

**Методичні вказівки
для підготовки та написання
розрахунково-графічної роботи з дисципліни
«Економічне обґрунтування інноваційних рішень»
для іноземних студентів, а також студентів,
що навчаються англійською мовою,
всіх технічних спеціальностей**

Міністерство освіти і науки України
Вінницький національний технічний університет

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Методичні вказівки для підготовки та написання розрахунково-графічної роботи з дисципліни «Економічне обґрунтування інноваційних рішень» для іноземних студентів, а також студентів, що навчаються англійською мовою, всіх технічних спеціальностей / Уклад. : Л. О. Нікіфорова, Н. В. Рибко. – Вінниця : ВНТУ, 2018. – 41 с.

У методичних вказівках розглядається процес організації та розрахунково-графічної роботи, її оформлення та підготовка до захисту студентами вказаних спеціальностей. Рекомендації щодо оформлення розрахунково-графічної роботи викладені відповідно до загальноприйнятих стандартів. Методичні вказівки можуть бути використані іноземними студентами та студентами, які навчаються англійською мовою, всіх технічних спеціальностей, а також екологічної спеціальності для підготовки й написання розрахунково-графічної роботи з дисципліни «Економічне обґрунтування інноваційних рішень».

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INTRODUCTION

The development of industrial production in Ukraine is possible under the condition of a substantial upgrade of production potential based on innovative solutions. Therefore, modern specialists need to create and implement knowledge-intensive technical and technological solutions that will ensure progress in industrial and non-productive spheres, increase the competitiveness of domestic enterprises, and as a result, achieve economic and social goals and effects determined by individual enterprises and the state as a whole.

The special attention during the conduct of innovation policy of the enterprise should be applied to the feasibility study of certain innovative decisions. After all, new ideas should take into account not only the technical side of scientific and technological progress, but they also should be economically justified. Because promising profits from the implementation of innovative solutions must exceed the costs associated with their implementation.

In modern conditions, the training of professional specialists who study in the technical field is needed on a wide scale from several points of view: firstly, when substantiating technical decisions it is necessary to take into account organizational and economic aspects; secondly, certain managerial positions (first of all, leaders of groups, laboratories, bureaus, departments in scientific-research, design, project organizations, masters of production sites, etc.) require in-depth technical training that professional managers and economists do not have. All applied science should be focused on consumers who need to be interested in using scientific ideas and developments.

The calculation and graphic work on discipline “Economic substantiation of innovative solutions” is the result of studying not only this discipline but also a number of other economic disciplines studied by students at previous courses, namely, “Economics and organization of production”, “Enterprise Economics” “Management”, “Marketing”, “Metrology” and “Standardization”. In addition, the calculation and graphic work contains most of the calculation procedures for the economic justification of the tasks faced by students during the implementation of the degree thesis (projects).

The developed methodical recommendations highlight the content and methodology of performance of student work; determine the order of execution of the relevant stages, as well as the procedure for design and protection of thesis.

Using the recommended methodological approach, the student recognizes a number of economic parameters on the basis of which it can be concluded that it is expedient to develop and implement an innovative solution.

The calculation and graphic work is performed by students independently.

1 AIM AND TASK OF CALCULATION AND GRAPHIC WORK

The calculation and graphic work on discipline “Economic substantiation of innovative solutions” is an important stage in studying the program material on this discipline.

The aim of the work is to systematize and consolidate the theoretical knowledge gained during the study course, gain by students the ability to economically substantiate innovative decisions, determine the costs of developing and implementing innovative solutions, planning the implementation of research and development work.

Writing calculation and graphic work is an important condition for strengthening and raising the level of economic knowledge of students of technical training areas. It involves the independent acquisition and expansion of the theoretical and practical knowledge that students receive in the course of studying the course; it allows to show the student’s ability to use the methodology and method of economic analysis of the validity of innovative solutions and projects, and on this basis to make a decision on the effectiveness of investing in a particular project. The methodology of such a work increases the professional level of training of future specialists.

In the process of writing the calculation and graphic work, the student shows the following skills:

- to carry out market analysis independently;
- to assess the level of quality and competitiveness of innovative solutions;
- to estimate the cost of development of an innovative solution;
- to determine the price characteristics of an innovative solution;
- to determine operating costs in the area of using an innovative solution;
- on the basis of the calculation of the system of the relevant indicators to evaluate the economic efficiency of the innovative solution.

The calculation and graphic work is analytical and practical, it is carried out on materials of literary sources and factual data.

2 CHOICE OF THE TOPIC OF CALCULATION AND GRAPHIC WORK

One of the important steps in the implementation of this calculation and graphic work is the choice of the topic and the formation of the task. When selecting a particular topic and forming a task, the scientific supervisor and the student must take into account the practical significance of the issue being studied, its relevance and timeliness of study, the expected degree of calculation outcomes. At the same time, choosing a subject, it is necessary to take into account the availability and the possibility of obtaining data, materials for the economic substantiation of the issue.

It is desirable that the topics of the calculation and graphic work were associated with the theme of the future master's work. This is possible in the long-term planning of the student's work and provided that at the time of the implementation of the calculation and graphic work the student finally decided on his professional interests, and, accordingly, with the topic of qualification work. However, the student has the opportunity to choose any of the proposed variants of the calculation and graphic work, or independently offer an option that is interesting to him and corresponds to the direction of preparation and the specialty on which the student is studying.

3 PROCEDURE OF PERFORMANCE OF CALCULATION AND GRAPHIC WORK

The structure of the calculation and graphic work must have a number of obligatory sections and constituent parts. They include:

1. The title page with the necessary signatures.
2. The form of an individual task on calculation and graphic work, signed by the supervisor.
3. The contents.
4. The main part of the calculation and graphic work.
5. The conclusions.
6. The list of used sources.
7. The appendices.

The title page is the first page of calculation and graphic work and is placed on the cover of course work. It must be written in standard type or printed on a computer in accordance with the recommended form (Appendix A).

The form of an individual task on the calculation and graphic work is given to the student by the supervisor and filled in by the supervisor according to the established model (Appendix B). The individual task should be the second page after the title page. The individual task for calculation and graphic work must contain the initial data, the date of issue, the signature of the supervisor and student.

The contents. The contents are placed immediately after the annotation, beginning with a new page with the heading "CONTENTS" in the middle of the line, capital letters with a higher font saturation. The contents include: sequentially listed names of all sections, subdivisions, items and sub-items (if they have headers); conclusions; references; names of appendices and page numbers that contain the beginning of the material (Appendix C).

The main part of the work. The main part of the calculation and graphic work contains the analytical and accounting part. In carrying out this part of the calculation and graphic work, the student must adhere to a substantiated and reasoned style of presentation and take into account the possible options for solving the problem based on the analysis of known solutions. The

argumentation in the text should be strengthened by corresponding calculations, graphs, diagrams, tables, etc.

The main part of the calculation and graphic work should reflect the coverage of the following issues.

3.1 The essence of the technical problem and the review of existing technical solutions to the problem

- To formulate the essence of the technical problem that arose at the present stage of the enterprise's activity.
- Indicate the need for modernization or development of a new technical solution (program).
- Describe the basic requirements of consumers for a new technical solution (program).
- Describe the known (existing) ways to solve a technical problem (writing a program).
- Set up the main real competitors and select an analogue for a student-developed technical solution or program writing. As the basic variant-analogue it is necessary to accept the product with the best indicators, presented on the market of similar products.

