BUSINESS PERFORMANCE MANAGEMENT USING MODEL FOR PROFIT OPTIMIZATION

Berislav Bolfek, Biljana Lončarić
[1]University of Applied Sciences of Slavonski Brod, Croatia

ABSTRACT

Performance management is an imperative for the management because their success in managing a company depends on achieved results. Therefore, it is very important that the management can always and at any moment affect business results, i.e. profit movement. Ordinarily, business results or profit monitoring does not seem to be a problem for the management, while taking various corrective actions directed at increasing profit is not that simple and this is a real problem for the management. The question that arises is what activities and what total number of these activities should be undertaken to achieve the planned level of profit.

As one of the possible ways for solving this problem is to develop a Model for profit optimization, which should assist the management in performance managing. Model for profit optimization consists of two procedures for the optimization of profit based on the method of linear programming. This model finds the optimal relationship between the income from the sale of various products and services, so it is possible to determine exactly which incomes should be increased and in what measure it should be done. In this way the management gets a new opportunity to take corrective actions in time to achieve the goals of the business policy in terms of making profit.

JEL clasiffication: C61, L25,

Keywords: management, profits, linear programming

1. INTRODUCTION

In today's dynamic environment, it is necessary to manage the business results, so that the company could be operated successfully and could make a profit, which presents the measure of the success of individual companies at the market. Among

many responsible tasks of a company management, the business results management has one of the most important roles. A profit is a measure of the success of individual companies, and therefore it is the most important category in relation to other financial indicators. Therefore, all companies regardless of their size must prepare "Income Statement", as a financial report, prescribed by the statutory accounting, whose purpose is to calculate the gain (or loss) precisely, for the period of one year (12 months).

"The business results are not expected, they are managed. Today the terms accepted in economic terminology are: cost management, financial management, inventory management, production management, sales management, personnel management, management accounting, quality management and other types of management. For effective business results management, it is important that clearly defined goals exist and that there is possibility to measure them.. Negative deviations from the goals refer to the necessity of taking action for their correction, or for making new business decisions that set new goals." (Avelini-Holjevac; 1998, 6)

The high quality business results management involves careful planning of all segments of business, as well as designing and monitoring of key indicators which reflect the actual situation (meaning how the company actually operates), and, at the end, analyzing the reasons and the sources of deviations between desires and reality, plans and results.

Bigger companies set up monitoring and compare realized profit with planned profit, and this activity does not present a problem for the management of the company. However, in the case that there is an unwanted deviation from planned profit what presents a bigger problem for the management, a corrective action in order to achieve the planned profit should be taken.

Therefore, one of the ways to solve the mentioned problem is to establish the model for profit optimization, developed and set up on the basis of linear programming methods.

2. MODEL FOR PROFIT OPTIMIZATION

Once comparison of the realized profit with the planned profit has been done, there is the possibility that the realized profit is lower than the planned profit, and that the deviation is bigger than allowed. This discrepancy leads the management to the situation where there is a need to take specific measures and activities immediately, in order to increase profit as well as to achieve the planned level of profit.

This situation can be solved in a way to increase revenues additionally, or to increase the existing volume of production and sales which will at the end result in increased profit. However, parallelly with the increase in revenues, there is the expenditures increasing, noting that the value of revenues increasing may not be the same as one on the expenditure side. The above shows that the expenditures do not have to grow as quickly as the revenues, but they can grow slower, or faster. Therefore, an effort has to be made to raise more these revenue that are followed by slower growth on the side of the expenditures.

Therefore, there is a need to make a selection of products and services that realize maximum profits and to organize their production and sales in order to reach planned profit by increasing total revenues. This means that the optimal relationship between the incomes from the sale of various products and services should be found, meaning that it is necessary to determine which revenues should be increased and how much.

In this case it is necessary to implement the process of profit optimization, and one of the ways to do it is by using the method of linear programming, which is described in the literature and can be used for this purpose. That is why the method of linear programming presents the basis on which the model for profit optimization has been positioned and developed.

Model for profit optimization just mentioned has been set up in a way so that the optimization of the model proceeds in two mutually connected activities. In the first activity the maximum profit, using the resources currently available for production, is being calculated, while in another activity we must calculate the maximum profit realized by using additional resources for production.

2.1. The procedure for the optimization of the profit I

The first activity in the Model for profit optimization is procedure for obtaining the optimal profit and through which the maximum profit, on the basis of all resources currently available for the production, is calculated.

