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II. REVIEWS AND NOTES

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SALES FORECASTING
IN A TELECOMMUNICATION COMPANY

The following paper deals with sales forecasting in a telecommunication company. A multiple regression model was used to calculate forecasts for the number of impulses generated by company's clients. As the regressor variables were employed: time variable, price of one impulse and general business indicator in industry. The low errors values testify the accuracy of built forecasts.

1. INTRODUCTION

A manager's activity is an ongoing decision process. The main difficulty connected with decision making is the fact that at the moment of taking a decision we do not know the future state of affairs and we are not able to determine what profit will bring us from this or that decision. When we come to our decision today, we know that its result will occur in the future and importantly, this result will depend not only on the managers but on controllable and uncontrollable factors as well. The forecast gives us additional information what may reduce the risk connected with deciding.

Among many different forecasts in business management sales forecast plays a special role, which can be a basis for decisions in production, supply, finance, store, working force etc. It defines expected sales volumes of a business in a given period. This forecast is built by forecast conditions resulting from the marketing plan and from agreed assumptions concerning the way the most important factors of the marketing environment affect sales volumes. Considering the changes (in quantity and in quality) in sales volumes we can prepare a short-term, middle-term or long-term forecast.

2. DESCRIPTION OF THE DATA
AND THE METHODOLOGY

In a telecommunication company, a sales forecast will concern the future volume of telecommunication services. In our consideration we will confine ourself to showing the way of defining the future number of impulses gene- rated by the company's clients. Other services will be ommited. In addition to that we will concentrate on the short-term forecast, 1-3 months, what allows us to take an asssumption that in the forecasting occurrence only quantitative changes will happen and they will find expression in forecast value changes corresponding with up to date observed regularities. The forecast number of impulses will be a basis for calculating the gross sales values of the com- pany's services in a given period.

The considerations will concern a specific telecommunication company X operating in our country but its name must stay unrevealed. That's why we have recalculated the data concerning generated impulses (in Table 1) accordingly.

Table 1
Numbers of impulses generated by clients of Telecommunication Company X
from January 1993 to December 1994.

1993		1994	
Months	Numbers of impulses	Months	Numbers of impulses
January	328701	January	364819
February	367400	February	351440
March	370568	March	312433
April	360674	April	291923
May	358303	May	313818
June	388113	June	323217
July	363292	July	286453
August	314689	August	296509
September	303843	September	330892
October	331840	October	285630
November	339296	November	297938
December	343743	December	302297

Source: Telecommunication Company X Reports.

The obvious fact is that the amount of generated impulses depends on the number of days in a given month. When the month is longer this amount rises and when the month is shorter, it falls. The data collected by the author show that the amount of generated impulses depends on the number of working

days in the month and additionally the structure of days, i.e. the number of Mondays, Tuesdays etc.

Research carried out by the telecommunication company X showed that the structure of generated impulses differed strongly according to a specific day (Table 2).

Table 2
The structure of generated impulses

Days of the week	Impulses in %
Monday	23,5
Tuesday	17,7
Wednesday	14,1
Thursday	15,3
Friday	20,6
Saturday	5,9
Sunday	2,9

Source: author's computations.

The main reason for this structure is probably the fact that the largest part of the impulses, from among total amount, is generated by companies (corporate bodies). Business activity of this group is restricted to five days of the week, i.e., from Monday to Friday. This situation means that in these days of the week they generate the largest part of the impulses (specially on Monday and Friday).

To omit the influence of these factors on the number of generated impulses the data in Table 1 were divided by coefficients k_i defined by equation (1):

$$k_i = 0,235\, n_{1i} + 0,177\, n_{2i} + 0,141\, n_{3i} + 0,153\, n_{4i} + 0,206\, n_{5i} + 0,059\, n_{6i} + 0,029\, n_{7i} \qquad i = 1, ..., 24 \qquad (1)$$

where k_i is the coefficient for period i,

n_{1i} is the number of Mondays at period i,

....

n_{7i} is the number of Sundays (holidays) at period i,

0,235;...; 0,029 – is the rate of impulses generated in particular days of week in total number.

The values obtained in this way present the weekly average number of generated impulses in specific months of years 1993-1994 (Table 3). The statistical analysis carried out did not reveal periodical fluctuations with other cycle length.

The sales volume of the company may be influenced by marketing instruments employed by the company, i.e. marketing-mix and its micro- and macro-environment. As most important among the controlled variables included to marketing instruments: product, distribution, price and promotion, the telecommunication company X assented a unit price of an impulse. The analyses carried out by the company show that there is a strong interdependence between the number of impulses and their price. When the price increases, the number of impulses falls. In the present situation of the lack of competition on the market of telecommunication services other marketing instruments do not play any important role.