3.2 Evaluation of the technical level of the quality of innovative solution

Assess the quality level of the basic analogue variant and the new technical solution (program). In this calculation and graphic work, when evaluating the quality of products, it is advisable to determine its absolute and relative levels.

1. The *absolute* level of quality of the innovative product is detected by calculating the indicators chosen for its measurement without comparing them with the corresponding indicators of similar products. To do this, it is necessary to determine the content of the main functions that an innovative solution must implement, customer requirements, as well as conditions that characterize the operation, determine the basic parameters that will be used to calculate the product level. The system of parameters accepted for calculations should adequately characterize the consumer properties of the innovative product (its purpose, reliability, economic use of resources, standardization, etc.).

In general, all the analyzed parameters are divided into three groups:

1. Normative parameters characterize the properties of the goods, regulated by obligatory norms, standards and legislation of markets of the future sale.

2. The group of technical parameters used to assess competitiveness usually includes indicators of assignment and reliability, as well as ergonomic and aesthetic indicators.

3. Economic parameters of competitiveness include consumer spending on the purchase of goods (directly the price of the product) and the costs associated with its operation.

For this calculation and graphic work the implementation of all normative parameters for both analogue and for innovation is a constant. To evaluate the innovative solution by technical parameters, fill in Table 1.

Then the value of the quality parameters in the balls is determined. It is necessary for each parameter to set its limit values (best, worse, average).

Table 1 – Basic technical parameters of innovative solution

Parameters	Absolute value of parameter			Coefficient of ponderability of parameter
	better	average	worse	
<i>1</i>				
<i>2</i>				
<i>3</i>				
<i>4</i>				
...				
<i>m</i>				100% or 1

All these data for each parameter are entered in Table 1. The ponderability of each parameter in the total number of specified parameters (*m*) being considered, is determined by the expert commission. The results of the expert commission are recorded in Table 2.

Table 2 – Expert evaluation of ponderability of parameters

Experts	Indicators							Total weight, %
	1	2	3	4	5	<i>m</i>	
1								100
2								100
3								100
4								100
...								100
<i>n</i>								100
Average value								100 %

Before analyzing the results of Table 2, it is necessary to determine the conditions for using the method of expert assessments, the main of which are the following:

1. Experts should not be interested in the results of forecasting.
2. Experts should give quantified answers.

3. The opinions of the experts should be consistent.

In order to check the consistency of expert opinions, you can use one of the following methods:

- ✓ to calculate the coefficient of multiple rank correlation of each expert's estimates for all parameters (the closer to 1.0, the higher the level of consistency of opinion, the value less than 0.5–0.7 is unsatisfactory);
- ✓ to calculate the coefficient of concordance (the closer to 1.0, the higher the level of consistency of opinion, the value less than 0,3–0,4 is unsatisfactory).

To simplify the calculations it is proposed to check the consistency of expert opinions, calculating the coefficient of concordance. The general formula for calculating the coefficient of concordance is given below:

$$w = \frac{12 \sum \Delta^2}{n^2(m^3 - m)}, \quad (1)$$

where n – number of experts;

m – number of possible evaluation options;

Δ – deviation from the average amount of ranks.

The average amount of ranks ($\overline{\sum p}$) is calculated by the following formula:

$$\overline{\sum p} = n \times (m + 1) / 2. \quad (2)$$

To calculate the coefficient of concordance, let us make Table 3, where we rank the experts' answers given in Table 2.

Table 3 – Ranking of the results of expert evaluation

Indicator	Rank ratio by the number of experts								Total rank	Δ	Δ^2
	1	2	3	4	5	6	...	n			
1											
2											
3											
4											
....											
m											
										$\sum \Delta^2$	

The example of calculating the coefficient of concordance is given in Appendix D. So, calculating the coefficient of concordance, we came to the conclusion that the consistency of expert opinions is satisfactory, and therefore the results of expert research are correct.

After checking the consistency of expert opinions, taking into account the ponderability of factors of the corresponding parameters, one can determine the absolute level of quality of the innovative solution by the formula:

$$K_{\text{я.а.}} = \sum_{i=1}^n P_{Hi} \cdot a_i, \quad (3)$$

where P_{Hi} is the numerical value of the i -th parameter of the innovative solution;

n is the number of parameters of the innovative decision taken for evaluation;

a_i is the ponderability factor of the corresponding parameter (the sum of the ponderability factors of all parameters should be equal to 1 or 100%).

2. At the same time the student should determine the *relative* level of quality of innovation being produced (projected), comparing its performance with the technical indicators of the quality of the best domestic or foreign analogue variant. The results are entered in Table 4.

The procedure for determining unit parametric indices for technical quality indicators is carried out according to the appropriate formulas. Anyhow, an increase in the value of the parameter indicates an increase in the quality of the new development, the unit parametric index is calculated by the formula:

$$q_i = \frac{P_i}{P_{\text{баз.и}}}. \quad (4)$$

Table 4 – Basic technical parameters of the innovative decision and the competitor's product

Indicators	Variants		Relative coefficient of quality	Coefficient of ponderability of parameters
	Basic (variant-analogue)	New (innovative solution)		
1				
2				
3				
4				
...				
m				100% or 1

If the decrease in the value of the parameter indicates the increase in the quality of the new development, then the unit parametric index is calculated by the inverse formula:

$$q_i = \frac{P_{\text{баз.и}}}{P_i}, \quad (5)$$

where q_i is unit parametric index, calculated on the i parameter;

P_i is the value of the i parameter of the product;

$P_{\text{баз}}^i$ is a similar parameter of the analogue product, with which the comparison is made.

The relative level of quality of an innovative decision is determined by the formula:

$$K_{\text{я.б.}} = \sum_{i=1}^n q_i \cdot a_i . \quad (6)$$

if $K_{\text{я.б.}} = 1$ – the development of quality indicators is similar to analogue product;

if $K_{\text{я.б.}} > 1$ – the level of competitiveness of the development of quality indicators is above the product-analogue;

if $K_{\text{я.б.}} < 1$ – the level of competitiveness of the development of quality indicators is below the product-analogue.

3.3 Conducting a market analysis

It is necessary to predict the demand for an innovative solution. The analysis of the demand for new products is one of the most important directions of activity of innovative companies. Commercial companies do not make sense to invest in R&D if the end result does not pay off. Therefore, it is necessary to calculate the market capacity. To do this, you need to predict the following data:

- average number of consumers using products similar to those developed (Π);

- average percentage of consumers who are interested in acquiring an innovative product (Π_n);

- average term of replacement of an innovative product (T);

- average percentage of consumers who want to redeem the product developed (C_n).

The forecast of these data is done by the student independently according to the following formulas:

- the need for an innovative product:

$$\Pi_i = \frac{\Pi \cdot \Pi_n \%}{100}, \quad (7)$$

- an optimistic forecast of demand for an innovative solution:

$$O\Pi = \frac{\Pi_i}{T}, \quad (8)$$

- a pessimistic forecast of demand for an innovative solution:

$$\Pi\Pi = \frac{O\Pi \cdot C_n}{100}, \quad (9)$$

- a realistic forecast of demand for an innovative solution:

$$P\Pi = \frac{O\Pi + \Pi\Pi}{2}. \quad (10)$$

After conducting all calculations, the student must draw a conclusion on the predicted analysis of the demand for new products.