The aim is to determine the exact quantity of the types of products or services which have to be produced and sold, with known profit realized on the particular product or service, in order to achieve maximum total profit in the current year. Available data for this purpose are in the planned calculations and work orders calculations indicating the profit amount in a particular product or service.

The above objective function which should be maximized can be written in the mathematical form in this way:

$$OP = P_1x_1 + P_2x_2 + \ldots + P_nx_n \rightarrow max \quad (1)$$

with following explanation:

OP – profit optimization at the annual level

P – profit realized by selling the specific product or the specific service (product groups or service groups)

x – amount of the products or the services (product groups or service groups)

n – number (code) of the specific product or the specific service (product groups or service groups)

The restrictive factors that appear in maximizing profits as available manufacturing capacities have to be taken into consideration. That is why there are following limitations in the model: availability of machine capacities, availability of work (human) capacities, possibilities to sell on the market, so far agreed sales and production, and availability of raw materials for production.

The first limiting factor is the total available machine capacities for the production of all products or services on annual basis, and can be expressed as follows:

$$mc_1x_1 + mc_2x_2 + \ldots + mc_nx_n \leq MC \quad (2)$$

with following explanation:

mc – machine capacity needed to create a single product or service expressed in machine hours

x – amount of the products or the services (product groups or service groups)

n – number (code) of the product or the service (product groups or service groups)

MC – total machine capacity available for production of all products or services on annual basis, expressed in machine hours

Another limiting factor is the total available working (human) capacity for production of all products or services on annual basis and can be expressed as follows:

$$hc_1x_1 + hc_2x_2 + \ldots + hc_nx_n \leq HC \quad (3)$$

with following explanation:

hc – working (human) capacity that is needed to create a single product or service, expressed in standard hours

x – amount of products or services (product groups or service groups)

n – number (code) of the product or the service (product groups or service groups)

HC – the total work (human) capacity available for production of all products or services on annual basis, expressed in standard hours

The third limiting factor is the market, which means that there is a limited possibility of sales for each product or service, and the maximum amount of market sales for each product or service has to be determined. This limit can be written as follows:

$$\begin{aligned} x_1 &\geq S_1 \\ x_2 &\geq S_2 \\ x_3 &\geq S_3 \end{aligned} \tag{4}$$

with following explanation:

S – maximum annual sales of products or services expressed in units of measure

x – amount of products or services (product groups or service groups)

n – number (code) of the product or the service (product groups or service groups)

The fourth limiting factor is the existing, already concluded contracts and customer orders for certain products and services, or contracted production (sales) for the current year. Above limit can be written as follows:

$$\begin{aligned} x_1 &\geq A_1 \\ x_2 &\geq A_2 \\ x_3 &\geq A_3 \end{aligned} \tag{5}$$

with following explanation:

A – agreed and realized sales (there are contracts and purchase orders, as well as the invoices for goods sold) of products and services for the current year, expressed in units of measure (pieces, kg, m, m2, m3, etc.).

x – amount of products or services (product groups or service groups)

n – number (code) of the product or service (product groups or service groups)

The fifth limiting factor is the overall availability of raw materials (materials for production) at the annual level which should be sufficient for the production of all products, and can be expressed as follows:

$$r_1x_1 + r_2x_2 + \ldots + r_nx_n \leq R \qquad (6)$$

where:

r – raw materials (materials for production) needed to create one product expressed in the unit of measure

x – amount of products or services (product groups or service groups)

n – number (code) of the product or the service (product groups or service groups)

R – total raw materials (materials for production) available for the production of all products at the annual level, expressed in units of measure (pieces, kg, m, m^2, m^3, etc.).

At the end we have to specify restrictions in regard to the non-negativity:

$$x_1 \geq 0,\ x_2 \geq 0,\ \ldots,\ x_n \geq O$$

After finishing the procedure for profit optimization, as a result we get the exact amount of certain products or services that should be produced or sold in the current year, in order to achieve maximized profits by taking into account all of mentioned limiting factors.

After the procedure for the optimization of profit has been finished, we can determine whether the optimized profit is lower than the planned profit. If the optimized profit is bigger or equal to the planned profit the obtained results can be applied. If the optimized profit is lower than the planned profit, the analysis of deviations for optimized profit should be done. Through this analysis it can be determined whether deviation is greater than allowed. If the deviation of the optimized profit is lower or equal to permitted deviation, current operations could be continued. However, in the case that the deviation of optimized profit is higher than permitted, it is necessary to carry out the process for profit optimizing II.