Table 3

The weekly average number of generated impulses from January 1993 to December 1994

1993		1994	
Months	Numbers of impulses	Months	Numbers of impulses
January	79840	January	84980
February	91850	February	87860
March	81390	March	69880
April	85630	April	71920
May	87030	May	73100
June	92540	June	77510
July	82230	July	66710
August	70860	August	68210
September	70760	September	75910
October	77280	October	66520
November	83120	November	68540
December	76900	December	69350

Source: author's computations.

Among elements of the micro-environment of the company: suppliers, middlemen, buyers, competitors etc. and the lack of competition; clients were recognized as the most important factor. As the variable characterizing clients the total number of them was assumed. The rise in the number of clients causes the rise in the number of generated impulses. Considering that the demand for new telephone links is not still met, we can assume that the telecommunication company is to a great extent in control of this variable. Generally the company is not able to control the variables of the marketing environment. In our case this fact may help us to build the forecast of the amount of generated impulses. We did not differentiate between the corporate bodies and individual clients, because we lacked the appropriate statistical data concerning the number of impulses for a specific day of the week. This

would be possible after carrying out the necessary statistical research but it exceeds the limits of this article.

Among the factors of the company's macro-environment are numbered: economic, demographical, political, judicial, technological, social, cultural and natural factors. Economic factors are most important for the defining of the future number of impulses. As seen above, most impulses are generated by corporate clients. Thus it has been assumed that the business activity of companies influences the forecast occurrence to a great extent. The rise of business activity stimulates the rise in the number of impulses, the depression has consequences in the fall of this number. To estimate the business activity of the companies we used the general business indicator in industry based on the research carried out by the Research Institute of Economic Development of Warsaw School of Economics.

Table 4
Values of regressor variables of models from January 1993 to September 1994

Months	Price of one impulse	Number of clients	Business indicator
1993			
January	600	6951	-5
February	600	6938	-5
March	600	6926	-3
April	600	7056	-3
May	600	7101	-6
June	600	7173	-10
July	600	7200	-12
August	700	7227	-11
September	800	7247	-5
October	800	7298	3
November	800	7324	5
December	800	7371	6
1994			
January	800	7421	3
February	800	7465	4
March	1000	7558	6
April	1000	7605	10
May	1000	7582	11
June	1000	7622	9
July	1100	7676	6
August	1100	7730	7
September	1100	7799	11

Source: author's computations.

To describe the weekly average number of impulses generated in given months of the examined period we used a multiple regression model. As the

potential variables explaining we employed: time variable t characterizing the development tendency of the examined occurrence, price (in ZL) of one impulse as the instrument of the marketing policy of the company (X_1), the number of clients characterizing micro-environment of the company (X_2) and general business indicator in industry characterizing the macroenvironment of the company (X_3). Estimation of the model parameters with different combinations of regressor variables was carried out on the basis of the first 21 observations from the period from January 1993 to September 1994. The remaining 3 observations served to define ex post errors of forecasts. The values of variables are given in Table 4. The number of clients was recalculated.

On the basis of evaluation of merits and statistics, the following model was chosen as the best one:

$$y_t = 139\ 708,1 + 1402,3\ t - 95,0\ X_{1t} + 636,1\ X_{3t} \tag{2}$$

with significant (on the level $\alpha = 0,05$) parameters and the coefficient of determination $R^2 = 0,73$.

For determining the forecast number of generated impulses, on the basis of developed model, during the last three months of 1994, we have to know the values of explaining variables during this period of time. Price of an impuls (X_1) in the last quarter of 1994 was defined in the marketing plan of the company on the level of ZL 1200. To define the necessary value of general business indicator in industry (X_3) forecasts concerning this variable were built on the observations in the period from January 1993 to September 1994. As the forecasting model was used Holt's exponential smoothing model with parameters $\alpha = 0,1$ and $\beta = 0,5$. The acquired forecasts for October, November and December 1994 were equal 16, 17 and 19% respectively. The forecasts for the number of generated impulses built through an extrapolation of the multiple regression model and their percentage errors can be found in Table 5.

Table 5
The forecasts for the number of generated telephone impulses

Months	Number of impulses	Forecast number of impulses	Percentage errors
October	285630	288305	-0,94
November	297938	296773	0,39
December	302297	300753	0,51

Source: author's computations.

3. CONCLUSION

The low errors values for each month prove the accuracy of built forecasts. It turns out that the way of constructing short-term forecasts of the number of generated impulses was right and that it has a real practical value for the telecommunication company.

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