3.4 Calculation of capital investments for the development of innovation

Capital investment in the development of innovation, in the general case, consists of the corresponding costs and is calculated by the formula:

$$K = Z_o + Z_p + Z_{\text{доп}} + Z_n + A_{\text{обл}} + M + K_e + B_{\text{эл}} + I_e, \quad (11)$$

where Z_o is the main wages of the developers, UAH;

Z_p – basic wages of workers who perform the corresponding work, UAH;

$Z_{\text{доп}}$ – additional wages of developers and workers, UAH;

Z_n – accrual to wages of developers and workers, UAH;

$A_{\text{обл}}$ – depreciation of equipment, premises and intangible resources for the development of a new solution, UAH;

M – costs for the materials used to develop a new technical solution, UAH;

K_e – cost of components that were used to develop a new technical solution, UAH;

$B_{\text{эл}}$ – electricity costs for the development of a new technical solution, UAH;

I_e – other expenses, UAH.

The fund of main wages for developers includes payments that are planned and included in the actual cost of conducting research.

The expenses for the main wages of the developers (Z_o) are calculated according to the formula:

$$Z_o = \sum_{i=1}^k \frac{M_{ni} \cdot t_i}{T_p}, \quad (12)$$

where k is the number of developer positions involved in the research process;

M_{ni} – monthly salary of a particular developer, UAH;

t_i – number of days of work of a particular developer, UAH;

T_p – average number of working days per month.

The calculations made should be reduced to Table 5.

Table 5 – Expenses for wages of developers

Name of the position	Monthly salary, UAH	Payment for a working day, UAH	Number of working days	Salary expenses, UAH
<i>Project Manager</i>				
<i>Engineer</i>				
...				
Total				3_o

The costs of basic wages (3_p) for the corresponding names of works are calculated by the formula:

$$3_p = \sum_{i=1}^n C_i \cdot t_i, \quad (13)$$

where C_i is hourly tariff rate of the worker of the corresponding category, for the corresponding work performed, UAH/hour;

t_i – time of work of a worker on a certain i-th technological operation in the manufacture of one product, hour.

The hourly tariff rate of a worker of a corresponding category of C_i may be determined by the formula:

$$C_i = C_1 \cdot K_i, \quad (14)$$

where K_i is a coefficient of interqualification ratio for setting the tariff rate for the worker of the corresponding category (Table 6);

C_1 – tariff rate of the first category, in accordance with the current legislation.

Table 6 – Interqualification ratio for setting tariff rates for workers

Category	1	2	3	4	5	6	7	8
Correlation ratio	1,0	1,1	1,35	1,5	1,7	2,0	2,2	2,4

The costs of basic wages of workers should be reduced Table 7

Table 7 – The cost of basic wages of workers

Name of work	Duration of operation, hour	Operating rate	Tariff coefficient	Hourly tariff rate, UAH	Amount of payment per worker, UAH
1					
2					
...					
Total					

The additional wages of developers and workers are calculated in accordance with the percentage specified in the initial data of the amount of the basic salary of developers and workers by the formula:

$$3_{\text{доп}} = H_{\text{доп}} (3_o + 3_p), \quad (15)$$

where $H_{\text{доп}}$ is the percentage of additional payroll in relative units.

The accrual on wages of developers and workers is calculated as 22% in accordance with the current legislation on the amount of the basic and additional wages of developers and workers by the formula:

$$3_{\text{н}} = (3_o + 3_p + 3_{\text{доп}}) \cdot 0,22, \quad (16)$$

In a simplified form, depreciation deductions for each type of equipment and premises can be calculated using the straight-line depreciation method of formula 17:

$$A_{\text{обл}} = \frac{L_{\bar{o}}}{T_{\bar{e}}} \cdot \frac{t_{\text{еук}}}{12}, \quad (17)$$

where $L_{\bar{o}}$ is balance cost of equipment, premises, etc., used for the development of a new technical solution, UAH;

$t_{\text{еук}}$ – the term of equipment usage, premises during development, months;

$T_{\bar{e}}$ – terms of useful use of equipment, premises, etc., years, according to the current tax law.

For implementation of the depreciation process, the main funds are divided into groups with a specified minimum lifetime. The classification of groups of fixed assets and other non-current assets and the minimum acceptable periods of depreciation are given in Table 8 according to paragraph 145.1 of the Tax Code.

Table 8 – Classification of groups of fixed assets

Groups	The minimum acceptable timeframes for useful use, years
<i>a</i>	<i>б</i>
Group 1 – land plots	–
Group 2 – capital expenditures for improvement of land not related to construction	15
Group 3 – buildings	20
structures	15
transmitting devices	10

Continuation of Table 8

Group 4 – machinery and equipment	5
of them:	
Electronic computers, other machines for the automatic processing of information, associated with them means of reading or printing information, related to them computer programs (except for programs for the purchase of which are recognized as royalties and / or programs which are called as intangible assets), other information systems, communications, routers, modules, modems, sources of uninterrupted living and their means of connecting to telecommunication networks, telephones (including cellular phones), microphones and radios, cost which exceeds 2500 UAH	2
Group 6 – tools, devices, inventory (furniture)	4
Group 7 – animals	6
Group 8 – perennial plantations	10
Group 9 – other fixed assets	12
Group 10 – library funds	–
Group 11 – low value non-negotiable tangible assets	–
Group 12 – temporary (non-titular) structures	5
Group 13 – natural resources	–
Group 14 – inventory packaging	6
Group 15 – hiring items	5
Group 16 – long-term biological assets	7

According to the current law, depreciation deductions are calculated separately for each group of fixed assets.

Table 9 – Depreciation deductions

Name of the equipment	Balance sheet cost, UAH	Cost of useful life, year	Term of use of the equipment, month	Amortization deductions, UAH
Computer				
Hydropower				
Non-material resources				
...				
Total				

To calculate the depreciation of intangible resources, the following formula is used:

$$A_{н.р.} = U_{н.р.} \cdot H_a \cdot \frac{t_{еук.}}{12}, \quad (18)$$

where H_a – the rate of depreciation, in relative units;

$U_{н.р.}$ – book value of intangible resources, UAH;

$t_{еук}$ – the term of use of intangible resources during development, months.

The calculations made should be reduced to Table 9.

The costs of materials (M), in value terms, are calculated separately for each type of materials according to formula 19.

$$M = \sum_{j=1}^n H_j \cdot U_j \cdot K_j - \sum_{j=1}^n B_j \cdot U_{еj}, \quad (19)$$

where H_j – norm of expenses of a material of j-name, kg;

n – the number of types of materials;

U_j – the cost of the material of the j-th denomination, UAH/kg;

K_j – coefficient of transport expenses, ($K_j = 1,1 \dots 1,15$);

B_j – weight of waste j-th name, kg;

$U_{еj}$ – cost of waste j-th name, UAH/kg.