2.2. The procedure for optimizing profit II

The procedure for optimizing profit II presents the second activity for profit optimization by which maximum profit can be calculated, in a way that, besides the existing resources of production, additional resources for production are conducted, too.

Assuming that the result got by getting optimized profit (according to the previous terms from 1 to 6) is not satisfactory, and optimized profit is still lower than planned, this means that revenues should be increased further. Namely, in such cases in order to increase revenues, it can be arranged to install additional shifts (second, third), and additional work in non-working days (on Saturday, on Sunday, during public holiday), under condition that there is a possibility for selling in the market additional quantities of products and services.

Therefore it is necessary to modify the existing objective function in the sense of the introduction of additional work expressed in hours, with the dilemma of (an unknown) how much extra work (hours) with a known cost we have to invest, in order to achieve maximized profits.

The objective function modified in this way can be also written in the mathematical form in this way:

$$OP2 = P_1x_1 + P_2x_2 + \ldots + P_nx_n - PMy - PSz \rightarrow max \qquad (7)$$

with following explanation:

OP 2 – Optimization of profit at the annual level

P – profit realized by selling specific product or service (product groups or service groups)

x – amount of products or services (product groups or service groups)

n – number (code) of the product or the service (product groups or service groups)

PM – price per additional machine hour

PS – price per additional standard (human) hour

y – the total number of additional machine hours

z – the total number of additional standard hours

Five of the existing restrictions that are listed in the previous expressions of (1) to (6) should be updated, only in the terms: (2) as the first limit, and (3) as the second limitation, while the other limitations do not change but remain the same. Thus, all restrictions by the modified objective function can be written as follows:

1st $OP = P_1x_1 + P_2x_2 + \ldots + P_nx_n \rightarrow max + y$

2nd $mc_1x_1 + mc_2x_2 + \ldots + mc_nx_n \leq MC + z$

3rd
$$x_1 \geq S_1$$
$$x_2 \geq S_2$$
$$x_3 \geq S_3$$

4th
$$x_1 \geq A_1$$
$$x_2 \geq A_2$$
$$x_3 \geq A_3$$

5th $r_1x_1 + r_2x_2 + \ldots + r_nx_n \leq R$

By maintaining the same restrictions in regard to the non-negativity:

$$x_1 \geq 0,\ x_2 \geq 0,\ \ldots,\ x_n \geq O$$

The result of the repeated process of profit optimization, with the modified objective function, is to get the total number of extra hours as the basis for increasing production, in order to achieve the maximum profit for the current year. Namely, in this way we get the exact number of extra machine hours and standard hours for each product or service, so increasing of the hours is not being implemented for all products and services linearly, but the optimum relationship between all products and services has been determined.

3. CONCLUSION

Business results management, in addition to financial management, production management, marketing management and human resources management, is one of the most important tasks facing management. To manage the business results, it is necessary to track from month to month moving of profit as well as the eventual loss during the whole business year.

However, for successful management it is not enough to monitor only realized profits, and to compare it with the planned profit values. The management is expected to react quickly and decisively to the unwanted situation of profit deviations, in sense of taking corrective actions to achieve planned or expected profits.

Exactly for this purpose The Model for profit optimization has been developed. Basis of the model is linear programming method that calculates the maximum profit that can be achieved in the current year with available and additional resources. Therefore, in the model there is the possibility to modify objective functions, in order to introduct additional resources.

The basic advantage for the management that Model for profit optimization provides is the possibility of taking timely corrective actions, in order to achieve the goals of business policy, as well as to realize principles of business results which should not be expected, but managed.

LITERATURE

1. Avelini-Holjevac, I. (1998). Kontroling: upravljanje poslovnim rezultatom, Hoteljerski fakultet Opatija, ISBN 953-6198-15-0, Opatija
2. Barković, D. (2001). Operacijska istraživanja, Ekonomski fakultet Osijek, ISBN 953-6073-51-X, Osijek
3. Bronson, R.-Nadimuthu,G. (1997). Operations research, McGraw – Hill, ISBN 0-07-008020-8, New York
4. Chadwick, L. (2000). Osnove upravljačkog računovodstva, Mate d.o.o., ISBN 953-6070-63-4, Zagreb
5. Schroeder, R. (1999). Upravljanje proizvodnjom, Mate d.o.o., ISBN 953-6070-37-5, Zagreb