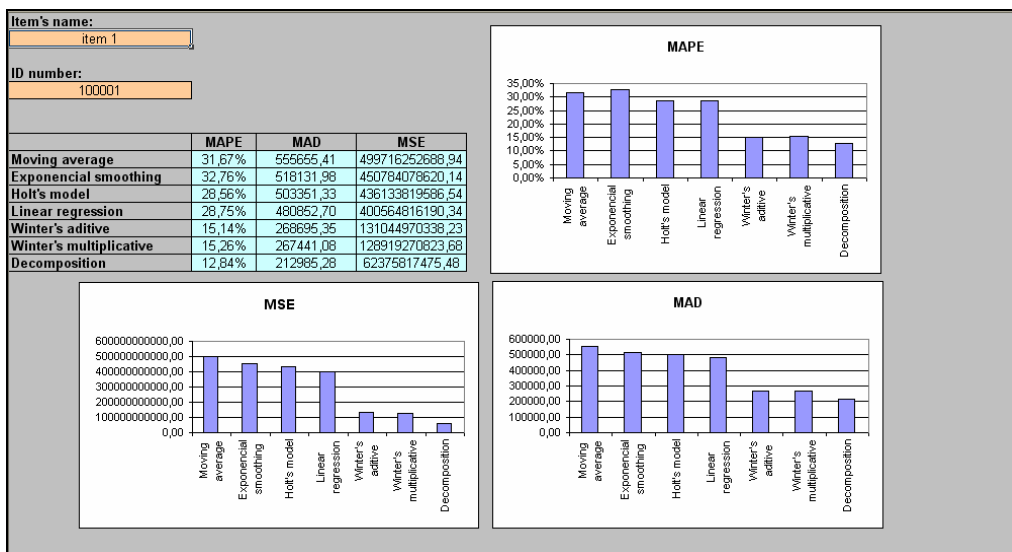

Fig.3 *Results of forecasting method application.*

185

Fig.4 *Summary of forecasting.*

4   CONCLUSIONS

Usage of forecasting methods in practice brings a lot of advantages in production planning and inventory control area, especially in planning accuracy and needed inventory level.

5   REFERENCES

[1] GREGOR, M. a i.: Dynamic Production Planning And Control. 1st edition, Zilina, University of Zilina 2000

[2] HORÁKOVÁ, H. – KUBÁT, J.: Inventory Control. 3rd edition, Praha, Profess Consulting 1998

[3] KRAJČOVIČ, M.: Analysis And Proposal Of Inventory Control System In Make-To-Stock Area. International Conference „Logistics & Distribution Systems", Zvolen 1999

[4] KRAJČOVIČ, M. – BUBENÍK, P.: Application Of Statistical Forecasting Methods In Sales Planning. International Conference „Logistics & Distribution Systems", Zvolen 2001