The calculations made should be reduced to table 10.

Table 10 – Costs for materials

Name of material, brand, type, grade	Price for 1 kg, UAH	Cost standard, kg	Waste quantity, kg	Cost of waste, UAH/kg	Cost of the consumed material, UAH
1					
2					
...					
Total					

Costs for component products ($K_е$), used in the development of an innovation unit, are calculated, according to their nomenclature, by the formula 20. Calculations made need to be reduced to table 11.

$$K_е = \sum_{j=1}^n H_j \cdot U_j \cdot K_j \quad (20)$$

where H_j – number of components j-th type, pcs.;

U_j – purchase price of components j-th type, UAH;

K_j – coefficient of transport costs, ($K_j = 1,1 \dots 1,15$).

Table 11 – Costs for components

Name of component parts	Quantity, pcs	Price per piece	Amount, UAH	Note
1				
2				
...				
Total				

Power consumption costs (B_e) are calculated by the formula:

$$B_e = \sum_{i=1}^n \frac{W_{yi} \cdot t_i \cdot U_e \cdot K_{eni}}{\eta_i}, \quad (21)$$

where W_{yi} is installed capacity of equipment at a certain stage of development, kW;

t_i is duration of equipment operation on a certain i-th technological operation in the manufacture of one product or in the development stage, hour;

U_e is the cost of 1 kWh of electricity, UAH; (the cost of electrical energy is determined by the data of the energy supply company);

K_{eni} is the coefficient, taking into account the use of power, $K_{eni} < 1$;

η_i is the coefficient of efficiency of the equipment.

The calculations made should be reduced to Table 12.

Table 12 – Electricity costs

Name of equipment	Installed capacity, kW	Duration of work, hour	Amount, UAH
1
2
...
Total			...

Other expenses include: general production costs (organization management costs, payment for business trips, fixed asset costs, etc.), administrative costs (legal and audit fees, fees, etc.) and other operating expenses (fines, penalties, penalties, etc.).

It is expedient to take other expenses of I_g as 200...300% of the basic wages of developers and workers who took part in the development of a new technical solution. The value of the expenses of I_g is calculated according to the formula:

$$I_g = (2...3) \cdot (3_o + 3_p). \quad (22)$$

The sum of all calculated costs will make capital investments on the development of a new technical solution.

3.5 Calculation of the total cost of the unit of innovation products

Cost of products is one of the most important indicators, which shows in the monetary form all the expenses of the enterprise related to the production and sales of products.

Cost of industrial products is the current expenses of the enterprise to its production and sales which are expressed in the form of cash. Costs of production form the production cost, and the costs of production and sales form the full cost of industrial products.

To calculate the cost of production, it is important to determine the composition of the costs that are included in it (that is, the calculation).

Calculation is computation of the unit cost of production, the final result of which is the compilation of calculations, that is, the document, which contains all the costs of production and sales of the unit of a particular type of products in the context of calculation articles.

The total cost of production unit includes the following costs:

1. Raw materials and materials.
2. Purchased component parts, semi-finished products, works and services of production character of third-party enterprises and organizations.
3. Fuel and energy for technological purposes.
4. Basic salary of workers.
5. Additional wages of workers.
6. Deductions for social measures on wages of workers.
7. Amortization of equipment.
8. Other direct production costs.
9. Expenses on sales.

Separate items of expenditure were calculated in paragraph 5 of this course work, namely:

1. Raw materials and materials.
2. Purchased component parts, semi-finished products, works and services of production character of third-party enterprises and organizations.
3. Basic salary of workers.

The remaining costs will be calculated according to the following methodology. The additional wages of developers and workers are calculated according from the amount of basic salary of workers by the formula:

$$3_{\text{дод.}} = H_{\text{дод.}} \cdot 3_p, \quad (23)$$

where $H_{\text{дод.}}$ is the rate of calculation of additional wages, in relative units.

The accrual of wages of workers $3_{\text{н}}$ is calculated as 22% in accordance with the current legislation from the sum of basic and additional wages of production workers by the formula:

$$3_{\text{н}} = (3_o + 3_{\text{дод.}}) \cdot 0,22, \quad (24)$$

In a simplified form, amortization deductions for each type of equipment and premises can be calculated using the straight-line depreciation method using formula 17. Depreciation for intangible assets is calculated only when the total time of use of intangible resources is relatively significant in comparison with the total time of use of other production assets (as a rule, it concerns developed software products). In this case formula 18 is used to calculate depreciation of intangible resources.

The calculations made should be reduced to Table 13, with the specified depreciation rate specified for it for the intangible resource.

Table 13 – Amortization deductions for equipment

Name of the equipment	Balance sheet cost, UAH	Term of serviceable use, years	Term of use of equipment, months	Amortization deductions, UAH
Turning lathe				
Hydropower				
Programme Excel				
...				
Total				

Power consumption costs (B_e) are calculated by the formula:

$$B_e = \sum_{i=1}^n \frac{W_{yi} \cdot t_i \cdot U_e \cdot K_{eni}}{\eta_i}, \quad (25)$$

where W_{yi} is the installed capacity of equipment at a certain stage of development, kW;

t_i is the duration of equipment operation on a certain i -th technological operation in the manufacture of one product or in the development stage, h;

U_e is the cost of 1 kWh of electricity, UAH (the cost of electricity is determined by the data of the energy supply company);

K_{eni} is the coefficient, taking into account the use of power, $K_{eni} < 1$;

η_i is the coefficient of efficiency of the equipment.

The performed calculations are desirable to reduce to Table 14.

Table 14 – Electricity costs

Name of equipment	Installed capacity, kW	Amount, UAH	Amount, UAH
1			
2			
...			
Total			

To simplify the calculation, other expenses include: total production costs (management costs of the organization, costs associated with the preparation and development of production (creation of jobs, the purchase of new equipment related to specific production, the purchase of tools, etc.), the payment of official business trips, administrative expenses (payment of legal and audit services, holding meetings, etc.) and other operating expenses (fines, penalties, forfeits, etc.).

It is expedient to accept other expenses I_e as 200...300% of the basic salary of workers who participated in the development of a new technical solution. The value of the costs of I_e is calculated by the formula:

$$I_e = (2...3) \cdot 3_p. \quad (26)$$

The sum of all the above-calculated items of expenses forms the production cost of the product. The total cost of a product is calculated by the formula 27.

$$S_n = S_e \times \left(1 + \frac{B_{3\sigma} \%}{100\%} \right), \quad (27)$$

where S_e is the production cost of the product, UAH;

$B_{3\sigma}$ is the planned sales costs.

The results of calculations of all types of costs, per unit production, need to be put together to Table 15.

Table 15 – Total production cost of the product

Item of cost	Conditional symbol	Amount, UAH	Note
1. Costs on materials per unit of production, UAH	M		
2. Costs on components per unit of products, UAH	K_e		
3. Costs on power electric power, UAH	B_e		
4. Costs on on the basic salary of workers, UAH	3_p		
5. Costs on additional wages of workers, UAH	$3_{\text{доп}}$		
6. Costs on accrual of earnings of workers, UAH	3_n		
7. Depreciation deductions, UAH	A		
8. Other expenses, UAH	$B_{3\sigma}$		
Production costs	S_e		
9. Expenses on sales, UAH	$B_{3\sigma}$		
Total cost of production unit	S_n		

The sum of all cost items calculated in Table 15 forms the total cost of the innovative product.

