OLSZTYN ECONOMIC JOURNAL
Abbrev.: Olszt. Econ. J., 2012, 7(2)

ALGORITHM OF CALCULATING THE ANNUAL ECONOMIC EFFECT FROM IMPLEMENTING DIFFERENT TYPES OF INNOVATION IN A BUSINESS ORGANIZATION

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K e y w o r d s. Innovation, economic effect, cost of production, savings of resources.

A b s t r a c t

The goal of this article is the development of a commonly acceptable algorithm of calculating the economic effect from introducing innovations in a business organization. The article uses the method of absolute economic efficiency. It results in a number of suggested formulas for calculating the annual economic effect obtained by a reduction of manufacturing costs, increases in sales, savings of labour, material and financial resources both in manufacturing and non-manufacturing business areas, utilization of production waste as well as a reduction of manufacturing defects.

ALGORYTM OBLICZANIA ROCZNEGO WPŁYWU EKONOMICZNEGO WDRAŻANIA RÓŻNYCH TYPÓW INNOWACJI W ORGANIZACJI GOSPODARCZEJ

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S ł o w a k l u c z o w e: innowacja, efekt ekonomiczny, koszt produkcji, oszczędności zasobów.

A b s t r a k t

Celem artykułu jest opracowanie powszechnie akceptowalnego algorytmu obliczania efektu ekonomicznego wdrażania innowacji w organizacji gospodarczej. W artykule wykorzystano metodę absolutnej sprawności ekonomicznej. Zasugerowano kilka wzorów do obliczania rocznego efektu ekonomicznego uzyskiwanego na skutek obniżenia kosztów produkcji, wzrostu sprzedaży, oszczędności w zakresie kosztów siły roboczej, materiałów oraz zasobów finansowych, zarówno w obszarach produkcyjnych, jak i nieprodukcyjnych działalności, wykorzystania odpadów produkcyjnych, a także zmniejszenia liczby wad produkcyjnych.

Introduction

One of the key priorities of the development strategy of the Republic of Moldova is economic growth based on the balanced development of the national economy, gradual substitution of the energy resource component of the national GDP by a high-tech export production component based on effective utilization of scientific, technological and human potential of the country. Economic growth is quite feasible, yet it is possible only due to intensive technical and technological renewal of the manufacturing process and implementation of an innovative development model in the national economy.

The applicability of researching the problems of innovative economies is undoubted, although the development of modern information systems in Moldova has only just begun. We can observe the gradual formation of new innovative structures which are able to create new commercially attractive projects financed by successful companies involved in the realization of unique innovative programs.

The notion of "innovation" or "novelty" implies the production of new goods and services of higher quality, growth of production efficiency, improvement of work conditions, reduction of material and energy resources used per unit of manufactured goods, reduction of the ecological consequences of manufacturing and other business activities as well as other factors (RAIZBERG et al. 2005, p. 151).

Because the implementation of innovation in a business organization can provide a number of both positive and negative results, the effect of innovation can be measured by its added value which represents economic, social, ecological, informational and other useful effects. It is computed as the difference between the benefits of value-adding effects from an innovative approach and its implementation costs, considering the possibility of certain negative outcomes (FATKHUTDINOV 2003, pp. 397–399).

A single generalizing factor of economic efficiency of any innovation is the *economic effect* which describes the absolute value of the difference between the revenues and the costs from the application of a particular type of innovation within a predetermined period of time, usually one calendar year. The value of an economic effect is measured in two forms: macroeconomic and internal. The existence of a macroeconomic effect from a particular technological, organizational, breeding or other type of innovation does not always imply the appropriateness of its use in a business organization. That is why each firm always has to focus, not as much on the value of the entire macroeconomic effect, but on its share received by each participant of the innovation process. In other words, it is necessary to compute the internal economic effect of an applied innovation (VYVARETS 2007, pp. 215–221).

The methodology of calculating the efficiency of innovation in business organizations is extensively discussed in the works of Prokopivny, Greschak, Vyvarets, Ivaschenko, Fathoutdinov and others. The algorithm of calculating economic efficiency, for instance, for technological innovations, stipulates a comparison between the total generated revenues and total costs incurred (POKROPIVNY 2003, pp. 250–252).