3.6 Determination of the price and critical volume of production of innovative goods (services)

Price is a monetary expression of the value of goods (products, services). It always fluctuates around the cost of production (the converted form of value of a unit of goods equals to the sum of production costs and average profit) and reflects the level of necessary labor costs.

Proceeding from the fact that innovative decisions are usually taken and implemented according to the customer's tasks or when the result of an innovative decision is products subject to state regulation, then the lower boundary of the price of implementation of an innovative solution can be calculated by the formula:

$$U_{H.M.} = S_n \cdot \left(1 + \frac{P\%}{100\%}\right) \cdot \left(1 + \frac{w\%}{100\%}\right), \quad (28)$$

where S_n is the full cost of innovation decision, UAH;

P is the profitability standard agreed with the customer or established by the state;

w is the value added tax rate, % ($w = 20\%$).

The upper limit of the price of an innovative solution reflects the price that the consumer is ready to pay for an innovative product and takes into account the level of its quality:

$$U_{B.M.} = U_{H.M.} \cdot K_{\text{я.б.}}, \quad (29)$$

where $K_{\text{я.б.}}$ is the relative level of quality of innovative solutions (see formula (1.6));

The contractual price ($U_{\text{дог}}$) can be established by the agreement between the manufacturer and the consumer in the interval between the lower and upper limit prices:

$$U_{H.M.} < U_{\text{дог}} < U_{B.M.}. \quad (30)$$

Potential consumers of the product and possible sales volumes are defined in the section "Market Analysis". However, economic indicators determine the critical volume of production, in which production is becoming feasible. It depends on the ratio of conditional variables, conditional-fixed costs in the cost of production and contractual prices.

The definition of the constituent part-conditional and conditional variable costs requires special calculations and an appropriate information base. In carrying out the course work and diploma project, a simplified method for

determining these costs is offered. For products of instrument-making enterprises it can be assumed that in the cost of production the share-variable costs make up 65...75%, and conditionally constant – 25...35%.

Thus, the analytically critical volume of production of innovative goods can be determined by dependence:

$$Q_k = \frac{(25...35)\% \cdot S_{\Pi} \cdot P\Pi}{U_{\text{доз}}'' - (65...75\% \cdot S_{\Pi})}, \quad (31)$$

where $U_{\text{доз}}''$ is the negotiable price **without VAT**, UAH;

$P\Pi$ is real forecast for all years of the life cycle of innovation, pcs.

Graphicly, the critical volume of production of an innovative product is found with the help of a break-even graph, on which we define at which volume of production (QI) the income from sales of products and its cost coincide (profit equals to 0), which corresponds to the break-even production. An example of constructing a schedule for determining the critical volume of production is given in the Appendix E, Fig. E.1.

3.7 The calculation of the competitiveness of innovation

In the broadest sense, the competitiveness of a product is the possibility of its successful sale in a certain market and within a certain period of time. At the same time, only homogeneous products with technical parameters and techno-economic indicators that are identical to those of the already sold goods can be considered as competitive. In order for a high-quality product to be simultaneous and competitive, it must meet the criteria for assessing the consumers of a specific market at a specific time.

One of the conditions for choosing a product by the consumer is the coincidence of the main market characteristics of the product with the conditional characteristics of the specific needs of the buyer. Such characteristics are most often considered as normative, technical parameters, as well as economic parameters.

The group competitiveness indicator for regulatory parameters ($I_{\text{гн}}$) in this work equals to 1.

The group parametric index for economic parameters is calculated by the formula:

$$I_{EI} = \sum_{i=1}^m q_i \cdot \beta_i, \quad (1.38)$$

where I_{EI} is a group parametric index based on economic indicators;
 q_i is an economic parameter of the i -th type;

β_i is the weight of the i -th economic parameter, $\sum_{i=1}^k \beta_i = 1$;

m is the number of economic parameters for which the evaluation is carried out.

The desired value is $I_{EII} \leq 1$, since the lower the cost of consumption is, the higher the competitiveness of the development is.

The economic parameters of competitiveness include consumer costs for the purchase of goods – directly the price of innovation, and the costs associated with its exploitation.

The number of economic parameters, their values and weight are given in the output data. The procedure for determining unit parametric indices by economic indicators is carried out by formula 39:

$$q_i = \frac{P_i}{P_{\text{баз.}i}}. \quad (39)$$

where P_i is the value of the i -th parameter of the innovation product;

$P_{\text{баз.}i}$ is a similar parameter of the analogue product with which the comparison is made.

On the basis of group parametric indices, the integral index of competitiveness is calculated according to the formula by the normative, technical and economic indicators:

$$K_{IHT} = I_{HII} \cdot \frac{I_{TII}}{I_{EII}}, \quad (40)$$

where I_{TII} is the relative level of quality of innovation, calculated by formula 6 ($I_{TII} = K_{\text{Я.В.}}$).

On the basis of the integral indicator, a conclusion is drawn about the competitiveness of the product, which is estimated:

- for $K_{IHT} < 1$ – the product being analyzed is inferior to the basic sample for competitiveness,
- for $K_{IHT} > 1$ – exceeds the sample,
- for $K_{IHT} = 1$ – the competitiveness of comparable goods is the same.

However, it should be born in mind that with the growth of I_{TII} (i.e., improving the consumer performance of the analyzed product), the index of K_{IHT} increases, characterizing the growth of competitiveness. With the growth of I_{EII} (the price of consumed goods being analyzed, compared to the base model), the K_{IHT} index decreases, reflecting a decline in competitiveness.

If the purpose of the assessment of the competitiveness of the goods is the decision-making on the withdrawal of goods on the market, the following predicted assessment of the competitiveness of the product is possible:

- $K_{IHT} = 1,6$ and more – very promising;
- $K_{IHT} = 1,40...1,59$ – perspective;
- $K_{IHT} = 1,20...1,39$ – low-probability;
- $K_{IHT} = 1,00...1,19$ – not prospective.

The integral indicator of competitiveness indicates the degree of its attractiveness from the buyer's point of view.

On the basis of the formulated conclusion, a decision is made on the design and manufacture of such a product or the removal of the product from production, its modernization or transfer to another market.

When designing, it is important to provide a promising and long-lasting competitiveness of new products to keep them in a certain market of goods. At the same time, more attention should be paid not only to the improvement of technical parameters, but also to the reduction of the cost of consumption.

3.8 Evaluation of the effectiveness of an innovative solution

When calculating the economic efficiency, it is necessary to take into account the change in the value of money in time, since a lot of time will pass from the investment to the profit receiving. In view of this, it is necessary to adhere to such principles.

1. The estimation of the efficiency of the use of invested capital is carried out by comparing the cash flow, which is based on the implementation of the innovation project, and the initial investments. The project is considered as effective if the return of the initial investment amount is ensured and the yield is determined for the investor who provided the capital.

2. The invested capital and cash flows generated by this capital (obtained from the sale of new products) are reduced to the current accounting period, which is usually determined by the year of the start of the project.

3. The process of discounting investments and cash flows is carried out at different discount rates, which are determined depending on the features of innovative projects. When determining the discount rate, the structure of investments and the value of individual components of capital are taken into account.

The basis of discounting is the notion of time advantage or a change in the value of money in time. This means that previously received money is more valuable than money received later, due to rising risks and uncertainties in time. That is, discounting is a recount of benefits and expenses for each accounting period with the help of the norm (discount rate).

When evaluating the effectiveness of innovative projects, it is planned to calculate such important indicators as:

- ✓ the net present value;
- ✓ the index of profitability (profitability);
- ✓ the payback period.

I. The indicator of Net Present Value (NPV) is net present value (discounted) profit or in literal translation of “net real value”, it gives an opportunity to obtain the absolute value of the effect from the project implementation.

To simplify the calculations we will assume that a project or development involves one-time capital investments. In this case, *NPV* can be determined by the formula:

$$NPV = \sum_{t=1}^n \frac{\Pi_t}{(1+d)^t} - K, \quad (41)$$

where Π_t is the profit derived from the sale of the annual batch of new products in the t year of project operation, UAH;

K is the value of capital investments in the development of an innovative solution (see the formula 11), UAH;

d is the rate of discount, the value of which depends on the level of risk, the level of bank deposit rates, the level of inflation;

n is the period during which the products will be sold in the market (the period of operation of the project), years;

t is the corresponding year of operation of the project, in which the profit is expected, UAH.

As a result of calculations you can get the following options:

- if $NPV > 0$, then the project can be recommended for implementation;

- if $NPV < 0$, then the project must be rejected;

- if $NPV = 0$, in case of making a decision on the project implementation investors will not receive income on invested capital.

An example of calculating the *NPV* is given in the Appendix *F*.

II. Return Index (Profitability) (I_d):

$$I_d = \frac{\sum_{i=1}^k \Gamma \Pi_{i,npus.}}{K}, \quad (42)$$

where $\sum_{i=1}^k \Gamma \Pi_{i,npus.}$ is the present value of the average annual value of cash flows for a certain period, UAH. The value of cash flows ($\Gamma \Pi_i$) is the magnitude of the total profit received from the sale of the entire batch of innovation product for the corresponding year, UAH. It is calculated as the product of the profit from the sale of the unit of innovation product and the amount of annual sales of the innovative product;

k is the period during which it is planned to use an innovative decision, years. In this paper, it is the average replacement period for the innovative product (T), see Section 2;

K is the value of capital investments in the development of an innovative solution (see formula 11), UAH.

Amount of present value of average annual value of money flows:

$$\sum_{i=1}^k \Gamma\Pi_{i. \text{npus.}} = \sum_{i=1}^k (\Gamma\Pi_i \times \mathcal{D}_{\text{MH.}}), \quad (43)$$

$\mathcal{D}_{\text{MH.}}$ is the value of the discount multiplier:

$$\mathcal{D}_{\text{MH.}} = \frac{1}{\left(1 + \frac{d\%}{100\%}\right)^i}, \quad (44)$$

where i is the year for which the discount factor is calculated: and $i_1 = 1$, $i_2 = 2$, etc.

The higher the value of this indicator is, the higher the return on investment capital is.

If $I_\delta > I$, then the project is effective and it can be recommended for implementation.

If $I_\delta < I$, then the project should be discarded because it is a loss for the investor.

If $I_\delta = I$, the project provides only the return of the invested capital.

III. The payback period shows how long the investment can be paid into an innovative project. It is usually calculated on the basis of undiscounted earnings. In international practice, the indicator of payback period is used. Payback period refers to the duration of the period during which the amount of net income discounted at the time of the investment is equal to the amount of investment. This is the period required to recover initial investment from the project's profits. The payback period can be calculated as follows:

$$T_{\text{ок}} = \frac{K}{\overline{\Gamma\Pi_{\text{npus.}}}}, \quad (45)$$

where $\overline{\Gamma\Pi_{\text{npus.}}}$ is the average annual value of cash flows for the whole period, UAH, calculated according to the formula 46:

$$\overline{\Gamma\Pi_{\text{npus.}}} = \frac{\sum_{i=1}^n \Gamma\Pi_{i. \text{npus.}}}{k}, \quad (46)$$

At the same time, it is worthwhile accepting only those projects for realization in which the payback period does not exceed the level acceptable to

the investor. However, a project whose payback period does not exceed the life cycle of an investment can be effective:

- When developing new software, technology, etc., the payback period of investments is considered to be acceptable, equal to 1 ... 3 years;
- when developing a particular item, goods, product, the payback period of investments is considered to be acceptable, equal to 3 ... 5 years;
- but in some cases, for example, in the development of materials with new properties, new technologies and other know-how, the creation of which exceeds 10 years, the payback period is considered acceptable for a period of 5 ... 8 years.

At the end of the seventh section a brief general conclusion is made regarding the feasibility of developing a new innovative solution or modernizing the existing in line with the determined indicators of the economic efficiency of innovative solutions.

Conclusions. The conclusions are written from a new numbered page with the title "CONCLUSIONS" in the middle of the line, capital letters with higher font saturation.

The conclusions are the final part, the result of the completed calculation and graphic work, indicating the achieved parameters and advantages of the projected object in comparison with the analogues and possible recommendations.

References. The list of used literature is written from a new numbered page with the title "REFERENCES" in the middle of the line, capital letters with higher font saturation. The references contain a list of literary sources, which should contain binding references in the text.

4 FORMATION OF CALCULATION AND GRAPHIC WORK

4.1 The text part of the manuscript

The calculation and graphic work according to DSTU 3008.95 "Documentation, Reports in the Field of Science and Technology" is executed in drawing handwriting or printed on a computer on A4 size paper (210×297 mm in size) on one side of the sheet at a single interval, 14 Times New Roman - Up to 44 lines per page. Striking and correcting words and numbers are not allowed. The text of the work should be printed by enabling the automatic syllabification of words, following the usual uniform density and the following size of the margins: the upper and lower – 20 mm, the right – 10 mm, the left – 25 mm.

The pages of the work must be numbered in Arabic numerals, following through-numbering throughout the text of the work. The page number is placed in the upper right corner of the page without the sign number and without a dot

at the end. The task form is the first page of course work, since the title sheet is not included in the numbering, but the number of pages on the form of the task is not put.

4.2 Tables, illustrations and their design

Tables are a list of systematized digital data, or some other information that is arranged in a specific order in rows and columns. Tables should be closed from all sides.

Tables consist of the following elements:

- table numbers;
- thematic headline;
- headlines;
- the main part, which in turn consists of a side view (on the left) and a graph, divided by parts both vertical and horizontal lines, depending on the total number of indicators.

Vertical lines of a table are called columns, graphs, horizontal ones are called lines.

Horizontal and vertical lines that delineate the rows of the table, as well as the left, right and bottom lines that restrict the table, cannot be performed if their absence does not hinder the use of the table.

The table should be placed immediately after the text in which it is mentioned for the first time or on the next page. All tables should refer to the text of the course work. It should be placed on the page in such a way that it was not necessary to read the text for its reading. If this is not possible, then the table is placed so that at the time of reading it was possible to read by turning the page clockwise.