The entire diversity of organizational, technological and other types of innovation covers a number of engineering, organizational and technological solutions implemented in the manufacturing process. These solutions usually value manufacturing efficiency in terms of a potential economic effect. Besides this, the efficiency of innovation is often evaluated analogously with investment- and innovation-driven projects on the basis of net discounted cash flows, return on invested capital and other measures which might not always reflect directly the value of a particular type of innovation implemented in a business organization.

The process of creation and assimilation of new goods and services, implementation of modern technologies and progressive methods of labour organization and manufacturing processes needs the development of a scientifically-based, commonly available methodical approach for evaluating a certain type of innovation (novelty) in the manufacturing process of a business organization.

In order to identify the most typical approaches of evaluating the efficiency of different types of innovation, an algorithm is suggested (RAIZBERG et al. 2005, p. 20) to calculate the annual economic effect from implemented types of innovation in the Republic of Moldova which can be used for the following purposes (PARMACLI 2003, p. 5–6):

– Technical and economic explanation for choosing the best options for creation and implementation of new equipment and technology;

– Reflection of efficiency measures in the accepted norms and parameters of an organization's business plans;

– Pricing of specific products as well as purchases and sales of technical documentation;

– Calculation of compensation to the authors of innovative approaches (novelties in a business organization);

– Possible resolution of certain litigations;

– Award of honourable titles to the authors of different types of innovations;

– Reporting to the statistical authorities about the implementation of any type of innovation.

The process of innovation consists of two major parts (GERCHIKOVA 1995, pp. 306–308):

– Creation of innovation which covers the period from early research and development to the starting date of its actual use;

– Implementation of innovation, *i*.e. the year during which positive results from the use of an innovative product or service are obtained and economic and other effects are determined.

In order to calculate the full economic effect on a business organization, methods of both comparative and absolute efficiency can be used. The method of comparative efficiency requires a computation of the actual results: the total cost of production, sales revenue, losses incurred by transferring manufacturing to another product, benefits of rationalization of labour resources, both in the manufacturing and in the exploitation areas.

In this case, the annual economic effect received by a firm as a result of the use of a novelty or a product with its application consists of:

– Increases in the business organization's revenues, gross margins and net profits (SHMALEN 1996, pp. 457–459);

– Reduction of production costs through savings or a more efficient use of available resources;

– Increases in revenues based both on a higher product price and a higher quantity of units sold;

– Other parameters (IVASCHENKO 2007, pp. 374–377).

If an implemented novelty has an analogue – *i*.e. a basis for comparison – then the relative economic efficiency is calculated. For this purpose, a comparative analysis of commensurable technical and economic parameters is conducted and the economic advantages of an implemented novelty are determined. If there is no comparison basis within the business organization itself, an analogue in another organization can be selected.

It is important to emphasize that according to the law "On Rationalization Activities" of the Republic of Moldova (2001), not less than 15% of the monetary value of an annual economic effect has to be directed to the author(s) of the innovative approach contributing to the effect and the remaining 85% should be retained by the business organization as a profit.

Algorithm of calculating the annual economic effect from reduced costs of production

The annual economic effect achieved by implementing particular types of innovation directed toward an increase in labour productivity, savings and efficient use of labour as well as material and financial resources related to production activities, and eventually reduction of the costs of production can be computed as (PARMACLI 2003, pp. 25–26):

$$E = \sum_{i=1}^{k} \Delta C_i S_i^n = \sum_{i=1}^{k} (C_i^b - C_i^n) S_i^n \quad (1)$$

where:

ΔC_i – represents the reduction of production costs per unit of product i;

S_i^n – is the amount of product i produced within one fiscal year;

C_i^b and C_i^n – are the costs per unit of a basic (known) product and a new (innovative) product i respectively;

k – is the number of new types of products.

Algorithm of calculating the annual economic effect as a factor of the rate of net sales growth

A higher volume of product units sold and, accordingly, sales revenues can be achieved by implementing the types of innovation associated with an increase in:

– Sales price due to improved quality parameters of new products and to mastered marketing, operating and other activities;

– Number of product units sold due to mastered marketing and other activities.