From the beginning of the line from the left edge above the table you place the inscription "Table" with the indication of its number. The tables should be numbered with Arabic numerals, numbered sequentially within the section. The table number consists of the section number and the sequence number of the table, separated by a dot. The table name is placed after the dash across the width of the entire text. Tables should have a meaningful heading. The name should be complete - with the indication of the object and period of research, simple and short. The name of the spreadsheet is typed in lower case letters (the first one is large), at the end of the title, do not put the dot. You should not underline headings.

All columns and sidebar tables should have titles. The title of the graph and the lines of the table should begin with a capital letter, subtitles - from the small one, when they are one sentence with the title, and from the big one, if they are independent. The height of the rows should be not less than 8 mm. Dots are not included at the end. A column with empty titles should not be in the table.

All rows and graphs of tables should have units of measure. If the indices of all rows have the same measurement unit, the last one is placed in the title of

the table. The name of the unit of measurement, if it is not a logical part of the text, is indicated at the end of the title, by a comma, the units of measurement in a separate column are not taken out.

The digital data in the tables is placed as follows: tens under tens, hundreds under hundreds, tenths under tenths, hundredths under hundredths.

The tenth part should be allocated from the whole number, not by a dot, but by a comma.

If the cell, according to logic, does not require any data, then it contains a “dash” sign. If there is no data to fill the cell, then use “n.i.”, that is “no information”. Leaving empty spaces in cells of tables is not allowed.

The notes to the tables should be given under the tables, rather than at the bottom of the page.

When transferring parts of the table to the next page (which should, be avoided, if it is possible), the word “Table” is indicated once over the first part of the table, over the other parts you should indicate the words “Continuation of the Table” with the indication of its number. You should not repeat the heading of the table and the title, but repeat the number of the graphs and their numbering on the next page. Counting the graph is also made where the numbers in the text are used to explain the order of calculations.

When referring to a table, its serial number is indicated, and the word “Table” is written form, for example “Table 2.2”. Repeated references to the table are given by writing the word “see”, for example: (see Table 2.2).

The illustrations (drawings, paintings, graphs, schemes, diagrams, photographs) should be placed in course work directly after the text for which they are mentioned for the first time or on the next page. All illustrations should be referenced in the text of the course work.

The illustrations may have a name that is placed under the illustration. When it is necessary, illustrative data is placed under the illustration (sub-picture text).

The illustration is indicated by the word “Figure” (for example, "Figure 1.1"), which, along with its name, is placed after explanatory data. The illustration should be numbered with Arabic numerals, the ordinal number is within the section, the illustration number consists of the section number and the sequence number of the illustration, separated by a dot, for example: Figure 1.1 – Determination of the critical volume of production.

When using the formulas, you must follow certain rules. Equations and formulas should be separated from the text by free lines. You must leave at least one free line above and below each formula. The formulas must be numbered within the section. Ordinal numbers are indicated by Arabic numerals in parentheses near the right-hand side of the page (for example, (1.2) – formula 2, section 1). Explanations of the values of symbols and numerical coefficients should be submitted directly under the formula in the sequence in which they are given in the formula. The value of each character and numeric coefficient must be submitted from a new line. The first line of explanation begins with the word “where” without a colon.

4.3 Listing of used references

When writing a list of scientific sources and abbreviations, the current Ukrainian standards and requirements that are in force at VNTU, namely DSTU GOST 7.1:2006 “System of standards for information, librarianship and publishing. Bibliographic description. General requirements and rules of drafting” (at the time of registration of the references) and DSTU 3582–97 “Information and documentation, word abbreviation in the Ukrainian language in the bibliographic description. General requirements and rules”.

The description of the works that are included in the references is carried out in the following order:

1. Books, brochures:

a) the surname and initials of the author or the name of the institution that is the author of the publication, the full stop;

b) the name of the work (always indicated completely in the form in which it is given on the title page of the book), the dash, the full stop (if there is no information on item “c”) and the inclined dash (if there is information on item “c”);

c) information on collective authors, editors, translators, the full stop, the dash;

d) information about the repetition of the publication, the full stop, the dash;

e) initial data: the place of publication, the colon, the publishing house (or organization that issued), the dash, the year of publication, the full stop, the dash;

f) the number of pages in the book, the letter “p”, the full stop.

If the book (article) is written by two authors and more, then their names with the initials are indicated in the sequence in which they are printed in the book or periodical publication, before the name of the next author the comma is put. In the presence of three or more authors it is allowed to indicate the surname and initials of only the first of them and the words “etc.”

The title of the publication is given in full, in the nominative case; The names of the cities Moscow (M.), Kiev (K.) are reduced to the beginning. The title of publishing is not taken in quotation marks, for example:

1. Moroz O. V. Models and methods of using motivational levers for increasing the efficiency of economic development in Ukraine: monograph / O. V. Moroz, L. O. Nikiforova, A. Shiyana // Vinnytsya : VNTU, 2016. – 179 p.

2. Articles in collected volumes, collections of works, scientific journals, newspapers:

a) the surname and initials of the first author, the full stop;

b) the title (headline) of the article (in full), one inclined dash;

c) the surname and initials of all authors, two inclined dashes;

d) the name of the collection (magazine), the full stop, the dash;

e) the initial data.

For a collection – the place of publication, year of publication, pages of placement;

For scientific works – the volume number (issue), name of scientific works, if there is any, place of publication, year of publication;

For magazines – edition year, number;

For a newspaper – year of publication, release date;

There is a full stop and the dash between the elements of the output data.

f) the number of pages on which the article is placed, the full stop.

For example:

1. Nikiforova L. O. Model of the mechanism of adaptation of migrating human capital for innovation and investment of attractive countries / L. O. Nikiforova, T. O. Jokush // Scientific Bulletin of Uzhgorod National University. Series : International Economic Relations and World Economy. – 2016. – № 10. – P. 39–44.

4.4 Design of appendices

Appendices, as a separate structural part of course work, must begin with a new page. In the middle of the line, the small letters (the original one is large) should be followed by the word “Appendix ___” and the capital letter indicating the appendix. Appendices should be indicated consistently, in capital letters of the English alphabet.

Illustrations, tables, formulas, and equations in the text of the application should be numbered within each appendix.

For example. Figure A.1 is the first drawing of Appendix A; Formula (A.1) is the first formula in Appendix A.

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Appendices

Appendix A

Ministry of Education and Science of Ukraine
Vinnitsa National Technical University
Faculty of Management and Information Security
Department of Economics of Enterprise and Production Management

CALCULATION AND GRAPHIC WORK

from the discipline
“Economic Reasoning of Innovative Solutions”
on the topic

Student: course ____ group _____

Supervisor: Ph.D. (Econ.), Assoc. Prof.
Nikiforova L. O.

Vinnytsia – 20__ year

Appendix B

Vinnitsa National Technical University
Faculty of Management and Information Security
Department of Economics of Enterprise and Production Management

INDIVIDUAL TASK

for calculation and graphic work

from the discipline

“Economic Reasoning of Innovative Solutions”

Student _____ course _____ group _____

Topic _____

Initial data:

1. Number of working days in a month, days	
2. Consumers who are interested on buying an innovative product, %	
3. Customers who want to purchase the developed product again, %	
4. The period during which products will be marketed, years	
5. Bonuses, %	
6. Other costs, %	
7. Amortization rate of the intangible assets , %	
8. Discount rate, %	

Supervisor Ph.D. (Econ.), Assoc. Prof. Nikiforova L. O. _____

Appendix C

CONTENTS

SECTION 1 TECHNICAL REASONING FOR INNOVATIVE RISK

1.1 The essence of the technical problem and an overview of existing technical solutions to the problem

1.2 Evaluation of the technical level of the quality of innovative solutions

1.3 Market analysis

SECTION 2 CALCULATION OF THE COSTS ON THE DEVELOPMENT OF INNOVATION

2.1 Calculation of capital investments on the development of innovation and its intrinsic cost

2.2 Determination of the price and critical volume of production of the innovative product

SECTION 3 ESTIMATION OF COMPETITIVENESS AND EFFICIENCY OF INNOVATIVE SOLUTION

3.1 Calculation of competitiveness of innovation

3.2 Evaluation of the effectiveness of the innovative solution

CONCLUSIONS

REFERENCES

APPENDICES

Appendix D

Table D.1 – Expert evaluation of the importance of parameters

Experts	Indicators							Total weight, %
	1	2	3	4	5	6	7	
1	20	20	10	20	15	10	5	100
2	20	15	20	15	15	10	5	100
3	20	20	10	20	15	10	5	100
4	15	20	20	30	0	10	5	100
5	20	20	20	15	13	10	2	100
6	30	20	20	20	0	5	5	100
7	25	20	20	20	10	5	0	100
8	25	20	15	15	10	10	5	100
9	25	15	10	20	20	5	5	100
10	25	15	16	20	10	10	4	100
11	20	20	20	20	15	5	0	100
12	25	15	17	19	15	5	4	100
13	15	15	20	15	20	10	5	100
14	20	20	13	20	15	7	5	100
15	20	15	20	20	15	8	2	100
16	22	20	12	19	15	8	4	100
17	23	15	15	20	15	6	6	100
18	25	15	15	20	12	9	4	100
19	20	20	15	17	15	9	4	100
20	25	20	12	15	15	8	5	100
Total value	22	18	16	19	13	8	4	100

Let us check the consistency of expert opinions by calculating the coefficient of concordance. To calculate the coefficient of concordance, make Table D.2, where we show the experts' answers given in Table D.1.

Table D.2 – Running of the results of experts' evaluation

direction(<i>m</i>)	grades										
	<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>	<i>7</i>	<i>8</i>	<i>9</i>	<i>10</i>	<i>11</i>
1	1	1	1	3	1	1	1	1	1	1	1
2	1	2	1	2	1	2	2	2	3	4	1
3	3	1	3	2	1	2	2	3	4	3	1
4	1	2	1	1	2	2	2	3	2	2	1
5	2	2	2	6	3	4	3	4	2	5	2
6	3	3	3	4	4	3	4	4	5	5	3
7	4	4	4	6	5	3	5	5	5	6	4

Grades									Total grades	Δ	Δ^2
12	13	14	15	16	17	18	19	20			
1	2	1	1	1	1	1	1	1	23	-57	3249
4	2	1	2	2	3	3	1	2	41	-39	1521
3	1	3	1	5	3	3	3	4	51	-29	841
2	2	1	1	3	2	2	2	3	37	-43	1849
4	1	2	2	4	3	4	3	3	61	-19	361
5	3	4	3	6	4	5	4	5	80	0	0
6	4	5	4	7	4	6	5	6	98	18	324
										$\sum \Delta^2 = 8145$	

The average amount of grades:

$$\overline{\sum p} = 20 \times (7 + 1) / 2 = 80$$

The coefficient of concordation:

$$w = \frac{12 \times 8145}{20^2 \times (7^3 - 7)} = \frac{97740}{400 \times (343 - 7)} = \frac{97740}{134400} = 0,7272$$

So, calculating the coefficient of concordation, we came to the conclusion that the consensus of experts is satisfactory, and therefore, the results of expert research are correct.

Appendix E

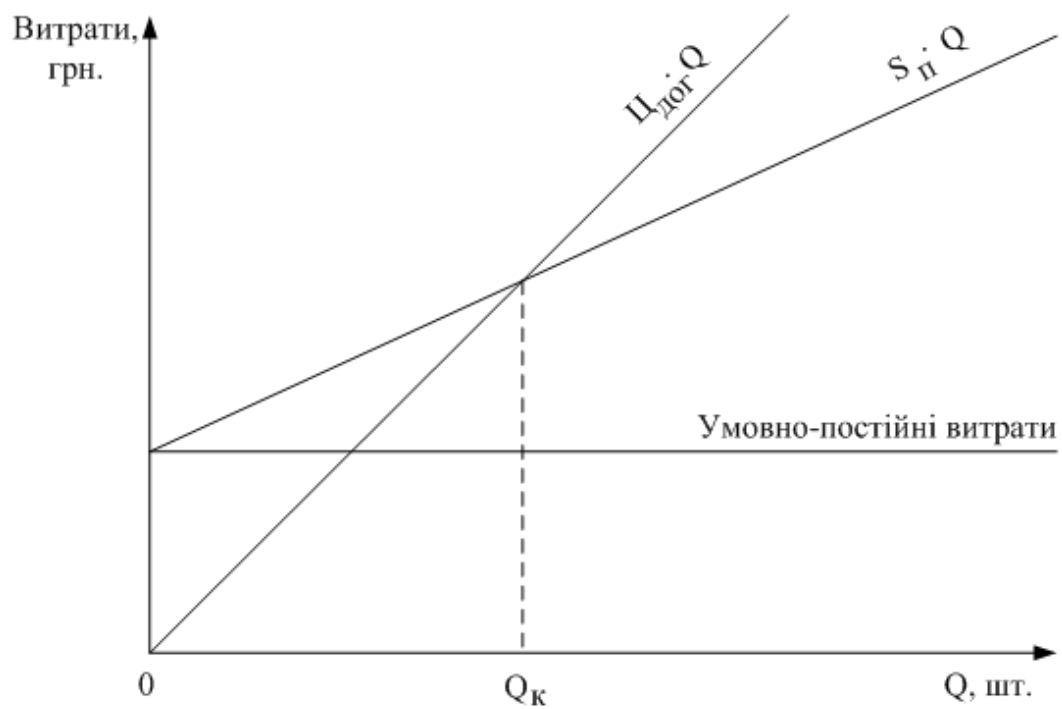


Figure E. 1 – Definition of critical production volume

Appendix F

You should determine the value of net discounted revenue from the development of new software, if it is planned for 3 years to use it. In the development of innovative software, the company once invested UAH 300,000 in investment. 250,000 annual profit is expected from its use. The discount rate is 0.2. We calculate according to the formula (1.41):

$$NPV = \frac{250000}{(1+0,2)^1} + \frac{250000}{(1+0,2)^2} + \frac{250000}{(1+0,2)^3} - 300000 = 227500 \text{ UAH.}$$

Given that $NPV > 0$, then the project can be recommended for implementation.

Навчальне видання

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для іноземних студентів, а також студентів,
що навчаються англійською мовою,
всіх технічних спеціальностей**

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