The annual economic effect expressed as an increase in the sales volume during a fiscal year due to the sale of new, higher-quality types of manufacturing and mastered marketing and other activities can be determined by the formula (PARMACLI 2003, pp. 27–28):

$$\Delta P = \sum_{i=1}^{k} (P_i^n - P_i^b) S_i^n \quad (2)$$

where:

P_i^n and P_i^b – are prices per unit of a new (innovative) and basic (known) product i respectively;

S_i^n – is the unit volume of sales of the new product i within a fiscal year.

The revenue increase from sales due to the implementation of a novelty which provides an additional amount of sales is:

$$\Delta P = \sum_{i=1}^{k} (P_i^b - C_i^b) S_i \quad (3)$$

where:

S_i – is the additional amount of sales of product i within a fiscal year.

Algorithm of calculating the annual economic effect from the savings of resources

Creation and implementation of a number of types of innovation can result from the savings of labour, material and financial resources both in the manufacturing and non-manufacturing-oriented business areas.

The use of innovative approaches in product manufacturing and service provision can yield two types of results:

– Savings are linked directly to production and sales, but they require only specific types of resources, for instance, raw materials, fuel, semi-finished goods, containers and others;

– Savings are not directly linked to manufacturing and sales, but they indirectly affect production costs, such as heating and illumination expenses for offices, facility departments and others.

In this case, there is no necessity for calculating the annual economic effect by comparing production costs and revenues based on formula (1). It is enough to calculate the value of saved resources.

Implementing innovation in a non-manufacturing unit of a business organization, e.g. by reducing the staff size or electricity expenditures at a socially-beneficial entity such as a sanatorium for factory employees, does not have a substantial impact on the total costs of production. Based on this rationale, calculation of the annual economic effect boils down to estimating the total value of saved resources.

The volume of saved material resources due to implementation of an innovative proposal within a fiscal year can be estimated by the following formula (PARMACLI 2003, pp. 29–32):

$$E = \sum_{i=1}^{k} (P_i + t_i)(m_i^b - m_i^n) S_i^n \tag{4}$$

where:

P_i – is the production cost per unit of resource i;
t_i – is the transportation or other type of expenditures connected to the purchase of resource i;
m_i^b and m_i^n – are the expenditures of material resources of type i per unit of basis and new production;
S_i^n – is the volume of production and sales of the new product i;
k – is the number of types of saved material resources due to the implementation of an innovative tool.

If the new technical solution is directed toward the savings of resources not associated with the firm's product, the calculation of the annual economic effect is recommended to be carried out by the following equation:

$$E = \sum_{i=1}^{k} (P_i + t_i) R_i \tag{5}$$

where:
R_i – is the volume of the saved resource i.

Accordingly, annual savings associated with employee termination could be expressed by the formula:

$$E = \sum_{i=1}^{k} (A_i, f + m_i + k_i) N_i \tag{6}$$

where:
A_i – is the annual salary fund of a terminated employee of category i, which includes bonuses, vacation payments, etc.
f – is the coefficient which takes into consideration the retirement plan and medical insurance contribution;
m_i – is the annual payment to the local municipal budget and other taxes paid by the business organization for each employee;
k_i – are the expenditures associated with the financial support of a terminated employee, labour safety and other expenditures per employee of category i;
N_i – is the number of terminated employees of category i.

Algorithm of calculating the annual economic effect from utilization of production waste

Production waste can be utilized by its finalization, recycling or use as an input manufacturing component of new products. In all cases, annual economic effect is suggested to be computed by the following formula:

$$E = \sum_{i=1}^{k} (P_i - P_i^r - C_i^r) S_i^n \tag{7}$$

where:
P_i – is the sales price per unit of new product i manufactured from production waste;

P_i^r – is the sales price of production waste used for the manufacturing of one unit of new product i;
S_i^r – are additional expenditures associated with the manufacturing of one unit of the new product i;
S_i^n – is the volume of manufactured and sold product i;
k – is the number of types of new products manufactured from production waste.

Production waste can also be used in accordance with a new suggestion without finalization or recycling. It might be optimal to calculate the annual economic effect using the equation:

$$E = \sum_{i=1}^{k} (P_i - P_i^r) R_i \tag{8}$$

where:
R_i – is the volume of the realized (sold) production waste of type i.

Algorithm of calculating the annual economic effect from lower production defects

An increase in production yield can be achieved due to the mastering of the technological process of manufacturing, improvement of employee education and skills, implementation of unique techniques and labour methods and other factors as well as due to the finalization (completion) of defective product units.

Calculation of the annual economic effect attained due to the reduction of production defects can be carried out by the following formula (PARMACLI 2003, pp. 33–35):

$$E = \sum_{i=1}^{k} (P_i - C_i) S_i \tag{9}$$

where:
P_i – is the sales price per unit of product i obtained by the finalization of defects of other techniques which can increase the production yield;
S_i – is the additional expense for finalization of one unit of defected product i or the prevention of defects;
S_i – is the unit volume of new product i obtained due to the reduction of production defects.

Conclusion

Creation and implementation of new equipment, inventions and innovative propositions are determined by the strategy of each business organization individually, the organization;s financial capabilities and precision of commercial projections. The suggested algorithm will allow calculating the economic effect from implementing different types of innovation in a business organization quickly, objectively and fairly precisely and will create favourable conditions for spurring innovators; interest in solving important manufacturing problems.

According to the National Bureau of Statistics of the Republic of Moldova, within the past ten years (2002–2011) each leu[1] invested in innovation and rationalization of the manufacturing process returned 2.3 lei on average per annum. In which other area of business is it possible to identify such a high return on invested capital? Within the specified period, the economic effect from implementing one invention or innovative product, service or approach in a business organization averaged approximately 10.9 thousand Moldovan Lei and from implementing one innovative proposal – at 9.7 thousand Moldovan Lei, accordingly. It is important to note that a number of innovative approaches and products also carry a socially-beneficial effect rather than only economic benefits, which pushes the value of implemented novelties even higher. As the statistics data reveal, business organizations have been able to generate annually an average of 1.8 million Moldovan Leiper through implementation of innovative approaches or products and 1.9 million Moldovan Lei per implemented innovative proposal (Statistical Yearbook of the Republic of Moldova, 2011).

The suggested algorithm obviously does not cover all types of sources of efficiency and the entire diversity of all types of innovation, which leaves room for future academic research in this area. Specific characteristics of particular types of innovation further dictate the use of different innovative approaches applicable to each individual innovation characteristic.

Translated by AUTHORS

Accepted for print 17.08.2012

References

FATKHUTDINOV R.A. 2003. *Innovative Management*. Text-book, 4th ed. St. Petersburg, Russia.

GERCHIKOVA G. 1995. *Management of a Business Organization*. Text-book, 2nd ed. M: Markets and Banking, UNITY.

IVASCHENKO N.P. 2007. (under chief edition of). *Economics of a Firm*. Text-book. M: – INFRA – M 528 pages.

[1] Moldovan national currency. 1 US Dollar – 12.4 Moldovan Lei, 1 Euro – 15.3 Moldovan Lei.

Law of the Republic of Moldova N138 – X Y, 10.05.2001. On Rationalization Activities.
Parmacli D.M. 2003. *Methods of Calculating Economic or Other Positive Effects from the Use of Innovation Proposals*. Comrat State University, Republic of Moldova.
Pokropivny S.F. 2003. (under edition of) *Economics of a Business Enterprise*. Text-book, Kiev, Ukraine (K: KNEU).
Raizberg B.A., Lozovsky L.S., Starodubtseva E. B. 2005. *Modern Economic Dictionary* 4th ed.-M: INFRA-M.
Shmalen G. 1996. *The Foundations and Problems of Economics of a Business Enterprise.*. Finance and Statistics Text-book.
Statistical Yearbook of the Republic of Moldova, 2011, www.statistica.md.
Vyvarets A.D. 2007. *Economics of a Business Enterprise.* M: Unity-Dana.